Race and National Football League Player Salaries After Controlling for Fantasy Statistics and Arrests

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Abstract:

This paper provides a novel contribution to studies of race and labor-market outcomes by using fantasy football statistics as a measure of performance across offensive skill positions and arrest data as a proxy for off-the-field behavior. We investigate whether the determinants of salary and employment vary between 2005-06 and 2015-16, as the 2011 collective bargaining agreement (CBA) introduced extensive regulation of rookie contracts. There are no discernible differences in outcomes between white and nonwhite players, nor between players with arrests and those without. As expected, fantasy football statistics are strong predictors of salaries and employment in both time periods.

Keywords:

National Football League, discrimination, compensation, Collective Bargaining Agreement, quantile regression

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Introduction

The National Football League (NFL) is the largest professional sports league in the U.S. in terms of revenue, earning in excess of $12 billion annually (Isidore, 2015). It employs almost 1,700 players during the regular season, and the players' salary cap is based on almost 50 percent of the total revenues (Davis, 2014). A major obstacle in past research on salaries and race in the NFL, such as the pioneering work by Kahn (1992), has been the inability to compare player performance across positions. 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 (quarterback, running back, tight end, and wide receiver), as fantasy 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 both groups of players are excluded from this research.

This paper is the first to incorporate fantasy football statistics as a means to compare the productivity of players who play different positions. We use these productivity statistics to see if race or getting arrested affect each player's salary and employment.[1] Both outcomes are measured for 2006 and 2016 in order to investigate potential effects of the 2011 collective bargaining agreement where, among other things, the salaries of rookies became largely determined by draft position rather than by negotiations between players and teams.

We find that race and arrest history have no discernible relationship with compensation or employment. Instead, performance and draft position are the primary determinants of both player salary cap values and of the likelihood of employment. Fantasy statistics alone explain nearly half of all variation in salary cap values. Given the explanatory power of this variable, excluding it (or a similar measure of performance) from an analysis of

[1] As we discuss in the data section, we use the terms 'salary' and 'salary cap value' interchangeably.

race would yield weak results. Salaries increase with experience, although at a decreasing rate. There is no systematic relationship between experience and employment.

Literature Review

Studies of labor-market outcomes in professional sports often address issues of racial discrimination, in the form of employer, employee, or customer. Employer discrimination occurs when an employer prefers to hire or not hire employees based on characteristics unrelated to productivity (such as race or gender). In a free market economy, employer discrimination is not profit-maximizing and therefore tends to lessen over time (Becker, 1971). Some might argue that owners of an NFL franchise are not profit-maximizers, given their wealth and the prestige of owning an NFL team. In a similar vein, Palmer and King (2006) point out that if Major League Baseball owners possess racial prejudices, they may have enough wealth to exercise racially-biased front office decisions for an extended period of time. Thus, employer discrimination is a possibility in the NFL.

Employee discrimination occurs when employees do not want to work with co-workers because of their characteristics that are unrelated to productivity (such as race or gender) (Becker, 1971). Employee discrimination would be difficult to measure in the NFL.

Customer discrimination, unlike other forms of prejudice, is not as easily forced from the market (Becker, 1971). If customers prefer white workers, employers will react by either hiring fewer nonwhite workers or paying nonwhite workers a lower wage. In the case of the NFL, customers could reward the employers who listen to their preferences with greater purchases of tickets, player jerseys, and other purchases that increase a team's revenue.

Because employee performance is more easily observed for professional athletes than for most other employees, many papers have studied the determinants of professional athletes' salaries. For football, the earliest work on this topic is by Mogull (1973).[2] He finds

[2] Kahn (1991, 2000) reviews the literature on labor economics and sports, not just football.

similar compensation between black and white football players using data compiled from questionnaires of 96 players from the 1970 season, but he does not control for individual player characteristics aside from experience.

The seminal paper on NFL salaries is by Kahn (1992). He includes data on 1,363 players for the 1989 season. On average, white players earn a maximum of four percent more than black players, but this result is not statistically significantly different from zero when controlling for different variables such as position. He finds that white players receive higher salaries in areas with a high percentage of white residents, whereas nonwhite players receive higher salaries in areas with higher percentages of nonwhite residents. This finding is consistent with customer discrimination.

More recently, Gius and Johnson (2000) sample 938 players from the 1995 NFL season. Although they determine that black players earn, on average, ten percent more than white players, they, like Kahn (1992) only have indirect measures of productivity such as position and experience. Using data from 2000 to 2008, Ducking et al. (2014) find no relationship between race and lifetime earnings for six positional groups (defensive backs, defensive linemen, linebackers, running backs, tight ends, and wide receivers).

In order to control for productivity, some studies focus on individual positions. Berri and Simmons (2009), in their analysis of quarterbacks between 1995 to 2006, find lower salaries for black quarterbacks, particularly at the higher end of the salary distribution. Keefer (2013) finds that black linebackers in the NFL earn ten percent less than their white counterparts, although this result is driven by lower salaries for nonwhites in the lower part of the salary distribution. Similarly, Ducking et al. (2017) find lower salaries for black linebackers compared to white linebackers at different parts of the salary distribution, but they find no racial differences for defensive lineman or defensive backs. When focusing on rookies (players just starting in the NFL), Burnett and Van Scyoc (2013, 2015a, 2015b) find

no discernible differences by race in the wage distribution of wide receivers, offensive linemen, linebackers, or tight ends.

Research on the NFL considers employment-related measures as well as salary-related measures. Using data from 1990 for multiple positions, Conlin and Emerson (2005) find that nonwhite players typically have a higher probability of having an active contract and starting more games. More recently, Keefer (2016) finds that black linebackers are more likely to start games. In contrast, Volz (2017) finds that black quarterbacks are more likely to be benched. For six positions, Ducking et al. (2015) find no differences by race in NFL career length using hazard models.

In summary, there is no consistent pattern in the relationship between race and employment or salary outcomes in the NFL. Some studies find that whites do better, others find that blacks do better, and some find similar results by race.

We contribute to the NFL earnings and employment literature in three ways. The first contribution is to use fantasy points as a comprehensive measure of productivity across players from different positions. By including this measure in regressions where we also control for player race, we contribute to the literature on discrimination in earnings and employment. Our second contribution is to study employment as an outcome rather than just focusing on player compensation. Although we cannot distinguish between the two main reasons for a player not being employed, namely not being offered employment versus turning down offered employment, our reduced-form measure of being under contract is still a useful outcome measure that is rarely analyzed. Finally, we look at the relationship between the off-the-field behavior of arrests and salaries / employment, complementing the work by Weir and Wu (2014) who show that an arrest in college correlates with a fall in draft position of 16 to 22 positions.

