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Abstract: Two recent articles in the Journal of Sports Economics have analyzed compensation discrimination in the National Football League. Keefer (2013) found white linebackers were paid a premium while Burnett and Van Scyoc (2013) find no white premium for either rookie linebackers or rookie offensive linemen. Following the same techniques we examine the market for all defensive players and three subsets of players: defensive linemen, linebackers, and defensive backs. Our results suggest that labor market discrimination in the NFL is neither systematic nor robust across groups of defensive players.

Keywords: National Football League, discrimination, compensation, quantile regression.

Introduction

Findings of racial discrimination in sports data always elicit notoriety. Findings of no discrimination do not procure the same response. Therefore, it is important that any positive findings of racial inequality be particularly robust. To test the robustness of Keefer (2013) findings of racial discrimination in the NFL labor market for linebackers we replicate his analysis for all defensive players. We then analyze three subsets of the defense: defensive linemen, linebackers and defensive backs following Keefer's procedure. Unlike the recent replications of Keefer's results by Burnett and Van Scyoc (2013a and 2013b) whose analysis looked only at rookie players in the NFL, our analysis uses performance variables as controls for productivity. Like Burnett and Van Scyoc (2013a and 2013b), we apply our analysis to multiple positions to test for the robustness of the results.

Like Keefer (2013) and Burnett and Van Scyoc (2013a and 2013b) we use ordinary least squares coupled with the Oaxaca Blinder decomposition technique as well as quantile regression to measure the effect of race on wages. In section one we discuss our data, in section two we report our results and in section three we conclude.

Section 1: Data

We use NFL data on defensive backs, defensive linemen, and linebackers from 2000 to 2008. We chose these three positional groups because performance statistics are available and can be used to control for productivity and the data gives us the ability to replicate the Keefer (2013) results for more than one group of defensive players. In addition to the productivity variables we also control for demographic variables in our analysis. We obtain data on player performance and demographic information from the NFL official website (www.nfl.com/players). Some players are not included in the sample for the following reasons:

1) their career started before the year 2000; 2) they played for more than one team in a season; 3) they have a missing or skipped season from the NFL's official website[1].

In our model we include games played per season, body mass index (BMI), draft position, and player performance variables measured by season. Defensive player productivity is measured by tackles, sacks, passes defended, interceptions, and forced fumbles. Tackles are defined as the total number of times a player tackles an opponent during a season. Sacks are defined as the total number of times a player tackles the opposing quarterback behind the line of scrimmage during a season. Passes defended and interceptions measure the total number of times a player breaks up a pass or catches a pass thrown by the opposing quarterback. Forced fumbles are defined as the total number of times a defensive player causes an offensive player to lose the football. Tackles, sacks, passes defended, interceptions, and forced fumbles are expected to have a positive impact on salary.

The defensive sample contains 653 players and 2,347 player years. Defensive backs represent 42.7% of the defensive players while defensive linemen represent 29.6% of the defensive players. Linebackers represent the remaining 27.7% of the defensive players. Defensive backs have slightly shorter careers than other defensive positions and hence represent only 40.5% of the defensive player years, while linemen and linebackers represent 31.1% and 28.4% of the defensive player years respectively. We report the means of the defensive players in table 1. We find that white players on average play slightly fewer games. Non-white players have more tackles, interceptions and passes defended but fewer sacks than white players. The differences in productivity might be due to the positional makeup of each defensive position. We find that a larger proportion of defensive lineman and linebackers are white while a larger

[1] Players are excluded from the sample if a season is missing or skipped in the USA Today's NFL salary database (content.usatoday.com/sportsdata/football/nfl/salaries/team) or if their salary is not available is this database.

proportion of defensive backs are non-white. We also find that defensive white players are taller and heavier than non-white defensive players. Overall we find that eighty five percent of players on defense are non-white and twelve percent are white.

