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The determinants of NFL player salaries

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THE DETERMINANTS OF NFL PLAYER SALARIES

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Abstract

Using performance data from 2013 and salary data from 2014 for 426 offensive skill position players in the National Football League (NFL), this study analyzes the determinants of player salaries in rookie and veteran NFL contracts. It is the first study to use fantasy football statistics as a measure of performance across positions. The results indicate that performance, as measured by fantasy football statistics, is the primary determinant of veteran players' salaries. Under the 2011 NFL Players Association Collective Bargaining Agreement (CBA), draft position is the primary determinant of rookie players' salaries.

Introduction

The National Football League (NFL) is the largest professional sports league in the world, earning revenues in excess of 12 billion dollars (Isidore, 2015) and employing almost 1,700 players during the regular season (Davis, 2014). This research studies the factors that determine the effective salaries of NFL players. A major obstacle to objective compensation comparisons in past research has been the inability to account for player performance across positions. This research bridges that gap using fantasy football statistics, which have become an extremely popular measure of a player's skill in the eyes of the average fan. This paper provides a unique contribution to the existing literature because it is the first to incorporate fantasy football statistics.

Using salary data from a set of 426 offensive skill position players in the 2014 season and performance data from 2013, I study the correlations of fantasy football statistics and off-field factors with player salaries and hope to answer the following research question: Is performance the primary determinant of NFL player salaries? In addition, this paper analyzes the structural changes to the NFL's collective bargaining agreement (CBA) with its players union to explain observed changes in the personnel and contract decisions by NFL franchises. Through this analysis, this research attempts to answer the secondary research question: How do the determinants of player salaries differ between veteran and rookie NFL contracts?

By dividing the data set into veteran and rookie contracts, I analyze the differences in determinants of salaries among players with negotiation powers under the CBA. The results indicate that performance and draft position are the primary determinants of player compensation among veteran and rookie contracts, respectively. Fantasy statistics alone explain nearly half of all variation in cap values among veteran players. Given the explanatory power of this variable,

excluding it (or a similar measure of performance) from an analysis would yield weak results. Non-performance related factors, such as race and arrest history, exhibit significant negative correlations with compensation among veterans, but the relationships are insignificant among players on rookie contract.

Literature Review

In the National Football League (NFL), the cost of talent makes up the largest portion of a team's annual costs, and a team's success is measured by its ability to win games (Fort, 2011). All teams in the NFL are subject to the "salary cap"—a maximum amount they can pay for labor. The salary cap contributes to a competitive balance among the 32 NFL teams by providing all teams with equal opportunities to acquire top talent (Larsen et al., 2006). Each year, the salary cap is calculated using a formula established in the collective bargaining agreement (CBA) between the NFL and the NFL Players Association (NFLPA).

Under the 2006 CBA, the salary cap was computed as all football-related revenues, minus one billion dollars allocated to the team owners, divided evenly among the 32 teams. Under this system, players collected about 60 percent of league revenues in the form of salaries in 2006 (Quinn, 2012). Restructuring the salary cap was a point of emphasis in negotiating a new CBA after the 2010 season (Quinn, 2012). In the 2011 CBA, the salary cap was restructured as the sum of 55 percent of revenue from national media contracts, 45 percent of league licensing revenues, and 40 percent of local team revenues.

A specific portion of each player's contract counts against the team's total salary cap. A player's cap value at the start of a year includes all guaranteed elements in the contract, any incentives deemed "likely to be earned," as well as a fraction of the player's signing bonus (NFLPA, 2011). Although signing bonuses are paid up-front, for cap purposes they are

amortized on a straight-line basis over the life of the contract or five seasons, whichever comes first (NFLPA, 2011). In the case that incentives actually paid in a year exceed those that were likely to be earned, the excess will be credited against the team's salary cap in the subsequent year. Within the constraints of the collective bargaining agreement, the determination of a player's salary may depend on a number of factors. For example, the structure of rookie contracts changed significantly under the 2011 CBA and is quite different than veteran contracts.