Although the vast literature on collective bargaining is potentially relevant for our study of the NFL, we do not contribute to that literature. Instead, our focus is solely on the relationship between race and labor-market outcomes controlling for on-the-field determinants, along with arrest records. For more information on collective bargaining and unions, see MacLeod (2011) as well as the citations therein.

National Football League Salary Cap and Collective Bargaining

In the National Football League, player salaries make up the largest portion of a team's annual costs (Associated Press, 2016). All teams in the NFL are subject to a "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 NFL ownership and the NFL Players Association (NFLPA).

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 beginning their professional careers. 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). Thus, the returns to experience may differ in the two time periods.

Data and Descriptive Statistics

We use data from two time periods equally spaced before and after the 2011 collective bargaining agreement. Specifically, we link 2005 productivity data with 2006 contract and salary cap data, and we link 2015 performance data with 2016 contract and salary cap data. Because we have data for two periods rather than every year, our results are only suggestive of changes associated with collective bargaining. To rule out other explanations such as general trends in the league, a complete panel data set with all years would be needed.[3]

[3] Our primary salary data source, spotrac.com (discussed further below), only provides current salary data.

We have two models, each with a different dependent variable. Both are based on contract and salary data available from sportrac.com, a partner of USA Today Sports Media Group. Teams are subject to a finite salary cap that varies year to year (it was $155 million in 2016), so cap value is an accurate representation of the relative value that a team places on each player. For this reason, the amount of a player's salary counted against the league's salary cap is the dependent variable in the first model, as this variable is the standard measure of player salaries in the sports economics literature (Berri and Simmons, 2009). Players who are not employed have a missing value for salary cap value and are excluded from the salary regressions. Salary cap values are measured in 2016 dollars using the consumer price index. In the second model, the dependent variable is a dummy variable equal to one for players who have a salary cap value – e.g. who are employed – in either 2006 or 2016. The analysis captures whether productivity and other player characteristics affect the duration of players' tenure in the league.

Productivity data come from www.pro-football-reference.com, a website with extensive information on individual players. Each year, the website publishes a player-level database containing fantasy football values, as well as the individual components of the fantasy statistic related to passing, rushing, and receiving. Our productivity variable is the total number of fantasy points for the 2005/2015 season, where a higher number represents a more productive player (such as 389 for Cam Newton in 2015) than a lower number (such as 1 for Doug Flutie in 2005).[4] Because the fantasy statistics are only meaningful for the players involved in passing, rushing, and receiving, fantasy statistics are only calculated for quarterbacks, running backs, wide receivers, and tight ends. Thus, the data in this paper only

[4] The standard definition for fantasy points is as follows. Players receive 1 fantasy point for each 25 yards of passing thrown, 4 points for each touchdown pass thrown, -2 points for each interception thrown, 1 point for each 10 passing reception yardage, 1 point for each 10 rushing yardage, 6 points for each touchdown rushed/received, 2 points for each two-point conversion rushed/received/passed, and -2 points for each fumble lost.

include players in those positions. By awarding points for yards and touchdowns and penalizing players for turnovers, fantasy football allows cross-positional comparisons of performance.

We supplement the productivity data with additional player data available from the website. First, player race, categorized as a dummy variable equal to one for nonwhites, was calculated based on an analysis of player photographs available on the website.[5] There are insufficient numbers of nonwhites other than African-Americans to estimate separate coefficients for these racial and ethnic groups.

Second, we collected data on each player's draft status. We created a dummy variable for being a first-round draft pick, a dummy variable for being a second-round draft pick, a dummy variable for being a third-round draft pick, and a dummy variable for not being drafted. The omitted category is the set of players who were drafted in the fourth round or later.

Third, we include four variables to measure experience. The first two variables are the number of seasons played and its square. The years of experience measures do not include seasons that a player missed due to injury or other reasons. A player who played in each season starting in 2001, for example, has a value of 5 for experience and 25 for experience squared in the 2005-2006 data set. The third experience variable is the number of games played in either the 2005 or 2015 season. The fourth experience variable is the number of Pro Bowl invitations through the 2005 or 2015 season.[6]

We also control for the player's position with a set of dummy variables. The omitted category is wide receiver, the most common position in the data. Even though the fantasy

[5] To minimize the possibility of miscoding race, at least two people looked at each photo. If the two people disagreed, the authors looked at the photo and agreed upon the player's race.
[6] As players who play in the Super Bowl do not play in the Pro Bowl, this variable measures being invited to the Pro Bowl whether or not the player actually participates in the Pro Bowl game.

statistic is designed to equate productivity across positions, teams need to hire players at each position. A team cannot substitute a wide receiver for a quarterback.

We have one measure of off- the-field characteristics. The USA Today Sports Media Group collects data on arrests of NFL players starting in 2000. Using these data, we create a dummy variable with a value of one if the player has been arrested at least once from when they enter the league (or 2000, for players who entered prior to 2000) through July of 2006 or 2016.[7] July is chosen as the end date because players report to training camp in August. 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 2014 season, Peterson played in only one game during that season. In this case, off-the-field actions eliminated the contributions he might have provided his team.

Team performance data indicate how effectively teams allocate finite cap space to optimize performance. Kahn (1992) included variables in his model to correct for variations in demographics among the cities where NFL teams are located. Because the appropriate team variables are not standard in the literature, we instead use team fixed effects (based on the 2005 or 2015 team) to account for any team-specific effects on labor-market outcome. Given the relatively small number of players per team, our preferred model excludes these team fixed effects.

Table 1 contains the descriptive statistics for the variables. The first two columns are for the 2005-2006 data and the second two columns are for the 2015-2016 data. In each year, the first column is for the entire sample of players in 2005 or 2015 (e.g. the regression sample

[7] Because so few players are arrested multiple times, we are unable to identify an effect of other measures of arrests such as the number of arrests.

for the employment regressions) whereas the second column is for the subset of players with salary cap information (e.g. the regression sample for the salary cap regressions).

