Player Actions and NFL Team Performance: Do Banned Substances and Behavior Matter?

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ABSTRACT

The NFL and NFLPA have agreed that certain player behaviors endanger players themselves, other players and/or the NFL's image. The parties have agreed on a schedule of fines and suspensions for such behavior with a stated purpose of concern for the player's health and the league's marketing. Players receive fines and suspensions for the use of performance-enhancing substances (PES) and substances of abuse (SOA). Players are also penalized for various on-the-field behaviors. Using the fines as proxies for the prohibited behaviors, this research investigates the relationships between the players' behaviors and team performance. These results show that the use of PESs is linked to worse team performance, but linked to better player performance on the defense. The use of SOAs is also linked to better team performance. For on-the-field behavior, uniform violations are positively related to team performance. Players customizing their look play better and improve their team's results.

Keywords: football, penalties, panel data

INTRODUCTION

Since the 1980s, the NFL and the NFL players union, the NFL Players Association (NFLPA), have agreed to a system of penalties, fines and suspensions to promote several ends including player safety, a level playing field and maintaining the league's value. Given stated purposes of each of the penalties, it seems that an investigation of the system's impact on players and their teams would have been undertaken to assess this possible impact. But no investigation has taken place. This paper aims to examine the impact of the system of punishment on team performance by using the dollar amount of the fines and the number of violations as proxies for each type of violation. The paper proposes that if the purpose of the penalty is in the interest of player safety and to level the playing field, then there should be no impact on the team's performance. That is, if the purpose of the penalty system is to help the player, then there should be no relationship between the amount of penalties and team performance. On the other hand, there will be evidence the system actually has a punitive purpose if we find a negative relationship between penalties and team performance. The NFL and NFLPA have also agreed to a uniform policy that guarantees the teams have a consistent look, embodying the term "uniform". This policy has several purposes: player safety (e.g., correct use of pads); marketing (e.g., commitment to league sponsors) and a level playing field (e.g., no shaded visors). While a policing policy exists for this uniform policy, players still violate it. This paper adds to the literature in this area by proposing that players alter their uniform to boost their confidence. With this hypothesis in mind, we expect to see a positive relationship between uniform fines and team performance. Using data for all 32 teams over seven (7) years, this paper uses a panel data approach to examine the NFL's penalty system and its impact on team performance.

There are two general categories of the NFL penalty system: fines related to substance abuse for both "street" drugs like marijuana (substances of abuse (SOAs)) and performance-enhancing substances (PESs) like steroids; and another set of on-the-field penalties addressing behavior that recognizes the importance of player safety and a set that addresses the value of the NFL's marketing position. The penalties can also be divided between off-the-field behavior (the use of drugs) and on-the field behavior (dangerous play or uniform violations). A more complete description of this penalty system appears later in this paper.

The remainder of this paper is organized with a literature review along with a history of the NFL and its players union providing background for the investigation. An examination of the data and regression analysis follows. A discussion of the results and summary finalizes the paper.

LITERATURE REVIEW

While performance-enhancing substance use among athletes ranges from weightlifters in the early Olympics to cyclists to today's bodybuilders at the local gym, relatively little research has been produced that examines the impact of these substances on athletic performance. Instead, much of this research studied various attitudes and reasons *why* athletes have taken these substances and less so on the impact on performance. No one is ready to admit (illegal) substance use, so it is difficult to say how on-the-field (in-the race, on-the-court, etc.) accomplishments are attributable to these substances. Anecdotal evidence from professional

track and field, MLB and professional cycling seems to link steroid use, blood doping and other techniques to better performance.[1] No such evidence from the NFL exists.

Literature addressing the effect of overly aggressive conduct on the field and uniform violations is also limited, with much of it focusing on psychological aspects. For on-the-field behavior, researchers look at several avenues with regard to psychology and its relationship to performance, but little work has been performed in this area. Frank (1988) investigates how the wearing of uniforms affects a player's play or the perception of their play. Frank claims that "black is the color of evil and death to all cultures," implying that black uniforms can be effectively used to intimidate opponents. Frank collects data on NFL and NHL teams that wear black (or pre-dominantly black) uniforms, and he found those teams have a higher percentage of penalties called against them. The author could not differentiate between whether the players played more aggressively or whether referees had a bias against black uniforms and therefore called more penalties on those players. As noted in Frank's paper, the self-perception and social constructs that people have against the color black tend to give the impression that athletes who wear black uniforms are more aggressive.