Prior to 2011, rookies drafted into the NFL had the potential to sign extremely lucrative contracts before setting foot on the playing field. During negotiations for the 2011 CBA, both owners and veteran players wanted to limit the size of rookie contracts (Brandt et al., 2013). Owners were motivated by major draft busts, like Ryan Leaf and JaMarcus Russell, and veteran players were unhappy about being out earned by rookies (Brandt et al., 2013). As a result, the pool of money allocated to rookie contracts shrunk, and rookies were forced into heavily structured, four-year contracts with fifth-year team options for first round picks (Quinn, 2012). Players do not have the option to restructure rookie contracts until after the third year of the contract. Consequently, many young players receive compensation well below their value, and the value of rookie contracts has dropped significantly since the implementation of the 2011 CBA (Brandt et al., 2013).

Veteran players may not receive the intended benefits from the rookie contract restructuring. Teams can draft and sign rookie players for relatively lower salaries than veteran players without the necessity to restructure contracts to reward performance above expectations (Brandt et al., 2013). There is little incentive for teams to sign more expensive veterans with a shorter shelf life. To players nearing the end of their careers, this may have very serious personal financial implications. The rate of bankruptcy among players 12 years out of the league is about

16 percent, largely independent of the career earnings of the player (Carlson et al., 2015). In other words, the length and value of a player's contracts over the duration of his career have little to no effect on the possibility of bankruptcy post-retirement. Therefore, veteran players have an incentive to remain in the league to prolong their financial wellbeing, regardless of how much they earned over their prior contracts. The league and the players union have taken action to assist veteran players in finding employment with efforts like the veteran combine, where players go through similar physical testing as rookies entering the draft. However, these efforts have been largely ineffective, thus far.

A team's coaches and front office personnel determine the value of each player on a position-by-position basis. Fort (2011) defined the value of an athlete as the player's addition to the team's winning percentage multiplied by the marginal revenue generated by that player's addition to winning percentage. Essentially, this is the dollar value of the team's improvement as a result of adding the player. The most obvious measure of a player's contribution is his statistics. Comparing player statistics across positions is difficult, however, because not all positions contribute equally to the outcome of a game or season. For example, a quarterback may play a larger role in the outcome of each game than a single wide receiver. Comparisons of statistical performance across positions require a uniform system to convert raw statistics into a single measure of value.

In recent years, the growing popularity of fantasy football has provided one way to compare performance across many positions. The comparison is limited to offensive skill positions, as points are awarded on an individual basis for yards gained and points scored. Defenses are scored as a team, rather than individually, and offensive linemen do not receive fantasy scores, so they are excluded from this research. In ESPN standard scoring leagues, one

point is earned for every ten rushing yards or twenty-five passing yards. In addition, six points are awarded for a rushing touchdown and four for a passing touchdown. Fumbles and interceptions count as a loss of two points (ESPN.com/fantasy/football). As part of employers' valuation processes, they may also consider outside factors that could keep players off the field entirely and minimize their contributions to team success. Even the best performer on the field is useless in a situation where he is not allowed to play. One such consideration is arrest history.

USA Today's online sports database documented over 800 arrests of NFL players since 2000 (www.usatoday.com/sports/nfl/arrests/). Under the league's personal conduct policy, players miss significant playing time for criminal offenses. Consider, for example, the case of Adrian Peterson, the star running back for the Minnesota Vikings. Due to legal issues near the beginning of the season, Peterson only played one game during the 2014 season. In this case, off-the-field actions eliminated the marginal productivity he could provide his team. Although the overall crime rate among NFL players is lower than the crime rate among the general population, there is some evidence that NFL players commit violent crimes at a higher rate (Leal et al., 2015). Even if the statistics do not indicate a strong relationship, almost 70 percent of Americans believe that the NFL has an epidemic of domestic violence (Leal et al., 2015).

The NFL commissioner determines league punishment for off-field behavioral issues, and he is responsible for maintaining the league's public image. He has the power to suspend a player from his team and keep him from playing for an extended period of time (NFLPA, 2011), and he may use that power to indicate to the public that the league does not tolerate violent crime. A player with a history of behavioral issues may pose the risk of wasting a team's cap space or drawing the ire of fans. Complicating the matter, not all behavioral issues may be indicated by a player's arrest history.

Weir and Wu (2014) find that an arrest history in college, whether the player is formally charged or not, correlates to a significant fall in draft position—between 16 and 22 spots. The fall in draft position does not have a negative impact on NFL performance, however. This is consistent with the idea that a player's value falls when he has a history of off-the-field issues, regardless of performance. Weir and Wu (2014) also find that suspensions enforced for noncriminal violations, such as team or university violations, lead to a similar drop in draft position and correlate with worse performance in the NFL. The performance drop-off may be indicative of attitude issues and difficulty getting along with coaches and teammates. Because these qualities are purely subjective, teams must make judgments about potential.