Table 1: Descriptive Statistics by Year and Sample

	2005-2006 data		2015-2016 data	
Variable	All players	In 2006 data	All players	In 2016 data
Cap value (2016 dollars)	2,205,845	2,205,845	3,078,038	3,078,038
	(2,602,452)	(2,602,452)	(4,516,954)	(4,516,954)
Employed, 2006 / 2016	0.757	1	0.727	1
Nonwhite	0.698	0.702	0.722	0.717
Fantasy points	49.3	61.4	57.6	71.1
	(64.7)	(68.5)	(70.7)	(76.2)
Quarterback	0.141	0.157	0.128	0.145
Running back	0.244	0.242	0.296	0.288
Tight end	0.217	0.202	0.208	0.206
Wide receiver	0.326	0.312	0.368	0.361
Experience	4.46	4.56	4.07	3.90
	(3.25)	(3.20)	(3.25)	(3.11)
Games played	11.1	12.2	10.7	11.6
	(5.33)	(4.87)	(5.28)	(5.05)
1st round draft	0.168	0.197	0.135	0.155
2nd round draft	0.126	0.139	0.107	0.126
3rd round draft	0.098	0.114	0.119	0.124
Undrafted	0.278	0.222	0.330	0.288
Pro bowls	0.387	0.455	0.509	0.550
	(1.15)	(1.24)	(1.48)	(1.44)
Arrested	0.080	0.087	0.080	0.068
Observations	589	446	587	427

Note: Means are reported, and standard deviations for non-binary variables are in parentheses.

Average player salaries (as measured by the salary cap value) are $2.2 million in 2006 and $3.1 million in 2016, both measured in 2015 dollars. Thus, average value increased by 28 percent in real terms. Approximately three-fourths of the players in 2005 and 2015 were employed the following season.

Approximately 70 percent of players are nonwhite. For all players, the average number of fantasy points was around 50 in 2005-06 and 57 in 2015-16. For players in the salary cap sample, the average fantasy points were 61 in 2005 and 71 in 2015. The most common position is wide receiver (the omitted category in the regressions), followed by

running back. Around 15 percent of players were drafted in the first round, and approximately 30 percent were not drafted. The average number of Pro Bowl invitations was less than one (0.4 to 0.5). Players had an average of 4.0 to 4.5 years of experience, and they played in an average of 11 to 12 of the 16 regular-season games. Finally, approximately eight percent of players had an arrest.

Table 2 illustrates differences across position and time in the fantasy points distribution, although all differences are not statistically significantly different due to the large standard deviations. Quarterbacks have the largest average fantasy points, at 95.3 in 2005-06 and 135.1 in 2015-16. Tight ends have the lowest average fantasy points: 29.8 in 2015-16 and 42.0 in 2015-16. The table also illustrates differences across the salary cap distribution by position as well as differences in the mean.

Table 2: Fantasy Points Distribution by Year and Position, Salary Cap Sample

2005-2006 data	QB	RB	TE	WR	Overall
Mean	95.3	75.9	29.8	65.6	61.4
Standard Deviation	84.0	82.6	37.3	57.9	68.5
10th Percentile	3	0	0	0	0
25th Percentile	15	8.5	2	16	7
50th Percentile	82.5	50.5	16.5	56	37.5
75th Percentile	172	111.5	41	103	92
90th Percentile	222.5	188	85.5	150	167
Observations	70	108	90	139	446
2015-2016 data	QB	RB	TE	WR	Overall
Mean	135.1	66.1	42.0	66.1	71.1
Standard Deviation	124.6	59.8	43.2	62.1	76.2
10th Percentile	0	2	0	2	1
25th Percentile	13	14	12.5	14	13
50th Percentile	104	49	24	45.5	44
75th Percentile	273	105	63.5	105	107
90th Percentile	303	155	102	159	173
Observations	62	123	88	154	427

Methods and Predicted Effects

Following previous work such as Kahn (1992), we use ordinary least squares and conditional quantile regression to estimate the effects of the individual and team variables on the compensation and on the likelihood of being employed for NFL offensive skill-position players as shown in equation [1] and equation [2] below.

[1] $$ln(CapValue) = Fantasy * \beta + PlayerStats * \gamma + Arrest * \lambda + Team * \theta + \epsilon$$

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. As mentioned previously, 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).

The salaries of NFL players are highly dispersed, ranging from little-used reserve players with salary cap values around $100,000 to superstar players earning over $10,000,000 per year. To address this range, we also estimate quantile regression models as is done in several previous papers starting with Berri and Simmons (2009). By focusing on particular percentiles in the salary distribution, such as the median, rather than the mean (as is done in an OLS regression), quantile regression models reduce the influence of outliers at both ends of the salary cap distribution.

Equation [2] is the model where being employed, as measured by being under contract, is the dependent variable. We estimate a probit model. In the appendix, we show that the results are not sensitive to the choice of probit, logit, or linear probability model. We estimate standard errors that are robust to heterogeneity.

[2] $$Pr(Employed) = Fantasy * \beta + PlayerStats * \gamma + Arrest * \lambda + Team * \theta + \epsilon$$

Both models contain quadratic terms for fantasy football points and experience. If fantasy points and experience measure productivity, standard labor economics theory predicts positive coefficients for the linear terms. If diminishing returns to productivity exist, then the coefficients for the quadratic terms would be negative. Because the adoption of the NFL's new collective bargaining agreement in 2011 resulted in many young players receiving compensation well below their values (Brandt et. al., 2013), experience may have a different effect on outcomes between the two periods.

The models include several player characteristics: dummy variables for position (relative to the omitted position of wide receiver), dummy variables for being drafted in the first round, the second round, the third round, or not being drafted (relative to the omitted group of being drafted in the fourth round or later), the number of games played in 2005 or 2015, and the number of times a player was invited to the Pro Bowl. We also control for one off-the-field characteristic, a dummy variable for being arrested.

Exceptional team performance should correlate to higher salaries, but the team-level salary cap limits the influence of team characteristics. Consequently, our preferred specification excludes team characteristics. We include team fixed effects in some specifications for ease of comparison with previous studies such as Kahn (1992).