A study by Cunningham (2009) discussed the attitude of black male athletes in the NBA and NFL concerning uniformity and aggressive behaviors on the field. Cunningham believed that black male athletes were targeted by their predominately white male employers for being flamboyant and overly aggressive. Cunningham stated that the NBA and NFL changed their uniform and dress policy to deter black athletes from representing their birth cultures. Current NFL rules do not allow players to wear a bandana or engage in excessive dancing after a touchdown.[2]

Covering all 32 NFL teams from 2003 to 2007, Stair, et al (2008) examined the role of both on-the-field skills and off-the-field behavior on an NFL team's winning percentage. The paper used on-the-field behavior (measured by offense, defense, special teams, net turnovers, penalties) and off-the-field conduct (measured by arrests) as independent variables. Results showed that quarterback skill (measured by quarterback rating) had the largest impact on team wins. The study found that team arrests (as a proxy for aggressive behavior) were not found to have a statistically significant impact on winning games.

In another article by Craig (2016), the author investigated aggressive behavior in the NFL. He found a relationship between NFL game-time temperature and aggressive player behavior. Using the number of penalties called on NFL players as a proxy for aggressive or violent behavior, Craig found that the higher the temperature, the more penalties are called against the home team. However, he did not connect this aggressive behavior to team performance.

Overall, this lack of research motivates further investigation into the relationship between a penalty system and its impact on players and their teams.

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[1] Ben Johnson, a gold medal winning sprinter, has a lifetime ban for steroid use. He had to return the medals. Mark McGwire's admitted use of steroids is linked to his home run record 1998 season. Lance Armstrong also admitted to using EPO (used to increase the number of red blood cells) during his Tour de France victories

[2] Bandana wearing was popular in the 1990s with NFL players. However, in 2001, the NFL decided bandanas did not represent the image the league wanted to project and wearing them was listed as a fineable offense.

NFL OFF-THE-FIELD PROHIBITED CONDUCT – PES AND SOA

The NFL and the NFLPA agree that two types of substances (PESs and SOAs) harm the players, inhibit fair competition and run counter to the league's marketing goals. The initial policies in place if a player was caught using these substances did not include penalties. Since that time however, the NFL and the NFLPA have agreed upon a system of penalties and fines to address this off-the-field behavior.

While the league began testing for SOAs in 1983, the policy in effect for this paper on SOA use is codified in the "2015 NFL Policy and Programs on SOAs."[3] The penalties are actually game suspensions which result in a loss of pay based on the player's salary, and as such, are reported as fines. For SOAs, the policy goal is to help players and to provide them with professional clinical treatments. Table 1 lists the prohibited substances and their detection limits under the SOA policy in effect for this paper.

From the 1960s, when Dianabol (the brand name for the first synthetic anabolic steroid) could be sold as an over-the-counter drug, until 1987 when the NFL first tested for their use, steroids were not banned by the NFL.[4] The current PES policy has been in existence since the 1993 Collective Bargaining Agreement (CBA) and is currently codified in the most recent "2018 Policy on Performance-Enhancing Substances". For PES, the goal according to the NFL Policy on Performance-Enhancing Substances, the purpose of these penalties is player safety and the creation of a level playing field.[5]

This study's data set covers the years 2012 through 2018 when the league and the NFLPA began to make all of the data for substance use available. The NFLPA reports total team fines and the total number of violations per team per season. The number and the amount of fines serve as a proxy for actual banned substance use. Given the stated purposes of both the PES and SOA penalty system, we would not expect to find a relationship between fines and team performance; the impact of imposing penalties should be neutral. However, if the data show a negative relationship between fines and team performance there is evidence the system does penalize a team.

PROHIBITED AGGRESSIVE ON-THE-FIELD BEHAVIOR

In addition to prohibited substance abuse, this paper also examines other prohibited player behaviors and whether these behaviors have a positive or negative effect on team performance. These "conduct" or on-the-field behaviors are divided between uniform violations and overly aggressive play infractions. Protecting players on the field is the number one priority of both the league and the NFLPA. "The rules are intended to protect the players from unnecessary risk, promote player safety, and emphasize sportsmanship and respect of teammates,

[3] The SOA policy has been widely contested by the owners and the players. In fact, the parties just agreed to shorten the testing window to two weeks for marijuana only and raised the detection level in the 2020 CBA.

[4] It was not until 1990 that Congress added steroids to the list of Schedule III drugs.

[5] The fine monies pay for running the SOA program (professional counselors, testing kits, lab results, and test proctors). The money does not serve as revenue for the league or owners so there is no motivation to run up the number of positive tests to generate revenue. The same holds for the PES fines. They are used to run the NFL's administration costs for the PES program.

opponents, coaches, officials, and fans." (NFL Fine Schedule and Appeals Process | NFL Football Operations, n.d.).