Section 2: Results

In table 2, we use the dummy variable technique to measure racial discrimination. In the overall sample the coefficient on race is insignificant, for the linebacker sample the coefficient is positive and significant showing that white players are paid a premium, for the lineman sample the coefficient is negative and significant showing that nonwhite players are paid a premium, and for defensive backs the coefficient is insignificant. Our result on the linebacker sample is consistent with Keefer (2013), however, for other positions we do not find that whites are paid a premium and in the lineman sample we find reverse discrimination. We suggest that the dummy variable technique to measure discrimination is not robust across samples and may be a proxy for some other characteristic that varies by race.

In table 3, we use the Oaxaca Blinder decomposition technique to measure racial discrimination. We find that for the overall sample and the linebacker sample neither the endowment effect nor the coefficient effect are significant. Our result is inconsistent with Keefer (2013) who finds a significant endowment and coefficient effect for the linebacker sample. In the lineman sample we find that the endowment effect is positive and significant for white players while the coefficient effect is negative and significant suggesting that ceteris paribus black players are paid a premium. For the defensive back sample the endowment effect is negative and significant and the coefficient effect is insignificant. Once again our results are mixed and are not robust across groups.

To further replicate Keefer (2013), we report the results of the dummy variable technique using quantile regression techniques. In table 4, we report the results for the overall model. We find that the coefficient on race is insignificant for all quantiles suggesting that for both marginal players and stars there is no labor market discrimination.

In tables 5, 6, and 7 we report the results for defensive linebackers, lineman and backs. In table 5, we find that the coefficient on race is positive but only statistically significant for linebackers at the 50th quantile. At this level, we find the coefficient positive and significant replicating Keefer (2013). At all other levels, however, the race dummy variable is insignificant. In table 6, we find that the coefficient on race is insignificant at all quantile levels for defensive lineman. In addition in table 7, we find that the coefficients on race are also insignificant for all quantile levels for defensive backs. The results of our quantile regressions show that race does not determine wages in the NFL. However, we do find that draft number is significant for all quantiles for each defensive position.

Section 3: Conclusion

Keefer (2013) utilizing the dummy variable approach and quantile regression shows discrimination against black linebackers. We replicate some of his results in the linebacker market; however, when we use the same technique for the defensive lineman and the defensive back market we fail to find racial discrimination. In fact, using the basic dummy variable technique, we find reverse discrimination in the defensive lineman market. Lastly when looking at the defensive market as a whole using the dummy variable technique in OLS, we fail to find labor market discrimination.

We then use the Oaxaca and Blinder technique and fail to find discrimination in any defensive positions for blacks but do find reverse discrimination in the market for defensive

lineman. Lastly we fail to find racial discrimination against nonwhites using the quantile regression technique for any of the defensive groups except for the 50^{th} percentile in the defensive linebacker market. Our results are consistent with Burnett and Van Scyoc (2013a and 2013b) who also fail to find racial discrimination in the market for rookies in the NFL.

Past research had suggested that discrimination by majority, white fans led owners in sports to pay white players a premium. Our results suggest that team owners in the pursuit of championships pay players based on their ability regardless of race. We suggest that this is an affirmation of Becker's theoretical implications of market competition overcoming discrimination.