Results

Salary Regressions

Table 3 contains the results from the ordinary least squares regressions for the 2005-2006 data, where the dependent variable is the log salary cap value. In the first column, race is the only control variable. This model provides the 'gross' difference in salary cap values by race. Column 2 includes controls for fantasy points and player characteristics, and column 3

adds team fixed effects for the player's 2005 team. For simplicity, we interpret the coefficients as percentages, a common practice in labor economics.[8]

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

Table 3: OLS Regression Results for Log 2006 Salary Cap Value

	1	2	3
Nonwhite	-0.058	-0.018	-0.027
	(0.107)	(0.077)	(0.093)
Fantasy points		0.010 ***	0.0108 ***
		(0.001)	(0.001)
Fantasy points^2 / 100		-0.001 ***	-0.0017 ***
		(0.0005)	(0.001)
Quarterback		0.154	0.151
		(0.122)	(0.122)
Running back		-0.241 ***	-0.231 ***
		(0.081)	(0.084)
Tight end		0.034	0.029
		(0.080)	(0.093)
Experience		0.216 ***	0.226 ***
		(0.033)	(0.032)
Experience squared		-0.014 ***	-0.015 ***
		(0.002)	(0.002)
Games played		-0.009	-0.008
		(0.009)	(0.008)
1st round draft pick		0.578 ***	0.612 ***
		(0.111)	(0.099)
2nd round draft pick		0.384 ***	0.410 ***
		(0.092)	(0.103)
3rd round draft pick		0.265 ***	0.277 **
		(0.089)	(0.111)
Undrafted		0.026	0.059
		(0.086)	(0.090)
Pro bowls		0.123 ***	0.132 ***
		(0.029)	(0.033)
Arrested		-0.061	-0.048
		(0.132)	(0.116)
Effect of 12-fantasy point increase			
0 points		0.121	0.127
60 points		0.101	0.103
100 points		0.087	0.086
200 points		0.052	0.045
Team Fixed Effects	No	No	Yes
Observations	446	446	446
R-squared	0.001	0.61	0.63

Notes: Each column is from a separate OLS regression. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1%, respectively, for a two-sided test. The overall fantasy points effect measures the sum of the fantasy points and fantasy points squared coefficients.

In Column 1, the coefficient for nonwhite players is -0.058 and is not statistically significantly different from zero. In our preferred specification in Column 2, nonwhite players have essentially the same salaries as white players. Although the coefficient is under -0.01 in magnitude, the large standard error of 0.07 limits the ability to draw inferences for this variable. In other words, our best guess (e.g. the coefficient) is that there is no evidence of racial discrimination in player salaries, but the precision of our best guess (e.g. the standard error) is not very strong.

In all specifications, fantasy points are positively associated with salary cap value and negatively associated with salary cap value when squared, suggesting decreasing returns to fantasy points. Fantasy points and fantasy points squared explain nearly half of the variation in log salary.[9] The table also presents the effects of a 12-point increase in fantasy points, equal to two touchdowns receiving or rushing and three touchdowns passing, for different levels of fantasy points. Because the standard deviation of fantasy points is approximately 70 (Table 1), an increase of 12 fantasy points is approximately one-sixth of a standard deviation. At zero fantasy points, the 10th percentile for most positions (Table 2), a 12-point increase in fantasy points corresponds to a salary increase of 12 percent. Due to the negative coefficient for fantasy points squared, the overall effect drops to ten percent at 60 points (roughly the sample mean) and nine percent at 100 points (near the 75th percentile). At 200 points, nearly the 90th percentile of fantasy points for quarterbacks (approximately 220 points), the effect is only 4.4 percent.[10]

Several player characteristics are significant determinants of player salaries. Conditional on fantasy points, running backs have lower salaries of 24 percent compared to wide receivers (the omitted category). The linear term for experience is positive, but the

[9] In results available from the authors upon request, the r-squared from a model that contains only fantasy points and its square has an adjusted R-squared of 0.47 in 2006 and 0.44 in 2016.
[10] The combined linear and quadratic effect of fantasy points is positive except for the top player, Shaun Alexander, who had 364 fantasy points in 2005.

quadratic term is negative, consistent with economic theory. An increase in experience from four years to five years is associated with a salary increase of nine percent. The overall effect of experience is negative once a player has nine years of experience. Compared to players drafted in the fourth round or later, first-round draft picks have salaries 58 percent higher. The salary premium for second and third round picks is smaller, at 38 and 27 percent, respectively.[11] There is no discernable salary cap difference between undrafted players and players drafted in the fourth round or later. A Pro Bowl invitation correlates with a 12 percent increase in salary. One interpretation of the positive and significant effects for early-round draft picks and Pro Bowls invitations is that teams believe that these players possess particularly valuable skills, such as leadership or teamwork, that are not completely captured by their fantasy points.

Arrest history has no detectable relationship with salaries. The coefficient of approximately -0.07 is dwarfed by its standard error. This result, coupled with the even smaller (in magnitude) coefficient for nonwhite, suggests that salaries depend much more on on-the-field characteristics rather than off-the-field characteristics.

The results are similar between the model in column 3 with team fixed effects and the model in Column 2 without them. We interpret this similarity as suggestive evidence that team level differences are unlikely to be a major influence of salary cap value.

[11] In results available from the authors upon request, if we also include a dummy variable for being drafted in the fourth round, that coefficient is small in magnitude and statistically insignificant.

Table 4: Quantile Regression Results for Log 2006 Salary Cap Value

	P10	P25	P50	P75	P90
Nonwhite	0.356 ***	-0.007	-0.033	-0.078	0.017
	(0.067)	(0.081)	(0.196)	(0.167)	(0.125)
Fantasy points	0.010 ***	0.008 ***	0.015 ***	0.010 ***	0.012 ***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Fantasy points^2 / 100	-0.001	-0.002 **	-0.001	-0.003 ***	-0.001 *
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Quarterback	0.194	0.178	-0.009	0.078	0.619 ***
	(0.297)	(0.190)	(0.300)	(0.102)	(0.198)
Running back	-0.300 **	-0.341 ***	-0.208 **	-0.260	-0.236 ***
	(0.150)	(0.096)	(0.106)	(0.229)	(0.082)
Tight end	-0.049	0.017	-0.023	0.185 *	0.037
	(0.110)	(0.071)	(0.107)	(0.100)	(0.177)
Experience	0.234 ***	0.231 ***	0.235 ***	0.210 ***	0.284 ***
	(0.041)	(0.038)	(0.049)	(0.074)	(0.051)
Experience squared	-0.018 ***	-0.013 ***	-0.015 ***	-0.016 ***	-0.014 ***
	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)
Games played	0.014 **	-0.016	-0.004	-0.012	-0.032 ***
	(0.006)	(0.014)	(0.012)	(0.017)	(0.012)
1st round draft pick	0.611 ***	0.278	0.642 ***	0.527 ***	0.454 ***
	(0.172)	(0.258)	(0.189)	(0.176)	(0.144)
2nd round draft pick	0.224 *	0.282	0.400 ***	0.290 **	0.319 **
	(0.117)	(0.196)	(0.137)	(0.117)	(0.160)
3rd round draft pick	0.357 ***	0.166	0.064	0.329 **	0.027
	(0.125)	(0.136)	(0.068)	(0.144)	(0.145)
Undrafted	0.025	-0.105	0.091	-0.132 **	0.045
	(0.103)	(0.107)	(0.128)	(0.064)	(0.193)
Pro bowls	0.104 **	0.140 ***	0.217 ***	0.107 ***	0.082
	(0.051)	(0.042)	(0.022)	(0.038)	(0.062)
Arrested	0.009	-0.148	-0.132	-0.322 **	0.013
	(0.199)	(0.281)	(0.121)	(0.157)	(0.158)
Overall Effect of 12-Fantasy-Point Increase at Percentile (by Position)					
Quarterback	0.115	0.081	0.161	-0.021	0.083
Running back	0.115	0.084	0.169	0.025	0.093
Tight end	0.115	0.087	0.178	0.078	0.119
Wide receiver	0.115	0.080	0.168	0.031	0.103
Observations	446	446	446	446	446
Pseudo R-squared	0.28	0.35	0.44	0.46	0.44