All of the aforementioned factors directly relate to a player's contributions on the field. It may be possible, however, that factors completely separate from performance influence the valuation process. Fan discrimination may affect management's decision to sign an athlete who could improve the team's performance (Fort, 2011). When fans prefer to watch players with certain characteristics unrelated to performance, the marginal revenue generated by a player may suffer and influence management's valuation. Kahn (1992) finds evidence consistent with fan discrimination based on race by studying the percent of white residents in the metropolitan area in which an NFL team played. He finds that white players receive higher salaries in areas with a high percentage of white residents, while non-white players see higher salaries in areas with higher percentages of non-white residents.

Discrimination may also occur at the ownership or teammate level. The wealthy owners of NFL organizations may value their own preferences over potential lost revenue from discrimination. Teammate discrimination occurs when players do not wish to interact with another player for reasons outside of performance. For example, the introduction of Jackie

Robinson into Major League Baseball exposed significant teammate discrimination. These types of discrimination are not profit maximizing and are not expected to persist (Fort, 2011). Because the NFL has little competition in the market for labor, however, owner and teammate discrimination could persist in the long run (Kahn, 1992).

One factor that may lead to discrimination is the racial identity of the player. Keefer (2013) finds that black linebackers in the NFL earn ten percent less than their white counterparts. However, a similar study by Burnett and Van Scyoc (2013) does not find statistically significant differences in the salaries of rookie wide receivers with respect to race. The effect of a player's race on salary is unclear from the literature. Any effects that race may have on player salary are most likely to occur in the initial hiring process. When making decisions on player retention, discrimination may play a smaller role due to the fact that players have had an opportunity to prove themselves for that specific employer (Conlin and Emerson, 2006).

Methodology

For this study, salary data for 426 offensive skill position players are collected from *Spotrac.com,* a partner of USA Today Sports Media Group. The highest paid player and average cap value for each position are listed in Table 1.

Table 1
Highest Paid Player by Position

Position	Highest-Paid Player	Team	Cap Value (2014)	Average Cap Value by Position
QB	Eli Manning	New York Giants	$20,400,000	$5,275,071
RB, FB	Adrian Peterson	Minnesota Vikings	$14,400,000	$1,734,462
WR	Mike Wallace	Miami Dolphins	$17,250,000	$2,530,006
TE	Jason Witten	Dallas Cowboys	$8,412,000	$1,792,419

Only players who have an active contract and filled a spot on the 53-man roster of one of the 32 NFL organizations at the time the data were collected are included. *NFL.com* provides

current rosters for all 32 teams and statistics for individual players. I collect data on years of experience, games played in the 2013 season, and race (white vs. nonwhite) from this website. I collect data on the number of Pro Bowls to which a player has been selected and whether a player was a first-round draft pick from *Pro-Football-Reference.com.*

I can identify players who entered free agency following the 2013 season, including both restricted and unrestricted free agents, from *Scout.com*, a Fox Sports affiliate. A player enters restricted free agency when his contract expires after his third year with a team. In this situation, the current team is allowed to match any qualifying offer the player has received from other teams; the player must accept the matching offer. In contrast, unrestricted free agents have completed a contract of at least four years in length and are allowed to sign with any team. Commonly, players who demonstrate value above their current contract leverage that position to renegotiate their contract prior to reaching free agency. These players are not classified as free agents.

I collect arrest data for all NFL players from the beginning of 2000 to 2013 from the *USA Today* online sports database (www.usatoday.com/sports/nfl/arrests). I include only players with active contracts, so recent cases in which the player was subsequently cut from the team's roster, such as Ray Rice, are not included. I collect 2013 fantasy football statistics and team performance data from *ESPN.com*. The median household income and percentage of white residents for the urban areas in which each NFL team play are available from the U.S. Census website (www.census.gov).

Data and Descriptive Statistics

Teams are subject to a finite salary cap that varies year to year ($133 million in 2014), so cap value is an accurate representation of the relative value that a team places on each player. For

this reason, *Cap Value* is the dependent variable. The average cap value of the players in this data set is $2,593,659. Of the positions included in this study, quarterbacks have the highest average cap value by a wide margin. This indicates that teams generally value the quarterback over other offensive skill positions. Eli Manning is the highest paid player in the data set with a cap value of $20,400,000 in 2014.