For example, players cannot pull the face mask of an opposing player, chop block or leg whip an opposing player. Unnecessary roughness against the opposing quarterback and late hits on other players after the whistle are prohibited. If caught during a game, these actions result in a "personal foul" penalty and a loss of 15 yards. These are penalties against *the team* for a player's infraction and result in a loss of yardage. This is what typically happens during a game. However, each of the actions listed above can result in additional fines for *the player* if league officials deem these behaviors were excessive.

NFL on-the-field fine structures are based on first and second violations and are relative to players' salaries for excessive violence or multiple infractions. For example, the first violation for a face mask penalty would result in a $10,527 fine, and a second violation of the same behavior would be $21,056. The NFL minimum salary in 2018 was $480,000, meaning that the player would be paid approximately $28,235 per week ($480,000/17). A minimum-salary player who received a second violation for a face mask penalty would forfeit nearly his whole paycheck. Each player's misconduct has a different fine value attached to its significance, as seen in Table 2 which lists all infractions.

If the behavior continues, the player is subject to a game suspension and additional loss of game checks. The NFL policy of suspension from games for on-the-field conduct has no set limits. The NFL can unilaterally impose any number of games they feel a player should be suspended for repeated on-the-field violations. In 2017, Cincinnati Bengals linebacker Vontaze Burfict was fined for an illegal hit during a preseason game. Because Burfict was a repeat offender for on-the-field violations, he was suspended for five regular-season games by NFL officials. Those five-game checks cost Burfict $882,353 in lost base-salary (Chavez, 2017).[6]

Sometimes a player may think he got away with an illegal action because he was not penalized during a game. However, after every NFL game, all plays are reviewed to determine if any on-the-field infraction has occurred. If a player is fined and assessed an on-the-field infraction, a notice will be sent via email several days after the game in question.[7] Unlike the fines for substance use, the fines and penalties for this dangerous on-the-field behavior are no doubt to prevent player injuries and deter the offending player from repeat actions.

This paper's data set includes the number of times a team's player has been fined and the total amount of fines. If these fines are effectively deterring dangerous behavior, we would expect to find a negative relationship between the variable and team performance.

UNIFORM VIOLATIONS

The next category of player behavior examined in this paper is uniform violations. These violations may seem trivial, but they serve a purpose in the league's branding and may also affect player safety. The NFL's Game Operations Manual states, "A player's appearance on the field conveys a message regarding the image of the league and directly affects the league's reputation and success." This suggests that protecting the brand of the company (or league) and

[6] Burfict would later appeal the fine, which was reduced to three games (Chavez, 2017).

[7] As noted with Burfict, a player can choose to appeal the fine. He will go before an appeals officer, who was jointly hired by the NFL and NFLPA. The appeals officer will hear the player's case and render a final binding decision to maintain, reduce, or rescind the fine. This data set only includes the final amount.

creating a unified look is critical to teams' marketing success and the success of their sponsors (NFL Uniform Inspection | NFL Football Operations, n.d.). The NFL Rules Enforcement Policy addresses all prohibited uniform violations. All players are required to tuck in their jerseys, wear only officially NFL licensed gear on the field and sidelines, and stockings must show white from the top of the shoe to the midcalf. Players cannot wear bandannas and are not allowed to alter their game-day uniform (jersey, pants, and socks).[8] Skilled players, such as wide receivers and defensive backs, seldom wear thigh pads or knee pads in their game-day uniforms, both a direct violation of the uniform policy.[9] Table 3 lists all these violations and their fines.

While the NFL and the NFLPA agreed on the violations and on a schedule of fines for a player who violates the uniform policy, their thoughts about these fines seem to differ. The NFL guarantees its advertisers a specific look for all players across all teams---a uniform. According to the CBA, "Compliance with the uniform rules helps the league to protect players from injury, maintain competitive balance, create a professional appearance, and protect the league's business partnerships." (NFL Uniform Inspection | NFL Football Operations, n.d.). In terms of these business partnerships, NFL inspectors protect the commercial brands of officially licensed products. Players, on the other hand, apparently gain confidence by personalizing their uniform. Deion Sanders, a star NFL defensive player in the NFL Hall of Fame, is quoted as saying, "If I look good, I feel good. If I feel good, I play good" (Sebra, 2013). (Data is unavailable as to whether Sanders paid any uniform fines during his playing days though.)

To ensure players comply with game-day uniform standards, the NFL hires 64 (two per game) sideline compliance inspectors to monitor and warn players of any uniform violations. If the uniform inspector notices a violation during the pregame warmups or actual gameplay, he will give the player and team representative a verbal warning. If the player does not correct the violation, he will not be permitted to play in the game. If a player's uniform is not in regulation during the game and compliance officers cannot correct the situation, the player will be assessed a fine after the game.