Notes: Each column is from a separate quantile regression. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1%, respectively, for a two-sided test. The overall fantasy points effect measures the sum of the fantasy points and fantasy points squared coefficients.

Table 4 contains the results from quantile regression models for the preferred specification that excludes team fixed effects. The bottom panel contains the overall effect of

a 12-point increase in fantasy points by percentile and position.[12] There is no discernible effect of race aside for a positive correlation for nonwhites of 35 percent at the bottom of the salary distribution. The coefficients for experience and experience squared are broadly similar across the distribution. The magnitude of the coefficient for fantasy points is highest at the median, whereas the magnitude for fantasy points squared is highest at the 75th percentile. Consequently, the overall effects for fantasy points are highest for the median, approximately 17 percent, and lowest for the 75th percentile. Quarterbacks receive a salary premium in excess of 60 percent at the top of the distribution. Rewards for first- and second-round draft picks and Pro Bowl invitations are highest at the median. Although arrests are negatively associated with salary at the 75th percentile, the insignificance at other points limits any inferences than can be drawn from this isolated result.

Next, we turn to the results for the 2015-2016 data. Table 5 contains the OLS regressions for 2016 log salary cap value, and the format is analogous to Table 2.[13] In 2016, there is a gross nonwhite pay penalty of 40 percent (Column 1). The coefficient for nonwhite is -0.091, a nontrivial wage penalty, in our preferred specification in Column 2, but it is not statistically significantly different from zero. The most notable difference across time is the greater differences in salary across position in 2016, even after controlling for productivity. Running backs earn nearly 40 percent less than wide receivers (the omitted group), whereas the premium for quarterbacks of more than 20 percent is not statistically significantly different from zero.

[12] Even though the regressions are estimated on the conditional quantiles of the salary distribution, the table reports the effects for different points of the fantasy point distribution. We do so because these points on the fantasy points distribution are reported in Table 2, and they are easier to follow. Fantasy points and salary cap have a correlation of approximately 0.7.

[13] Even though the salaries of rookies are highly structured after the 2011 CBA, we include all experience levels in the regressions for ease of comparison with the results for 2006 salaries. The results are similar, but much less precisely estimated, when we limit the sample to players with at least four years of experience (the first year when players can sign new contracts). These results, in Appendix Table 1, are discussed in more detail later.

Table 5: OLS Regression Results for Log 2016 Salary Cap Value

	1	2	3
Nonwhite	-0.430 ***	-0.091	-0.091
	(0.128)	(0.087)	(0.094)
Fantasy points		0.010 ***	0.009 ***
		(0.002)	(0.001)
Fantasy points^2 / 100		-0.001 ***	-0.001 ***
		(0.0005)	(0.001)
Quarterback		0.224	0.226
		(0.160)	(0.148)
Running back		-0.394 ***	-0.392 ***
		(0.083)	(0.083)
Tight end		0.100	0.043
		(0.094)	(0.101)
Experience		0.305 ***	0.320 ***
		(0.033)	(0.038)
Experience squared		-0.019 ***	-0.019 ***
		(0.003)	(0.003)
Games played		-0.014	-0.005
		(0.010)	(0.009)
1st round draft pick		0.560 ***	0.509 ***
		(0.128)	(0.120)
2nd round draft pick		0.304 **	0.280 **
		(0.119)	(0.115)
3rd round draft pick		0.085	0.012
		(0.114)	(0.117)
Undrafted		-0.010	-0.024
		(0.084)	(0.088)
Pro bowls		0.142 ***	0.126 ***
		(0.029)	(0.036)
Arrested		-0.162	-0.124
		(0.123)	(0.138)
Effect of 12-fantasy point increase			
0 points		0.116	0.110
60 points		0.096	0.091
100 points		0.082	0.078
200 points		0.047	0.047
Team Fixed Effects	No	No	Yes
Observations	427	427	427
R-squared	0.03	0.67	0.70

Notes: Each column is from a separate OLS regression. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1%, respectively, for a two-sided test. The overall fantasy points effect measures the sum of the fantasy points and fantasy points squared coefficients.

In general, most of the player characteristics are significant determinants of salary. Experience is positive, but experience squared is negative. Due to the increased magnitude of the experience squared coefficient, the overall returns to experience become negative after eight years. Being drafted in the first two rounds correlate positively, whereas there are no salary distinctions for being drafted in the third round or later or being undrafted. The increase in salary of each Pro Bowl invitation is similar in both years. Although the magnitude of the arrest variable more than doubled in 2016 compared to 2006, the coefficient is still imprecisely estimated and is statistically insignificant. Again, results are similar between the model with team fixed effects (Column 3) and the column without (Column 2).

The quantile regression results for 2016, in Table 6, show a lot of variation by salary quantile. Nonwhites are indistinguishable from whites throughout the distribution, although the coefficients for the 10^{th} and 75^{th} percentiles are nontrivial at 15 percent. The coefficients for fantasy points are larger toward the top of the distribution than at the bottom. The returns to experience are positive, although at a decreasing rate, throughout the distribution, and the both the linear and quadratic terms are largest in magnitude near the top of the salary distribution. The coefficients for running backs have large magnitudes throughout the distribution, with most pronounced effects at the top. Draft position has notable effects except at the very top of the distribution. The rewards for Pro Bowl invitations are roughly consistent across the quantiles. As in 2006, arrests have the most pronounced effects at the 75^{th}, and to a lesser extent, the 50^{th} percentile.