The independent variables are measures of individual characteristics, individual performance, and team and city characteristics. *Arrest* is a dummy variable with a value of one if the player has been arrested at least once from 2000 to 2014 and zero if the player has not been arrested over that time period. About eight percent of the players in this study have been arrested.

Non-White is a dummy variable equaling one if the player is non-white and zero if the player is white. About 66 percent of the players are non-white.

Experience, Experience Squared, First Round Pick, Undrafted, Games Played, Percent Games Started, Pro Bowls, and *Fantasy PPG* are variables designed to indicate an individual player's performance. *Experience* represents the number of years that a given player has participated in the NFL. With seventeen years, Peyton Manning has the most experience. The average number of years of NFL experience is 5.13. *Experience Squared* represents the square of the number of years a player has been in the NFL. This variable will control for the effects of diminishing productivity that would be expected at older ages due to the highly physical nature of professional football.

First Round Pick is a dummy variable equaling one if the player was selected in the first round of the NFL draft and zero if drafted in any other round or undrafted. About 18 percent of the players are first round draft picks. *Undrafted* is a dummy variable with a value of one for players who were not selected in the NFL draft. These players were signed as undrafted free

agents after the draft process concluded. Over 25 percent of the players in this data set went undrafted.

Games Played represents the number of games in which the player participated during the 2013 season. The average is nearly 12 games. *Percent of Games Started* indicates the percentage of the 16 game season that the player started in 2013. The average percent of games started was about 39 percent.

Pro Bowls indicates the number of times that a player has been selected to the Pro Bowl over the course of his career. With thirteen appearances, Peyton Manning has been selected the most often. The average number of Pro Bowls is 0.57.

Fantasy PPG represents the average number of fantasy points a player scored in ESPN standard scoring leagues in each game that they appeared, computed as the total number of fantasy points earned in the 2013 season divided by the number of games in which the player appeared. Peyton Manning averaged over 25 points per game, the league high for 2013. In comparison, the league average was less than 5 points per game.

Free Agent is a dummy variable that takes a value of one if a player became a free agent following the 2013 season and zero otherwise. About 24 percent of the players were free agents who re-signed with their 2013 team or signed with a different team for the 2014 season.

Team performance data indicates how effectively teams allocate finite cap space to optimize performance. *Playoffs* is a dummy variable with a value of one if the player's team reached the playoffs in 2013 and zero if it did not. For players who were traded or signed by another team out of free agency, the team that they played for in 2013 is used instead of their current team. Each year, 12 out of 32 teams participate in the NFL playoffs. *Team Winning*

Percentage indicates the percent of the games won over the course of the 16 game 2013 season. Each player's team is determined in the same manner as the *Playoffs* variable.

Kahn (1992) includes variables to correct for variations in demographics among the cities where NFL teams are located. *Median Income* and *Percent White Residents* describe the demographics in the urban areas where each team plays. Foxborough, Massachusetts, home of the New England Patriots, has the highest percentage of white residents at 90.3 percent. In contrast, Detroit has the lowest percent of white residents: 10.6 percent. San Francisco has the highest median household income ($73,802), while Detroit has the lowest ($26,325).

Descriptive statistics for the variables are reported in Table 2 for the total data set, as well as veteran and rookie contract subsets. I define a player on a rookie contract as any player with two or three years of experience, as contracts cannot be renegotiated until after the third contract year under the 2011 CBA. I cannot include first-year players because they lack performance statistics from 2013. A veteran is defined as any player with more than three years of experience.

Model

I use ordinary least squares regression to estimate the effects of the individual, team, and city variables on the compensation of NFL offensive skill-position players. Veteran and rookie contracts are modeled separately due to the effects of the 2011 CBA on rookie contract structures. The variables included in the final models were selected based on theoretical significance and inclusion in previous literature. To provide insight into the explanatory value of each independent variable, the dependent variable was also regressed against each independent variable individually. The R^2 from the individual regressions are presented in appendix Table 1.