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Table 1: Descriptive Statistics								
VARIABLES	Means							
	Overall Sample		Linebackers		Defensive Linemen		Defensive Backs	
	nonblack	black	nonblack	Black	Nonblack	black	nonblack	black
Lncapvalue	13.60	13.54	13.72	13.48	13.66	13.67	13.25	13.50
	(0.0524)	(0.0213)	(0.0801)	(0.0392)	(0.0912)	(0.0425)	(0.0914)	(0.0311)
Draft Selection number	108.9	119.1	92.43	123.7	110.7	120.9	138.0	115.2
	(4.559)	(1.949)	(6.531)	(3.740)	(7.381)	(3.642)	(10.68)	(2.926)
Body Mass Index	31.89	31.10	30.99	30.98	34.97	36.73	27.78	27.39
	(0.197)	(0.0998)	(0.103)	(0.0549)	(0.306)	(0.136)	(0.153)	(0.0455)
Experience	3.104	3.003	3.064	3.055	3.324	3.152	2.761	2.870
	(0.104)	(0.0434)	(0.160)	(0.0863)	(0.180)	(0.0842)	(0.199)	(0.0617)
Experience Squared	13.40	12.78	12.94	13.25	15.44	14.13	10.39	11.58
	(0.849)	(0.350)	(1.283)	(0.704)	(1.541)	(0.700)	(1.397)	(0.478)
Gamesplayed	12.73	13.11	12.34	13.45	13.07	12.85	12.85	13.08
	(0.253)	(0.0967)	(0.425)	(0.180)	(0.404)	(0.187)	(0.478)	(0.144)
Tackles	41.38	41.19	54.47	52.65	32.68	28.29	32.23	43.00
	(1.834)	(0.716)	(3.460)	(1.812)	(1.974)	(0.761)	(3.453)	(0.994)
Sacks	1.810	1.204	1.411	1.163	2.934	2.602	0.444	0.288
	(0.157)	(0.0485)	(0.207)	(0.0897)	(0.308)	(0.118)	(0.113)	(0.0217)
Passesdefended	1.793	3.194	1.986	1.958	1.426	1.436***	2.113***	5.116***
	(0.132)	(0.0906)	(0.214)	(0.103)	(0.167)	(0.0716)	(0.361)	(0.169)
Interceptions	0.412	0.783	0.607	0.435	0.125	0.0845	0.577	1.461
	(0.0473)	(0.0315)	(0.0828)	(0.0372)	(0.0321)	(0.0124)	(0.140)	(0.0597)
Forcedfumbles	0.562	0.651	0.593	0.706	0.699	0.721	0.239	0.570
	(0.0546)	(0.0237)	(0.0823)	(0.0466)	(0.103)	(0.0499)	(0.0617)	(0.0312)
Observations	347	1,999	140	527	136	592	71	880

Table 2: Regressions of Natural Log of Cap value				
VARIABLES	Overall Sample	Defensive Linebackers	Defensive Linemen	Defensive Backs
Draft Selection number	-0.00397***	-0.00354***	-0.00395***	-0.00414***
	(0.000133)	(0.000247)	(0.000261)	(0.000203)
Body Mass Index	0.0152***	0.0293*	0.00565	0.0346***
	(0.00280)	(0.0151)	(0.00698)	(0.0128)
Dummy Variable for Nonblack Players	0.00126	0.109**	-0.109**	-0.00392
	(0.0306)	(0.0469)	(0.0554)	(0.0633)
Experience	0.310***	0.255***	0.384***	0.290***
	(0.0219)	(0.0381)	(0.0424)	(0.0348)
Experience Squared	-0.00707***	-0.000472	-0.0146***	-0.00646
	(0.00266)	(0.00458)	(0.00495)	(0.00444)
Games Played	0.00650**	0.000962	0.00490	0.00494
	(0.00295)	(0.00533)	(0.00610)	(0.00479)
Tackles	0.00196***	0.00339***	0.00577***	0.00107
	(0.000473)	(0.000784)	(0.00180)	(0.000934)
Sacks	0.0465***	0.0367***	0.0303***	-0.0111
	(0.00587)	(0.0107)	(0.0111)	(0.0268)
Passes Defended	0.0240***	0.0170	0.0133	0.0291***
	(0.00400)	(0.0124)	(0.0144)	(0.00483)
Interceptions	0.0219**	0.0253	0.0618	0.0245**
	(0.0106)	(0.0263)	(0.0686)	(0.0120)
Forced Fumbles	0.00830	0.0126	0.0330	-0.00597
	(0.0125)	(0.0223)	(0.0234)	(0.0202)
Dummy Variable for Year 2001	-0.0863	-0.294**	-0.0815	-0.0213
	(0.0837)	(0.150)	(0.162)	(0.128)
Dummy Variable for Year 2002	-0.221***	-0.419***	-0.271*	-0.162
	(0.0776)	(0.141)	(0.150)	(0.119)
Dummy Variable for Year 2003	-0.227***	-0.419***	-0.352**	-0.112
	(0.0766)	(0.138)	(0.150)	(0.117)
Dummy Variable for Year 2004	-0.115	-0.313**	-0.146	-0.0475
	(0.0767)	(0.139)	(0.148)	(0.118)
Dummy Variable for Year 2005	-0.0647	-0.322**	-0.178	0.0731
	(0.0758)	(0.139)	(0.147)	(0.116)
Dummy Variable for Year 2006	0.0868	-0.148	0.0278	0.171
	(0.0745)	(0.136)	(0.144)	(0.114)