The model presented in equation [1] assumes that, because fantasy points attempt to equate productivity across positions, the salary returns to fantasy points are constant across position. Table 7 evaluates the plausibility of that assumption by presenting, for the preferred model specification excluding team characteristics, results from OLS models with and without interactions between position with fantasy points. For brevity, the table only contains

the coefficients for fantasy points and position variables; results for other variables are similar between the two models.

Table 6: Quantile Regressions for 2016 Log Salary Cap Value

	P10	P25	P50	P75	P90
Nonwhite	-0.150	-0.083	-0.039	-0.145	-0.014
	(0.159)	(0.082)	(0.102)	(0.100)	(0.137)
Fantasy points	0.006 **	0.004 **	0.009 ***	0.011 ***	0.014 ***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Fantasy points^2 / 100	-0.001	0.0004	-0.0009	-0.002 ***	-0.003 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Quarterback	0.508 **	0.131	0.031	0.211	0.198
	(0.238)	(0.134)	(0.148)	(0.276)	(0.317)
Running back	-0.235	-0.184 *	-0.299 ***	-0.459 ***	-0.549 ***
	(0.189)	(0.094)	(0.099)	(0.106)	(0.166)
Tight end	0.122	0.076	0.063	-0.012	0.036
	(0.098)	(0.104)	(0.117)	(0.095)	(0.197)
Experience	0.117 *	0.243 ***	0.333 ***	0.355 ***	0.349 ***
	(0.067)	(0.073)	(0.057)	(0.047)	(0.063)
Experience squared	-0.005	-0.014 **	-0.020 ***	-0.023 ***	-0.023 ***
	(0.007)	(0.006)	(0.005)	(0.004)	(0.005)
Games played	0.037 **	-0.004	-0.015	-0.025 **	-0.036 **
	(0.018)	(0.010)	(0.011)	(0.010)	(0.015)
1st round draft pick	0.679 ***	0.544 **	0.769 ***	0.610 ***	0.182
	(0.223)	(0.226)	(0.196)	(0.160)	(0.171)
2nd round draft pick	0.361	0.281 *	0.441 ***	0.288 *	0.227
	(0.260)	(0.158)	(0.122)	(0.149)	(0.157)
3rd round draft pick	0.072	0.158	0.127	-0.035	-0.144
	(0.260)	(0.171)	(0.121)	(0.149)	(0.198)
Undrafted	0.096	-0.091	0.017	-0.102	-0.033
	(0.190)	(0.085)	(0.094)	(0.096)	(0.146)
Pro bowls	0.144	0.154 ***	0.123 ***	0.139 **	0.127 *
	(0.103)	(0.044)	(0.036)	(0.054)	(0.077)
Arrested	-0.201	-0.095	-0.257 **	-0.291 *	0.005
	(0.322)	(0.178)	(0.121)	(0.157)	(0.335)
Overall Effect of 12-Fantasy-Poin		427	427	427	
Quarterback	0.070	0.048	0.082	0.006	-0.021
Running back	0.070	0.048	0.094	0.084	0.071
Tight end	0.070	0.048	0.100	0.103	0.103
Wide receiver	0.070	0.048	0.095	0.084	0.068
Observations	427	427	427	427	427
Pseudo R-squared	0.28	0.35	0.47	0.52	0.53

Notes: Each column is from a separate quantile regression. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1%, respectively, for a two-sided test. The overall fantasy points effect measures the sum of the fantasy points and fantasy points squared coefficients.

Table 7: OLS Model with Interactions between Fantasy Points and Position

	2005-06		2015-16	
Overall Effect 12-Fantasy-Point Increase at Mean by Position				
Quarterback	0.088	0.083	0.069	0.077
Running back	0.095	0.084	0.093	0.067
Tight end	0.111	0.106	0.101	0.132
Wide receiver	0.099	0.115	0.093	0.129
Fantasy points	0.010 ***	0.013 ***	0.010 ***	0.019 ***
	(0.001)	(0.003)	(0.002)	(0.003)
Fantasy points^2 / 100	-0.001 ***	-0.002	-0.001 ***	-0.006 ***
	(0.0005)	(0.001)	(0.0005)	(0.002)
QB * Fantasy points		-0.010 **		-0.010 **
		(0.004)		(0.004)
QB * Fantasy points^2 / 100		0.004 **		0.005 ***
		(0.002)		(0.002)
RB * Fantasy points		-0.003		-0.013 ***
		(0.003)		(0.004)
RB * Fantasy points^2 / 100		0.001		0.006 **
		(0.002)		(0.002)
TE * Fantasy points		-0.003		-0.001
		(0.005)		(0.005)
TE * Fantasy points^2 / 100		0.002		-0.002
		(0.004)		(0.003)
Quarterback	0.154	0.405 *	0.224	0.415 **
	(0.122)	(0.212)	(0.160)	(0.180)
Running back	-0.241 ***	-0.080	-0.394 ***	0.021
	(0.081)	(0.115)	(0.083)	(0.118)
Tight end	0.034	0.134	0.100	0.234 *
	(0.080)	(0.128)	(0.094)	(0.140)
Observations	446	427	427	427
R-squared	0.62	0.69	0.67	0.68

Notes: Each column is from a separate OLS regression. Although not reported in the table, each regression also includes the set of control variables listed in column 2 of Tables 3 and 5 Standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1%, respectively, for a two-sided test. The overall fantasy points effect measures the sum of all the relevant coefficients for a change in 12 points for a player of that position. For example, a running back's overall value would include the coefficients for fantasy points, fantasy points squared, as well as the interaction between running back and fantasy points and the interaction between running back and fantasy points squared.

In general, the lowest overall returns to fantasy points are for quarterbacks and running backs, and the highest overall returns are for tight ends and wide receivers. This pattern is consistent across both years. The results from the interaction model suggest that the returns for tight ends and wide receivers have slightly increased between the two time

periods, compared with a slight decline in returns for quarterbacks and running backs. The results from the interaction model also suggest that, irrespective of fantasy points, quarterbacks demand a high salary premium in excess of 40 percent, although the position variables are imprecisely estimated, particularly in the interaction model. In sum, allowing the returns to fantasy points to vary by position produces more variation in returns to fantasy points by position. However, the relatively small sample size for some positions (Table 2) limits the inferences that can be drawn from the interaction models.