Table 2
Descriptive Statistics

Variable	**Mean *(Standard Deviation)***		
	Total Data Set	Veteran Contracts	Rookie Contracts
Cap Value	2,593,659 *(3,660,113)*	3,700,403 *(4,261,482)*	807,931 *(760,036)*
ln(Cap Value)	14.128 *(1.059)*	14.571 *(1.063)*	13.412 *(0.531)*
Fantasy PPG	4.941 *(5.001)*	5.789 *(5.272)*	3.574 *(4.197)*
Arrest	0.085 *(0.278)*	0.118 *(0.323)*	0.031 *(0.173)*
Nonwhite	0.657 *(5.139)*	0.624 *(0.485)*	0.718 *(0.451)*
Experience	5.139 *(3.026)*	6.814 *(2.710)*	N/A
$(\text{Experience})^2$	35.542 *(42.691)*	53.741 *(45.646)*	N/A
First Round Pick	0.178 *(0.383)*	0.228 *(0.420)*	0.098 *(0.298)*
Undrafted	0.251 *(0.434)*	0.186 *(0.390)*	0.356 *(0.480)*
Pro Bowls	0.566 *(1.503)*	0.871 *(1.834)*	0.074 *(0.305)*
Games Played	11.883 *(5.157)*	12.114 *(5.059)*	11.509 *(5.305)*
% Games Started	0.393 *(0.371)*	0.475 *(0.381)*	0.263 *(0.313)*
Free Agent	0.237 *(0.426)*	0.369 *(0.483)*	0.025 *(0.155)*
Team Win %	0.507 *(0.192)*	0.518 *(0.191)*	0.491 *(0.193)*
Playoffs	0.404 *(0.491)*	0.430 *(0.496)*	0.362 *(0.482)*
% White Residents	0.544 *(0.177)*	0.544 *(0.181)*	0.542 *(0.170)*
Median Income	46,232 *(11,198)*	47,000 *(11,500)*	44,992 *(10,610)*
ln(Median Income)	10.712 *(0.244)*	10.728 *(0.248)*	10.687 *(0.236)*
N	426	263	163

The model in equation [1] applies to all players and to veterans.

$$[1] \quad ln(Cap\ Value) = \beta_0 + \beta_1 * FantasyPPG + \beta_2 * Arrest + \beta_3 * Nonwhite + \beta_4 * Experience + \beta_5 * Experience^2 + \beta_6 * FirstRoundPick + \beta_7 * Undrafted + \beta_8 * Probowls + \beta_9 * FreeAgent + \beta_{10} * TeamWin\% + \beta_{11} * \%WhiteResidents + \beta_{12} * ln(MedianIncome)$$

In this model, the dependent variable is the natural log of the cap value. *Cap value* does not represent all of the cash a player may receive in a given year, but it provides an excellent way to compare salaries because it captures the value of a player relative to the total team salary cap. Signing bonuses are amortized on a straight-line basis over the term of a player's contract, even though the player may receive the entire bonus up front (NFLPA, 2011). Variables to measure performance are included in model [1] because veteran players have had the opportunity to negotiate a salary based on performance. Strong correlations among *Games Started, Games Played,* and *Fantasy PPG* motivated the decision to include only the latter variable to minimize the effects of multicollinearity in the model. Similar concerns about the correlation between *Team Win Percentage* and *Playoffs* motivated the decision to include only the former.

Model [2] is designed to capture the factors that determine *Cap Value* in rookie contracts.

$$[2] \quad ln(Cap\ Value) = \beta_0 + \beta_1 * Nonwhite + \beta_2 * FirstRoundPick + \beta_3 * Undrafted + \beta_4 * FreeAgent + \beta_5 * \%WhiteResidents + \beta_6 * ln(MedianIncome)$$

Like model [1], *ln(Cap Value)* serves as the dependent variable. The difference between the two models is the absence of individual and team performance variables in model [2].

Because players cannot renegotiate rookie contracts until after the third year, performance cannot exert positive influence on rookie contract cap value. At the inception of the contract, performance is an unknown. Therefore, cap value may only vary with performance to the extent that future performance is explained by known factors at the inception of the contract. *Free Agent* is included in this model because teams have the option to release a player at any time, so a player with two or three years of experience may still be classified as a free agent.

Predicted Signs of Coefficients

For each variable in the models, I specify the expected sign of the coefficient in the fitted model. Expected signs are determined by examining the findings of past literature and applying the theoretical relevance of each variable. A positive sign indicates that I expect an increase in the value of the variable to correlate with an increase in the natural logarithm of *Cap Value*. A negative sign indicates that I expect an increase in the value of the variable to correlate with a decrease in the natural logarithm of *Cap Value*.