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 2 (cont.): Regressions of Natural Log of Cap value				
VARIABLES	Overall Sample	Defensive Linebackers	Defensive Linemen	Defensive Backs
Dummy Variable for Year 2007	0.107 (0.0744)	-0.0893 (0.136)	0.0616 (0.144)	0.151 (0.114)
Dummy Variable for Year 2008	0.173** (0.0740)	-0.0205 (0.136)	0.126 (0.143)	0.210* (0.113)
Constant	12.38*** (0.116)	12.16*** (0.491)	12.63*** (0.306)	11.90*** (0.373)
Observations	2,346	667	728	951
R-squared	0.713	0.733	0.717	0.708

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 3: Oaxaca Blinder Decomposition Results

	Overall Sample		Defensive Linebackers		Defensive Linemen		Defensive Backs	
VARIABLES	Differential	Decomposition	Differential	Decomposition	Differential	Decomposition	Differential	Decomposition
Prediction_1	13.54***		13.62***		13.71***		13.12***	
	(0.0588)		(0.0925)		(0.109)		(0.0825)	
Prediction_2	13.55***		13.51***		13.66***		13.50***	
	(0.0210)		(0.0386)		(0.0414)		(0.0311)	
Difference	-0.00798		0.118		0.0512		-0.380***	
	(0.0625)		(0.100)		(0.117)		(0.0881)	
Endowments		0.0148		0.0148		0.200*		-0.338***
		(0.0559)		(0.0850)		(0.105)		(0.0935)
Coefficients		-0.0674		0.108		-0.133*		-0.200
		(0.0485)		(0.0654)		(0.0684)		(0.138)
Interaction		0.0446		-0.00460		-0.0165		0.158
		(0.0375)		(0.0442)		(0.0471)		(0.137)
Observations	2,346	2,346	667	667	728	728	951	951

*Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1*

Table 4: Quantile Regression Results for all Defensive Positions					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	q10	q25	q50	q75	q90
Nonblack	0.00850	-0.00513	0.0306	0.0357	0.0312
	(0.0220)	(0.0232)	(0.0265)	(0.0385)	(0.0526)
Defensive line	0.00323	-0.0536	-0.0174	0.0191	0.0985
	(0.0434)	(0.0412)	(0.0468)	(0.0650)	(0.148)
Linebacker	0.0124	-3.79e-05	-0.0145	-0.0151	-0.0377
	(0.0283)	(0.0228)	(0.0269)	(0.0395)	(0.0639)
Draft number	-0.00403***	-0.00358***	-0.00352***	-0.00426***	-0.00482***
	(0.000285)	(0.000156)	(0.000139)	(0.000195)	(0.000254)
BMI	0.00726**	0.00966***	0.00860*	0.0114*	0.0110
	(0.00341)	(0.00353)	(0.00472)	(0.00609)	(0.0119)
Tenure	0.189***	0.186***	0.232***	0.312***	0.414***
	(0.0169)	(0.0196)	(0.0227)	(0.0324)	(0.0520)
Tenuresq	-0.00385	0.00508*	0.00578*	-0.00218	-0.0147*
	(0.00261)	(0.00303)	(0.00300)	(0.00465)	(0.00757)
Gamesplayed	0.0231***	0.00723***	0.00400	0.00589	-0.00663
	(0.00498)	(0.00222)	(0.00243)	(0.00371)	(0.00531)
Tackles	0.000370	-0.000106	0.00132*	0.00190**	0.00389***
	(0.000316)	(0.000342)	(0.000722)	(0.000765)	(0.00111)
Sacks	0.00678	0.0310***	0.0412***	0.0564***	0.0679***
	(0.00534)	(0.00773)	(0.00731)	(0.0116)	(0.0135)
Passesdefended	0.00413	0.0139***	0.0199***	0.0343***	0.0310***
	(0.00318)	(0.00401)	(0.00669)	(0.00727)	(0.0114)
Interceptions	0.00978	0.00502	0.0258*	0.0111	0.0350
	(0.00845)	(0.0103)	(0.0147)	(0.0147)	(0.0292)
Forcedfumbles	0.00214	-0.00391	0.00446	0.00249	-0.00106
	(0.00635)	(0.0115)	(0.0189)	(0.0190)	(0.0350)
Constant	12.24***	12.38***	12.48***	12.62***	13.14***
	(0.139)	(0.110)	(0.148)	(0.184)	(0.370)
R^2(pseudo)	0.467	0.486	0.516	0.528	0.492
Observations	2,346	2,346	2,346	2,346	2,346