We also explore the sensitivity of the results to the length of time in the league. As mentioned previously, one of the changes in the 2011 CBA was the introduction of more structured, three-year contracts for draft picks. Because our data do not contain contract information, we cannot identify players in their first contract from those on subsequent contracts. As a proxy for contract, we instead run a regression limited to players with at least four years of experience. Appendix Table 1 contains the results from our preferred specification, comparing results for the full sample (Columns 1 and 3) with those for players with at least four years of experience (Columns 2 and 4).

The overall returns to an increase of 12 fantasy points are slightly larger in the veteran sample compared to the full sample. As expected, the coefficients for experience decrease in magnitude, especially in 2015-16, when inexperienced players are excluded. The wage penalty for running backs is larger in the sample of veteran players, particularly in 2015-16. The premium for first-round draft picks becomes statistically indistinguishable from zero in the veteran sample for 2005-06. Overall, the results are broadly similar between the sample of all players and the sample of veteran players.

Employment Regressions

In addition to salaries, employment is another labor-market outcome of interest, particularly given the high turnover in the NFL due to the physical nature of the sport. Our

second outcome measure is a dummy variable equal to one for players with a contract in 2006 or 2016. Table 8 contains the marginal effects and their corresponding standard errors from a probit model for our preferred specification. As shown in Appendix Tables 2 and 3, the results are qualitatively similar across probit, logit, and linear probability models. The data are from 2005-2006 in the first column, and they are from 2015-2016 in the second column. The independent variables for productivity and player characteristics are measured in 2005 or 2015. The results are from the preferred model specification excluding team characteristics, analogous to the second column in Tables 3 and 5.

As in the log salary regressions, race has no discernable correlation with employment. Fantasy points have a positive but diminishing association with the likelihood of employment in both columns. The effect of a 12-point increase in fantasy points from 60 points, roughly the mean in both years for the sample, is approximately three percent. Thus, fantasy points have a much stronger impact on the intensive margin of salary (9-10 percent) than on the extensive margin of having employment or not (3 percent).

Only a few of the player characteristics have statistically significant effects on the likelihood of being employed in both years, in contrast to the results for log cap value where many player characteristics are statistically significant. Quarterbacks are 10.8 percent more likely to be employed than wide receivers in the 2005-2006 data, and the differential is nearly double at 18.5 percent in 2015-2016 data. This result is consistent with a theory that good quarterbacks are more difficult to hire than good wide receivers. Each game played is associated with a 1.6 percentage-point increase in the likelihood of being employed.

Table 8 illustrates few differences across years in the determinants of employment. Experience has a marginal, negative association (at the ten-percent level) with the likelihood of being employed in 2016, compared to a coefficient very close to zero in 2006. Focusing on the linear term for simplicity, each additional year of experience is associated with a three-

percentage-point decline in the likelihood of employment in 2016. Two of the draft pick variables are marginally significant at the ten-percent level in 2006, but all the draft pick variables are indistinguishable from zero in 2016.

Table 8: Probit Marginal Effects for Likelihood of Having Employment

	2005-6	2015-6
Nonwhite	-0.011	0.036
	(0.040)	(0.050)
Fantasy points	0.005 ***	0.004 ***
	(0.001)	(0.001)
Fantasy points^2 / 100	-0.001 ***	-0.001 ***
	(0.0003)	(0.0003)
Quarterback	0.108 ***	0.185 ***
	(0.041)	(0.043)
Running back	-0.023	-0.013
	(0.044)	(0.045)
Tight end	-0.003	0.076 *
	(0.044)	(0.043)
Experience	-0.0003	-0.030 *
	(0.016)	(0.018)
Experience squared	-0.001	-0.001
	(0.001)	(0.002)
Games played	0.016 ***	0.016 ***
	(0.004)	(0.004)
1st round draft pick	0.010	-0.006
	(0.062)	(0.074)
2nd round draft pick	0.026	0.067
	(0.050)	(0.061)
3rd round draft pick	0.084 *	-0.016
	(0.047)	(0.066)
Undrafted	-0.080 *	-0.035
	(0.043)	(0.044)
Pro bowls	-0.015	0.016
	(0.021)	(0.019)
Arrested	-0.027	-0.069
	(0.073)	(0.078)
Observations	589	587
Pseudo R-squared	0.24	0.21

Notes: Each column is from a separate probit regression. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1%, respectively, for a two-sided test.

Conclusion

We provide a new approach to studying the relationship between race and labor-market outcomes for NFL players. We include two determinants that have not been used previously. First, we use fantasy points as a measure of productivity, allowing us to compare players in different positions. Second, we measure off-the-field behavior by including a dummy variable equal to one for players who have been arrested.

We find no conclusive evidence that, conditional on productivity, salaries or contracts are correlated with race or arrests. Like the early work on this topic (Mogull, 1973; Kahn, 1992) that had multiple positions but no measures of productivity, we cannot reject the hypothesis that, holding productivity constant, white and nonwhite players receive similar salaries and are equally likely to be employed. In most cases, the coefficient for nonwhite is near zero (but imprecisely estimated). Similarly, there is no relationship between arrests and labor-market outcomes.

We find that fantasy points have a positive but diminishing association with NFL salaries and contracts five years before and five years after the adoption of the 2011 collective bargaining agreement. At approximately the mean of player productivity, 60 fantasy points, a 12-point increase in fantasy points corresponds with an increase in salary of nine to ten percent and an increase in the likelihood of having a contract of three percent. In other words, a boost in productivity of two to three touchdowns has sizable rewards for average players. Fantasy points alone explain almost half of the variation in salaries.

We find little evidence of systematic changes between 2005-06 and 2015-16 in the determinants of salary and employment. Despite the introduction of heavily structured contracts for rookies in the 2011 collective bargaining agreement, we do not see any marked changes in how teams reward productivity or other player traits. Future work should use

panel data spanning before and after the CBA to produce more thorough investigation of its impacts on players.