Assuming that League punishment following a player's arrest affects playing time and productivity, a previous arrest should negatively affect player salary. The most extreme case of a negative impact on salary—a team releasing a player—is not accounted for in this study, as only players currently occupying a roster spot are included in the data set. A team may retain a player after being arrested if it values his contributions to the team enough to compensate for the negative publicity they may receive. Until contract renegotiations, the cap value of players in this situation may not be affected.

A survey conducted to measure the public attitude toward Michael Vick's criminal punishment and reinstatement to the League indicates that white respondents tend to support harsher punishment of players who have been arrested (Piquero et al., 2011). As a result, arrests

may have a larger effect on salary among teams located in cities with a high percentage of white residents. Overall, there is no evidence to suggest that arrest would have a positive effect on salary. I expect a negative coefficient for the *Arrest* variable.

In the market for linebackers from 2001-2009, Keefer (2013) find evidence consistent with differences in salary based on race. The results suggest that white linebackers receive ten percent higher salaries on average than their black counterparts. Kahn (1992) shows that the correlation between race and salary is dependent on the racial demographics of the urban area where the team plays. He finds that white players tend to earn more than non-white players in areas with a high percentage of white residents, while non-white players tend to earn more in areas with a high percentage of non-white residents. In contrast, Gius and Johnson (2000) conclude that white players earn ten percent less than black players. Another recent study by Burnett and Van Scyoc (2013) finds no differences in the salaries of rookie wide receivers in the NFL based on race. As this data set closely resembles my subset of rookie contracts, I expect to see a similar lack of correlation between race and compensation among players in their rookie contracts. To the extent that correlation exists, I would expect the sign of *Nonwhite* to be negative, as found in the previous literature.

Following the NFL's new collective bargaining agreement in 2011, the value of rookie contracts has dropped significantly (Brandt et. al., 2013). In addition, all new rookie contracts last for four years and cannot be renegotiated until after the completion of three full seasons. Consequently, many young players receive compensation well below their values (Brandt et. al., 2013). As a result, I expect *Experience* to have a positive coefficient in the total and veteran data sets, as players with the skill level to continue playing beyond their rookie contracts sign new, more lucrative contracts following their third or fourth year in the league. Following labor

economics theory, I expect the sign of *Experience Squared* to be negative as players face diminishing productivity at older ages. *Experience* and *Experience Squared* are not included in the model for rookie contracts because each variable would have only two possible values.

NFL teams spend first round draft picks on players they believe possess the potential to have the largest impact on the future of the organization. As such, they should place a larger value on players selected early in the draft resulting in a positive coefficient. I expect *First Round Pick* to be positive in the rookie contract subset, as first round draft picks reflect high performance expectations. The salary restrictions imposed on rookies in the 2011 collective bargaining agreement may mitigate this effect in the total data set, as the decrease in average rookie contract value post-2011 CBA may reduce the average salary of first round picks in the total data set. I expect this variable to be weaker in predicting veteran contracts, as these players have performed well enough to warrant new or continued contracts regardless of draft position. In all cases, I expect the sign of coefficient for *First Round Pick* to be positive.

I expect the *Undrafted* variable to take the opposite sign of the *First Round Pick* variable, and I expect the magnitude to be nearly the same. I expect undrafted players among the rookie contract to have especially small contracts, as they must prove they are capable of performing at the same level as players deemed to have more potential in the draft. Much like the *First Round Pick* variable, I expect the effect of *Undrafted* to diminish in the total data set and veteran subset, as compensation decisions move toward measured, rather than expected, NFL performance.

Standout players at each position are selected to participate in the Pro Bowl each year. Many Pro Bowl appearances suggest that a player has performed extraordinarily well over an extended period of time and may warrant a higher salary. I expect a positive correlation between *Pro Bowls* and *Cap Value*.

Players who outperform their contracts have the opportunity to leverage their performance to negotiate for higher salaries in free agency. Such performance may also enable a player to negotiate a contract extension that would keep him from entering free agency at all. The frequency of these contract extensions may reduce the number of highly valuable players entering free agency and so reduce the positive effects on salary. With the new collective bargaining agreement limiting the value of rookie contracts, teams may find it a more efficient allocation of cap space to draft and sign multiple rookies instead of signing one veteran from free agency (Brandt et al., 2013). As a result, free agency may be negatively correlated with salary. The sign of the coefficient is difficult to predict in the veteran subset because I cannot measure the prevalence of contract renegotiation. Because players on rookie contracts do not have this renegotiation option, I expect the sign of *Free Agent* to be negative within the rookie subset. A team has no incentive to release a player on a rookie contract into free agency unless he performs below the value of the contract and show little future potential. Such expectations would likely result in a smaller contract with a new team or the player leaving the league entirely.