Uniform violations, both the number of infractions and the total amount of fines per team per season, are the fourth and last variables in the data set related to player behavior. This paper questions whether players are showing their individuality and showing bravado to create an edge to improve their performance. As such, the uniform-related variables (serving as a proxy for this behavior) should be positively related to team performance.

DATA

Cross-sectional time-series data covering the 2012 through 2018 NFL seasons is used for a total of 224 observations. In addition to the variables of interest (PES, SOA, CONDUCT, and UNIFORM), other endogenous variables traditionally used in this stream of research are included. The data cover 16 regular-season games each season. The dependent variable, Team

[8] Even coaches are subject to the uniform policy. Patriots' Coach Bill Belichick is known for wearing a hoodie with torn sleeves. When the NFL switched its clothing sponsor from Reebok to Nike, Belichick was also required to switch hoodie brands though he was able to cut off the sleeves.

[9] Watching a player's eyes can tip off where a play is going or the player's intention. As a result, some players have tried to wear shaded visors to prevent the opposition from being tipped off. Shaded visors are banned unless their need can be explained for medical reasons.

Performance, is measured in several ways including the team's winning percentage (WINPER), in addition to offensive points scored (TOTOFF) and defensive points allowed (TOTDEF) allowing for the impact of player behavior to be more evident on either side of the ball. [10] TOTOFF measures the effectiveness of the offensive players' skill in scoring touchdowns, extra points and field goals. TOTDEF measures the effectiveness of the defensive players' ability to minimize the points their offensive opponents can score. This variable is the total amount of points given up by the defensive unit, excluding all points scored on special teams, offensive turnovers that result in touchdowns, and offensive sacks in the endzone.

The fines are divided between on-the-field behavior (CONDUCT fines and UNIFORM fines) and off-the field substance use (PESs and SOAs). The fine amounts per team (in dollar terms and the number) are available from the NFLPA database.[11]

In addition to the variables of interest, other variables are typically included in these team performance regressions. For this paper, the relevant variables affecting team performance include: quarterback rating (QBR), number of All-Pro Players on the team (ALLPRO), number of players on the injured reserve list (IR), and the head coach's career winning percentage (HCWINPER). In addition, total offensive yards, total yards allowed, total cash spend and the lagged value of the team's winning percentage are also included as independent variables. This lagged variable captures the fact that the NFL uses a reverse order draft so that the worst teams are able to draft the top talent the next season which would help the team improve its performance. The NFL also "challenges" a team for it having a winning season by scheduling better teams for the next season making the schedule more difficult.

Over the years, NFL scouts have tried to find tangible and intangibles to measure quarterback play. In 2011, a group of ESPN employees developed a formula to assess the quarterback and his contribution to winning football games. The formula, called "Quarterback Rating" (QBR), produces a measure of quarterback efficiency and is used in this paper to capture the impact of a quarterback's play.[12] The Associated Press (AP) and USA Today vote each season on the best performing players on each team. Players can be voted to first or second-team All-Pro. A three-year window is used because a player's skills are unlikely to diminish in three years.[13] ALLPRO is the total number of All-Pro players on each team for the rolling window. The injured reserve list is an NFL-designated list of players who are injured during the season. After serving eight (8) weeks on the injured reserve list, up to two players can return to the NFL roster each season. When players will miss the majority of the football season due to an on-the-

[10] NFL statistics show that teams that score more offensive points win more games. In fact, some people claim that the NFL's rules have been set up to make it easier for the offense to score, because offense sells tickets. While total revenue might be considered a measure of a team's success, this paper recognizes that most revenue flows from TV contracts, which are decided years before the games are played and therefore, not a focus of this paper's regression analysis.
[11] Because the game check fines for SOAs and PESs are based on a player's salary, it is difficult to disentangle whether the team has experienced a large number of violations or if one well-paid player has been caught. By using both variables, both features of the penalty structure can be examined
[12] A QBR is calculated for each game in the season and then an overall value is computed for the season. The highest QBR is 158.3. More details can be found at ESPN.com.
[13] While the Pro-Bowl designation might be more the more popular recognition of skilled players, the All-Pro designation is more valued by the players themselves (Carter, 2020).

field injury, they are placed on the injured reserve list. With only 53 roster spots on a team (11 designated for offense, 11 designated for defense, and three (3) special teams' players) usually there is only room for about one back-up player per position. When a player is injured, not only does the team lose this player's skill, but they must (in many cases) turn to hire an unsigned free-agent player to replace the injured player, use a player from the practice squad, or another player on the team must take over a position. In each case, the replacement player's skill is usually less than the injured player's skill, which leads to a lower performance for the team. This variable (IR) recognizes the loss of the highly skilled player and the use of a less-skilled player for that position.