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Appendix Table 1: Salary Cap Regressions for All Players Versus Veteran Players

	2005-06		2015-16	
	All	Veteran	All	Veteran
Nonwhite	-0.018	-0.081	-0.091	0.00002
	(0.077)	(0.106)	(0.087)	(0.136)
Fantasy points	0.010 ***	0.013 ***	0.010 ***	0.012 ***
	(0.001)	(0.002)	(0.002)	(0.002)
Fantasy points^2 / 100	-0.001 ***	-0.002 ***	-0.001 ***	-0.002 ***
	(0.0005)	(0.0005)	(0.0005)	(0.0006)
Quarterback	0.154	-0.007	0.224	0.148
	(0.122)	(0.161)	(0.160)	(0.234)
Running back	-0.241 ***	-0.333 ***	-0.394 ***	-0.772 ***
	(0.081)	(0.125)	(0.083)	(0.142)
Tight end	0.034	0.134	0.100	0.060
	(0.080)	(0.106)	(0.094)	(0.149)
Experience	0.216 ***	0.170 **	0.305 ***	0.018
	(0.033)	(0.069)	(0.033)	(0.101)
Experience squared	-0.014 ***	-0.012 ***	-0.019 ***	-0.004
	(0.002)	(0.004)	(0.003)	(0.006)
Games played	-0.009	-0.012	-0.014	-0.010
	(0.009)	(0.015)	(0.010)	(0.016)
1st round draft pick	0.578 ***	0.165	0.560 ***	0.419 ***
	(0.111)	(0.145)	(0.128)	(0.152)
2nd round draft pick	0.384 ***	0.340 ***	0.304 **	0.509 ***
	(0.092)	(0.124)	(0.119)	(0.159)
3rd round draft pick	0.265 ***	0.359 ***	0.085	0.155
	(0.089)	(0.134)	(0.114)	(0.192)
Undrafted	0.026	-0.015	-0.010	-0.090
	(0.086)	(0.125)	(0.084)	(0.161)
Pro bowls	0.123 ***	0.141 ***	0.142 ***	0.117 ***
	(0.029)	(0.031)	(0.029)	(0.031)
Arrested	-0.061	-0.098	-0.162	0.020
	(0.132)	(0.135)	(0.123)	(0.168)
Overall Effect of 12-Fantasy-Point Increase at Mean				
Quarterback	0.0885	0.0960	0.0697	0.0915
Running back	0.0952	0.1082	0.0934	0.1031
Tight end	0.1112	0.1369	0.1017	0.1302
Wide receiver	0.0988	0.1115	0.0934	0.1062
Observations	446	243	427	185
R-squared	0.61	0.62	0.67	0.68

Notes: Each column is from a separate OLS regression. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1%, respectively, for a two-sided test. The overall fantasy points effect measures the sum of all the relevant coefficients for a change in 12 points (2 touchdowns rushed / received or 3 touchdowns thrown), calculated at the mean for that position.

Appendix Table 2: Probit, Logit, and OLS Models for Having a Contract in 2006

	Probit	Logit	OLS
Nonwhite	-0.011	-0.008	0.003
	(0.040)	(0.035)	(0.046)
Fantasy points	0.005 ***	0.005 ***	0.003 ***
	(0.001)	(0.001)	(0.001)
Fantasy points^2 / 100	-0.001 ***	-0.001 ***	-0.001 ***
	(0.0003)	(0.0002)	(0.0002)
Quarterback	0.108 ***	0.089 **	0.139 **
	(0.041)	(0.037)	(0.059)
Running back	-0.023	-0.018	-0.009
	(0.044)	(0.039)	(0.042)
Tight end	-0.003	0.001	-0.007
	(0.044)	(0.038)	(0.047)
Experience	0.000	-0.002	0.003
	(0.016)	(0.014)	(0.018)
Experience squared	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
Games played	0.016 ***	0.013 ***	0.022 ***
	(0.004)	(0.003)	(0.004)
1st round draft pick	0.010	0.000	0.003
	(0.062)	(0.059)	(0.045)
2nd round draft pick	0.026	0.015	0.018
	(0.050)	(0.045)	(0.048)
3rd round draft pick	0.084 *	0.069 *	0.079
	(0.047)	(0.041)	(0.049)
Undrafted	-0.080 *	-0.070 *	-0.105 **
	(0.043)	(0.039)	(0.047)
Pro bowls	-0.015	-0.016	0.000
	(0.021)	(0.021)	(0.013)
Arrested	-0.027	-0.015	-0.007
	(0.073)	(0.066)	(0.053)
Observations	589	589	589
(Psuedo) R-squared	0.24	0.24	0.22

Notes: Each column contains the marginal effects (for logit and probit models) / coefficients (for the OLS model) and their standard errors from a separate regression. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1%, respectively, for a two-sided test.

Appendix Table 3: Probit, Logit, and OLS Models for Having a Contract in 2016

	Probit	Logit	OLS
Nonwhite	0.043	0.041	0.034
	(0.050)	(0.047)	(0.047)
Fantasy points	0.004 ***	0.004 ***	0.004 ***
	(0.001)	(0.001)	(0.001)
Fantasy points^2 / 100	-0.001 ***	-0.001 **	-0.001 ***
	(0.0003)	(0.0003)	(0.0002)
Quarterback	0.187 ***	0.171 ***	0.244 ***
	(0.042)	(0.038)	(0.076)
Running back	-0.013	-0.010	-0.010
	(0.045)	(0.041)	(0.042)
Tight end	0.078 *	0.070 *	0.078
	(0.043)	(0.038)	(0.051)
Experience	-0.030 *	-0.030 *	-0.035 **
	(0.018)	(0.017)	(0.017)
Experience squared	-0.001	-0.001	-0.0003
	(0.002)	(0.001)	(0.001)
Games played	0.017 ***	0.015 ***	0.019 ***
	(0.004)	(0.004)	(0.004)
1st round draft pick	-0.007	-0.001	-0.031
	(0.074)	(0.069)	(0.053)
2nd round draft pick	0.066	0.069	0.039
	(0.061)	(0.052)	(0.052)
3rd round draft pick	-0.017	-0.007	-0.030
	(0.066)	(0.060)	(0.056)
Undrafted	-0.035	-0.032	-0.048
	(0.044)	(0.041)	(0.045)
Pro bowls	0.016	0.014	0.021
	(0.019)	(0.018)	(0.017)
Arrested	-0.069	-0.059	-0.059
	(0.078)	(0.075)	(0.072)
Observations	587	587	587
(Psuedo) R-squared	0.21	0.21	0.21

Notes: Each column contains the marginal effects (for logit and probit models) / coefficients (for the OLS model) and their standard errors from a separate regression. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1%, respectively, for a two-sided test.