Fantasy football provides a unique way to evaluate an offensive player's contribution on the field. By awarding points for yards and touchdowns and penalizing players for turnovers, fantasy football allows cross-positional comparisons of performance. I expect *Fantasy PPG* to be positively related to player cap value.

Exceptional team performance should correlate to higher salaries. Assuming a successful team is able to identify the players who make the largest contribution, those players should receive a relatively high salary. Offensive skill position players may receive more credit for a team's success, as their contributions are easily observed. I expect *Team Winning Percentage* to be positively related to player salary.

As outlined by Kahn (1992), *Percent White Residents* may affect salaries for white and non-white players differently. The sign of the coefficient may depend on the distribution of white and non-white players in certain urban areas. *Median Income* should have a minimal effect on salary because each team is operating under the same salary cap, and it is in each team's best interest to efficiently allocate the entirety of the cap space.

Results and Discussion

Table 3 contains the results from the ordinary least squares regression used to estimate the empirical models specified in [1] and [2]. Model R^2 in Appendix Table 1 represents the R^2 value when the natural log of cap value is analyzed against that single regressor.

Fantasy PPG is statistically significant ($p<.01$) in both models. The result from the veteran contract model indicates that a one-point increase in fantasy points per game correlates with a 10.6 percent increase in cap value. [1] The *Fantasy PPG* model R^2 (.46) indicates that this variable explains nearly half of the variation in the natural log of cap value for veteran players. Of the variables considered in the veteran contract model, *Fantasy PPG* has the greatest explanatory value by a wide margin. The veteran contracts model provides the clearest image of the true correlation between fantasy performance and cap value because it excludes rookie contracts, which cannot be influenced by fantasy performance.

Arrest is statistically significant ($p<.05$) in both models. The influence is clearest in the veteran data set. The model for veteran contracts indicates that a past arrest correlates with a 26.1 percent decrease in cap value.

[1] Because the dependent variable is the natural log of cap value, coefficients are interpreted as $e^{coef} - 1$.

Table 3
Regression Results
Dependent Variable—ln(Cap Value)

Variable	***Coefficient (Standard Error)***		
	Total Data Set	Veteran Contracts	Rookie Contracts
Constant	13.228** *(1.349)*	11.917** *(1.963)*	15.241** *(1.349)*
Fantasy PPG	0.080** *(0.007)*	0.101** *(0.009)*	N/A
Arrest	- 0.261* *(0.103)*	- 0.302* *(0.128)*	NA
Nonwhite	- 0.161** *(0.060)*	- 0.184* *(0.087)*	0.034 *(0.058)*
Experience	0.483** *(0.038)*	0.448** *(0.076)*	N/A
$(Experience)^2$	- 0.026** *(0.003)*	- 0.025** *(0.005)*	N/A
First Round Pick	0.512** *(0.082)*	0.379** *(0.110)*	1.236** *(0.090)*
Undrafted	- 0.137* *(0.067)*	- 0.058 *(0.107)*	- 0.247** *(0.480)*
Pro Bowls	0.132** *(0.029)*	0.118** *(0.034)*	N/A
Free Agent	- 0.374** *(0.073)*	- 0.383** *(0.088)*	- 0.519** *(0.174)*
Team Win %	0.017 *(0.152)*	- 0.133 *(0.225)*	N/A
% White Residents	0.156 *(0.183)*	0.173 *(0.264)*	- 0.060 *(0.176)*
ln(Median Income)	- 0.097 *(0.131)*	0.041 *(0.187)*	- 0.172 *(0.130)*
Adjusted R^2	0.7119	0.6303	0.6191
F-Statistic	F(11,414)=88.51**	F(11,251)=38.23**	F(6,156)=44.89**
N	426	263	163

**Significant at the one-percent level
*Significant at the five-percent level

The *Nonwhite* variable provides one of the more interesting results in this research. The models indicate that race is statistically significant in the total ($p<.01$) and veteran ($p<.05$) contract data sets, but it is not statistically significant in the model for rookie contracts. The model for veteran contracts indicates that nonwhite players receive, on average, 16.8 percent less than their white counterparts. I suspect that this result may be partially due to the fact that 13 of the top 15 cap values in the veteran contract data set belong to white starting quarterbacks. The density of high-value, white players at the top of the distribution exaggerates the magnitude of the coefficient.