As noted earlier, players may be penalized for dangerous on-the-field actions like horse-collar tackling during the game. By including NETYDS, a measure of yards assessed for and against each team, the regressions will capture the impact of penalties on team performance and allow the CONDUCT to capture the impact of the fine structure on illegal on-the-field behavior not caught during the game. This data is available from NFL.com.

HCWINPER is the overall NFL career winning percentage for the team's head coach. Head coaches are responsible for every decision that takes place in the practice and game field. A higher winning percentage signals a better coach.

If teams spend more to acquire more talented players, there should be evidence of this relationship, assuming the more talented players actually play better. In 2011, the NFL instituted an improved measure of how much money is actually spent on player talent each year called "cash spend". Carter (2020) provides a more complete discussion of this variable CASHSPEND.

Summary statistics for these variables are presented in Table 4.

METHODOLOGY AND RESULTS

Given the cross-sectional time-series nature of the data, panel data regressions are estimated for two sets of models, fixed effects (FE) and random effects (RE). To account for any autocorrelation, robust errors are included in the regression specification. The FE model captures a within effect (the behavior of variables for a team over time) while the between effect (the behavior of variables across the teams) is captured by the RE model. In some cases, the random effects assumptions are not met, and the fixed effects model is more appropriate. Several tests are reported to assess the significance and appropriateness of the models. For the fixed effects models, the Least Squares Dummy Variable (LSDV) is reported and serves as an R-squared for the model. An F-test is also reported that tests whether the cross-sectional (teams) have a common intercept. The last test reported is the Hausman test. This checks the appropriateness of the model with a null hypothesis that the estimates are consistent. If the null hypothesis is rejected, then the FE regression is better model to use for the analysis.

The following equation was estimated for the first set of player behavior regressions.

$$\text{Team Performance}_{i,t} = \beta_0 + \beta_1 \text{ Substance Fines(PES)}_{i,t} + \beta_2 \text{ Substance Fines (SOA)}_{i,t} + \beta_3 \text{ Conduct Fines (on-the-field)}_{i,t} + \beta_4 \text{ Conduct Fines (uniform)}_{i,t} + \beta_5 X_{i,t} + \varepsilon_{i,t} \quad (1)$$

where: Team performance can be one of three measures: Team Winning Percentage, Total Offensive Points or Total Points Allowed;
X = vector of other factors affecting team performance;
i = NFL team; and
t = NFL season

The second set of regressions was estimated using the number of fines imposed.

$$\text{Team Performance}_{i,t} = \beta_0 + \beta_1 \text{ Number of Violations (PES)}_{i,t} + \beta_2 \text{ Number of Violations (SOA)}_{i,t} + \beta_3 \text{ Number of Conduct Violations (on-the-field)}_{i,t} + \beta_4 \text{ Number of Violations (uniform)}_{i,t} + \beta_5 X_{i,t} + \varepsilon_{i,t} \quad (2)$$

Table 5 provides output for model 1, where the prohibited actions are measured in the dollar fine amounts, with the dependent variable of winning percentage for two panel data regressions. Diagnostics show the FE model is the appropriate regression. The RE model's Hausman test's null hypothesis (the general least squares (GLS) estimates are consistent) is rejected. Additionally, the Breusch-Pagan test's null hypothesis (no random effects present) cannot be rejected. Both results show that the higher the PES fines, the worse the teams do. While the player might believe he is playing better because of the substance, once he is caught and suspended, his behavior hurts the team's performance. Additionally, this result runs counter to the stated purpose of helping the player. These results show that punishment also hurts the team.[14]

The results show that uniform fines are positively related to the winning percentage. The higher the uniform fines, the better the team does. Players who are expressing their individuality through uniform infractions are perceived as brash and arrogant; however, their play on the football field matches the bold confidence in dress. The results lend evidence to the fact that these players' behaviors help the team win football games. The other variables are as expected: the better the coach, the more wins a team has; and the more points scored by the offense and the fewer points allowed the defense, the better the team does. Last year's winning percentage is negatively correlated to this year's wins which could be due to the fact that teams with a higher winning percentage in the previous season are given a more difficult schedule in the following season. Having All-Pro players on the roster contributed to wins and, finally, the more players who were placed on the injured reserve list, the worse the team performed.

Table 5 reports the results for player behavior, based on fine dollar amounts, with the dependent variable TOTOFF. Similar to the diagnostics presented in Table 5, these tests also support the use of the FE model. None of the variables of interest are significant in the FE model. The other significant variables are as expected, except for points allowed by the defense, which had a positive correlation. Results imply that for each extra point allowed, the better offense will perform. Typically, when defensive units give up a lot of points, their offense unit is forced to be more aggressive to score points to remain relevant in the game which could explain this result. As expected, coaches' winning percentage and better QBR scores help the team score offensive points.

Table 5 reports the results for player behavior, based on fine dollar amounts, with the dependent variable TOTDEF. Tests show the FE model is, again, the more appropriate model. The PES fines are negatively related to the points allowed by the defense. The more fines paid for PES infractions, the fewer points are scored by the opponent. That is, defensive play improves with more players testing positive for PES use. At first glance, these results conflict with results in Table 5 which show that, overall, PES fines hurt the team performance measured with winning percentage. However, it could be that players (using PEDs and competing before

[14] Due to the confidentiality of the fines, individual player data is not available. Because the fine amounts are based on a player's salary, a large dollar amount of fines could reflect one high-paid player was caught or a larger number of lower-paid players were caught. As a result, the average amount of fines was included in the regression analysis, but the conclusions remained the same.

they are discovered) hold down scoring by offenses, but not enough to impact the game's outcome.

The other variables for this regression appear similar to ones above. A better coach holds scoring down, and last year's winning percentage (coupled with a tougher schedule) is associated with more points allowed. More players on IR leads to more scoring allowed. It should be noted that in all three of this set of regressions the amount spent by the team is not associated with performance. This is probably a result of the fact that a team's spending doesn't change that much from year-to-year and that teams must follow a strict salary cap on spending that is uniform across all the teams (though some may choose to spend less). In addition, net penalty yards are not associated with any of the performance variables.

The next set of regressions present results for model 2 where the variables of interest are measured by frequency and begin with Table 6 with the dependent variable of WINPER. For this regression, similar to the ones above, the Hausman and Breusch-Pagan tests confirm the FE model is the appropriate regression model. In both models though the models provide robust results. SOA use is positively related to performance. The more instances of fines, the higher the winning percentage. These SOAs are drugs like marijuana and cocaine. It could be that these drugs serve to reduce pain and help players play through pain, resulting in better performance. In addition, the number of uniform violations is positively related to the winning percentage. For each uniform violation, the winning percentage increases --- which leads support to Deion Sanders' famous observation noted earlier. Maybe looking good really does boost effort and make a player play better. The other significant variables are similar to the previous models above. Coaches' winning percentage, injured reserved, total offensive points, and last year's winning percentage all were statistically significant to winning games.

Table 6 reports the results for Player Behavior based on the number of violations with the dependent variable of TOTOFF. Again, the FE is the appropriate regression model. None of the variables of interest related are significant in this set of regressions. This result is similar to the TOTOFF regression when the dollar values of the fines were used. Other variables proved significant as expected, including coaches' winning percentage, QBR, points allowed, lagged winning percentage, and All-Pro players.

Table 6 reports the results for Player Behavior based on the number of violations with the dependent variable of TOTDEF. Tests show the FE model provides consistent and efficient results. The FE results imply that uniform violations are related to fewer points allowed by the defense. This result provides robustness to the uniform violation results in Table 8 for winning percentage. There appears to be a link, especially on the defensive side of the ball, that players committing uniform violations tend to play better. Plus, this aggressive behavior does not seem to lead to any on-the-field penalty calls hurting the team's performance. Similar to other regression results, the head coach's winning percentage, offensive scoring, and last year's team success proved to be significant in this set of regressions.

SUMMARY

Using panel data for all 32 NFL teams over a seven-year period, this paper examines certain player behaviors and their impact on a team's performance. Fines and penalties for this behavior are used as proxies for the behavior. Two categories of player behavior were examined: substance use for two types of drugs ("street drugs" and performance-enhancing drugs) and for on-the-field behavior (aggressive, unsafe play and uniform violations). In regards to drug use, the

paper also considers whether the results align with the NFL and NFLPA's stated purpose of the penalty system helping the player, not penalizing the team and leveling the playing field.

When using the dollar amount of fines, the results show that the use of performance-enhancing drugs like steroids are associated with lower overall team performance and better defensive performance. This result tends to imply that the effects of the drug policy might help the defensive player, but overall, the team is penalized for the player's drug use.

For "street drug" use, there appears to be a positive relationship to the team's performance. It is not surprising that in 2020, the NFL and the NFLPA were willing to loosen the penalty for this type of drug use. While the dollar fine will still be imposed, there will no longer be game suspensions.