Experience and *Experience Squared* remain very consistent across both models. Each additional year of NFL experience correlates to a 62.1 percent increase in cap value in the model for the total data set. The negative coefficient for *Experience Squared* reflects diminishing productivity in later years. These results are statistically significant ($p<.01$).

As expected, being a first round draft pick has a strong, positive correlation with cap value. This variable, when considered alone, explains over half of the variation in the natural log of cap values of rookie contracts. It has, by far, the most explanatory power of the variables in the model for the rookie data set. Among rookie contracts, first round draft picks receive, on average, 244 percent larger cap values than players not drafted in the first round. For veterans, first round picks receive 46.1 percent more than their counterparts on average. The variable is statistically significant ($p<.01$) across all models.

The correlation between being undrafted and compensation manifests in the opposite direction of first round picks. It is important to note that the result is only statistically significant in the model for rookie contracts ($p<.01$), where going undrafted correlates with a 21.9 percent

lower cap value. The lack of significance in the veteran model indicates that players who prove themselves worthy of a contract do not face lower contract values in subsequent contracts.

As expected, Pro Bowls are positively correlated with cap value, with a 12.5 percent increase for each additional Pro Bowl invitation among veteran contracts. This result is statistically significant ($p<.01$).

Free agency following the 2013 season correlates with a 31.8 percent decrease in cap value. This result is statistically significant ($p<.01$) and indicates that the most valuable free agents tend to renegotiate contracts prior to expiration, rather than enter free agency. Among rookie contracts, free agents received, on average, 40.5 percent lower cap values in the following year. This relationship is consistent with the assertion that teams only release players from rookie contracts when they significantly underperform. Teams have an incentive to renegotiate contracts with players who outperform their current contracts before those players enter free agency. Such a tactic prevents a player from abandoning the team for more money elsewhere. For players who underperform in their contracts, teams are not as aggressive. Therefore, underperforming players are heavily represented in the free agent market, and free agents receive, on average, a pay cut between 30 and 40 percent.

Team winning percentage is not statistically significant in determining a player's cap value. In addition, neither the percentage of white residents nor the median household income in the area where teams play have statistically significant effects on cap value. The insignificance of team performance and metropolitan demographics may be a result of the standardized salary cap by which all teams must abide, regardless of success or location.

Conclusions

Past research into the determinants of NFL player salaries struggles to compare players across positions because of the differences in statistical performance measures. This research is the first to use fantasy football statistics as a formal measure of cross-positional performance. Using salary data from 2014 and the previous year's individual and team performance information, this research analyzes the determinants of NFL player salaries in rookie and veteran contracts.

The results indicate that race and arrest history are significant factors in determining a veteran player's cap value but have little to no significant effects on the cap values of players on rookie contracts. The results also suggest that, while race and arrests are significant, the greatest variation in an NFL player's cap value comes from the player's individual performance and career factors. Players receive, on average, 11 percent larger cap values for each additional fantasy point per game. The statistical significance of these results and the raw explanatory power of the variable indicate that fantasy football statistics closely mirror the real-life performance judgments made in the front offices of NFL organizations.

In rookie contracts, draft position is the primary determinant of salary. First round draft picks receive significantly higher salaries, while undrafted players receive much less. These differences persist throughout the length of rookie contracts due to the limits on negotiation in the 2011 collective bargaining agreement.

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Appendix Table 1
Individual Model R^2
Dependent Variable—ln(CapValue)

Variable	***Model R^2***		
	Total Data Set	Veteran Contracts	Rookie Contracts
Fantasy PPG	0.4384	0.4592	--
Arrest	0.0029	0.0043	--
Nonwhite	0.0135	0.0112	0.0061
Experience	0.3548	0.1485	--
$(\text{Experience})^2$	0.2831	0.1324	--
First Round Pick	0.2489	0.1964	0.5505
Undrafted	0.0810	0.0300	0.1705
Pro Bowls	0.2848	0.2555	--
Free Agent	0.0005	0.1025	0.0188
Team Win %	0.0025	0.0006	--
% White Residents	0.0002	0.0004	0.0005
ln(Median Income)	0.0000	0.0014	0.0068
N	426	263	163