The last set of results showed that uniform violations are positively related to overall team and defensive performance. While the league prefers to have a marketable, consistent look across all teams and all players, the players themselves (especially defensive ones) prefer to customize their look and play better as a result.

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Table 1. Substances of Abuse Detection Limits

Benzoylecognine (cocaine) ≥ 150 ng/mL
Delta 9-THC-carboxylic acid (marijuana) ≥ 35 ng/mL
Amphetamine and its analogues ≥ 300 ng/mL
Opiates (total morphine and codeine) ≥ 300 ng/mL
Opioids (e.g., hydrocodone, oxycodone) ≥ 300 ng/mL
Phencyclidine (PCP) ≥ 25 ng/mL
Methylenedioxymethamphetamine ("MDMA") and its analogues ≥ 200 ng/mL
Alcohol ≥ .06 g/dl (%); depending on previous violations

Table 2. On-the-field Fines	First Offense	Second Offense
Violation against game official:		
Physical Contact with official	$35,096	$70,194
Verbal or other non-physical	$28,075	$56,156
Player Safety Rules and/or Flagrant Personal Fouls (minimum fines):		
Striking/Kicking/Kneeing	$10,527	$21,056
Horse Collar Tackle	$21,056	$42,115
Face Mask	$10,527	$21,056
Leg Whip	$21,056	$42,115
Late Hit	$10,527	$21,056
Spearing	$28,075	$56,156
Illegal Helmet Use	$28,075	$56,156
Hit on Defenseless Player	$28,075	$56,156
Blindside Block	$28,075	$56,156
Roughing the Passer	$21,056	$42,115
Low Block or Chop Block	$10,527	$21,056
Fighting	$35,096	$70,194
Entering Fight Area – active	$ 7,017	$14,037
Entering Fight Area – non-active	$ 3,507	$10,527
Sportsmanship		
Excessive Profanity or other Unsportsmanlike Conduct	$14,037	$28.075
Taunting	$10,527	$14,037
Football in Stands	$ 7,017	$14,037

Table 3. Uniform Fines	First Offense	Second Offense
Foreign Substances on:		
Body/Uniform	$10,527	$21,056
Chin Straps	$10,527	$14,037
Personal Messages	$ 7,017	$14,037
Other Uniform/Equipment Violations	$ 7,017	$14,037

On-Field Commercial Logo Violations:	Considered violation of official NFL licensing Agreements; suspension or fine; severity to be determined by the degree of violation.
Gang Signing:	Considered conduct detrimental to the NFL; suspension or fine; severity to be determined following provisions of the Personal Conduct Policy.

Table 4. Summary Statistics of Explanatory Variables

Variables	Mean	Standard Deviation
CONDUCT Fines	$170,826	$99,189
CONDUCT # of Violations	13.04	5.49
UNIFORM Fines	$ 83,850	$90,653
UNIFORM # of Violations	10.97	7.37
Coach's Win Percentage	50.29	14.04
PES Fines	$217,425	$689,210
PES # of Violations	1.13	1.31
SOA Fines	$494,798	$1,104,977
SOA # of Violations	4.70	5.49
Net Yards	-6.19	196.27
QBR	81.12	19.84
Injured Reserve	11.75	4.78
Total Offense Points	363.13	71.08
Points Allowed Defense	363.16	55.77
All-Pro Players	3.88	2.29
Total Cash Spend	$145,631,024	$26,166,285

Table 5

Dependent Variable	WINPER				TOTAL OFFENSE				TOTAL DEFENSE			
	Fixed Effects		Random Effects		Fixed Effects		Random Effects		Fixed Effects		Random Effects	
	Coef.	P-Value	Coef.	P-Value	Coef.	P-Value	Coef.	P-Value	Coef.	P-Value	Coef.	P-Value
Constant	57.82	0.00***	52.45	0.00***	117.36	0.04**	92.33	0.04**	403.45	0.00***	411.94	0.00***
SOA Fines	0.01	0.42	0.00	0.65	0.00	0.59	0.00	0.23	0.00	0.51	0.00	0.25
PES Fines	0.00	0.00***	0.00	0.00***	0.00	0.69	0.00	0.48	-0.01	0.00***	-0.01	0.10
UNIFORM fines	0.01	0.061*	0.01	0.03***	-0.01	0.74	-0.02	0.56	-0.03	0.38	-0.02	0.50
CONDUCT fines	0.00	0.75	0.00	0.95	0.00	0.88	0.01	0.72	0.00	0.79	-0.02	0.66
HCWINPER	0.15	0.01**	0.24	0.00***	2.13	0.00***	2.48	0.00***	-2.52	0.00***	-2.57	0.00***
QBR	-0.02	0.64	-0.01	0.88	1.20	0.00***	1.42	0.00***	-0.11	0.59	-0.09	0.66
IR	-0.23	0.06	-0.20	0.18	-3.51	0.00***	-2.46	0.00***	3.00	0.00***	2.24	0.00***
TOTOFF	0.15	0.00***	0.14	0.00***					0.16	0.02**	0.06	0.01**
TOTDEF	-0.18	0.00***	-0.17	0.00***	0.23	0.00***	0.02	0.08**				
ALLPRO	0.58	0.06*	0.09	0.74	5.10	0.02**	4.27	0.02**	-3.80	0.11	-4.17	0.03**
CASHSPEND	0.00	0.83	-0.01	0.57	0.07	0.70	-0.06	0.75	-0.11	0.50	-0.03	0.84
NETYDS	0.00	0.62	0.00	0.31	0.02	0.32	0.02	0.19	0.01	0.26	0.02	0.28
WINPER(-1)	-0.08	0.02**	-0.06	0.02**	-0.19	0.00***	-0.44	0.02**	0.75	0.00***	0.67	0.00***
LSDV R Squared	0.89				0.58				0.53			
Joint Test	110.34	0.00***			14.72	0.00***			15.02	0.00***		
Breusch Pagan Test			0.00	0.97			1.30	0.25			5.04	0.03**
Hausman Test			81.15	0.00***			50.21	0.00***			66.10	0.00***

Robust (HAC) standard errors, fines in $1000s, Cashspend in $1,000,000s

*** significant at the 0.01 level, ** significant at the 0.05 level, * significant at the 0.1 level

Table 6

Dependent Variable	WINPER				TOTAL OFFENSE				TOTAL DEFENSE			
	Fixed Effects		Random Effects		Fixed Effects		Random Effects		Fixed Effects		Random Effects	
	Coef.	P-Value	Coef.	P-Value	Coef.	P-Value	Coef.	P-value	Coef.	P-value	Coef.	P-Value
Constant	56.34	0.00***	52.04	0.00***	100.42	0.09*	75.11	0.10	371.58	0.00***	392.43	0.00***
SOA #	0.19	0.07**	1.44	0.06*	-0.42	0.60	-0.74	0.26	0.20	0.63	0.08	0.82
PES #	-0.35	0.50	0.00	0.80	2.73	0.38	2.58	0.26	-1.14	0.62	-2.88	0.24
UNIFORM #	0.24	0.01	0.26	0.00***	0.50	0.48	-0.25	0.61	-1.00	0.06*	-1.05	0.03**
CONDUCT #	0.01	0.90	-0.04	0.64	0.33	0.66	0.58	0.048*	0.93	0.24	0.21	0.81
HCWINPER	0.19	0.00***	0.24	0.00***	2.02	0.00***	2.40	0.00***	-2.54	0.00***	-2.62	0.00***
QBR	-0.03	0.46	-0.03	0.42	1.05	0.00***	1.40	0.00***	0.05	0.83	0.03	0.90
IR	-0.16	0.36	-0.19	0.29	-3.57	0.02**	-2.15	0.02***	4.02	0.00***	2.86	0.00***
TOTOFF	0.15	0.00***	0.15	0.00***					0.18	0.00**	0.17	0.00***
TOTDEF	-0.17	0.00***	-0.16	0.00***	0.28	0.00***	0.21	0.01**				
ALLPRO	0.49	0.14	0.07	0.78	5.39	0.03**	4.31	0.05**	-3.24	0.17	-3.64	0.00*
CASHSPEND	-0.03	0.30	-0.03	0.21	0.11	0.64	-0.20	0.92	-0.15	0.37	0.02	0.93
NETYDS	0.00	0.43	0.00	0.39	0.02	0.36	0.03	0.13	0.02	0.26	0.01	0.44
WINPER(-1)	-0.08	0.03**	-0.09	0.00***	-0.66	0.00***	-0.35	0.07*	0.77	0.00***	0.62	0.00***
LSDV R Squared	0.89				0.59				0.59			
Joint Test	143.36	0.00***			14.77	0.00***			2.04	0.01**		
Breusch Pagan Test			0.98	0.33			1.53	0.22			8.09	0.00***
Hausman Test			61.09	0.00***			77.08	0.00***			37.14	0.00***

Robust (HAC) standard errors, Cashspend in $1,000,000s

*** significant at the 0.01 level, ** significant at the 0.05 level, * significant at the 0.1 level