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 --year dummies included

Table 5: Quantile Regression Results for Linebackers					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	q10	q25	q50	q75	q90
Nonblack	0.0444	0.0489	0.0776*	0.106	0.145
	(0.0412)	(0.0363)	(0.0416)	(0.0820)	(0.111)
Draft number	-0.00385***	-0.00332***	-0.00311***	-0.00386***	-0.00407***
	(0.000442)	(0.000295)	(0.000231)	(0.000374)	(0.000410)
BMI	0.0129	0.00287	0.0104	0.0213	0.0436*
	(0.0111)	(0.00919)	(0.0105)	(0.0192)	(0.0255)
Tenure	0.142***	0.138***	0.175***	0.319***	0.340***
	(0.0409)	(0.0345)	(0.0402)	(0.0577)	(0.0753)
Tenuresq	0.000172	0.00902	0.0133**	-0.00190	-0.00317
	(0.00654)	(0.00555)	(0.00584)	(0.00752)	(0.0106)
Gamesplayed	0.0251***	0.000342	-0.000793	-0.00262	-0.0166**
	(0.00736)	(0.00436)	(0.00365)	(0.00869)	(0.00754)
Tackles	0.000488	0.000651	0.00286**	0.00305**	0.00556***
	(0.000582)	(0.000556)	(0.00118)	(0.00155)	(0.00146)
Sacks	0.0121	0.0309***	0.0506***	0.0266	0.0447*
	(0.0117)	(0.0119)	(0.0132)	(0.0208)	(0.0237)
Passesdefended	0.00236	0.0162	-0.0150	0.0314	0.0383
	(0.00939)	(0.0117)	(0.0217)	(0.0261)	(0.0236)
Interceptions	0.0440**	0.0328*	0.0527	0.0175	0.0277
	(0.0199)	(0.0196)	(0.0338)	(0.0524)	(0.0657)
Forcedfumbles	0.0222	0.0162	0.00712	-0.0179	0.00531
	(0.0153)	(0.0169)	(0.0257)	(0.0379)	(0.0508)
Constant	12.12***	12.70***	12.48***	12.74***	12.42***
	(0.371)	(0.297)	(0.400)	(0.643)	(0.843)
R^2(pseudo)	0.458	0.49	0.533	0.56	0.569
Observations	667	667	667	667	667

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 --year dummies included

Table 6: Quantile Regression Results for Defensive Linemen					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	q10	q25	q50	q75	q90
Nonblack	-0.0351	-0.0657	-0.0362	-0.0361	-0.0704
	(0.0546)	(0.0480)	(0.0613)	(0.0780)	(0.101)
Draft number	-0.00370***	-0.00388***	-0.00400***	-0.00439***	-0.00480***
	(0.000550)	(0.000306)	(0.000283)	(0.000355)	(0.000479)
BMI	0.00522	0.0102*	0.00740	0.0102	-0.00641
	(0.00564)	(0.00546)	(0.00640)	(0.00883)	(0.0162)
Tenure	0.235***	0.250***	0.319***	0.376***	0.473***
	(0.0389)	(0.0366)	(0.0481)	(0.0623)	(0.0960)
Tenuresq	-0.00543	-0.000833	-0.00408	-0.0113	-0.0235**
	(0.00472)	(0.00497)	(0.00590)	(0.00758)	(0.0114)
Gamesplayed	0.0204**	0.00420	-0.00183	-0.00274	-0.00104
	(0.00937)	(0.00488)	(0.00540)	(0.00619)	(0.0116)
Tackles	0.000908	0.00151	0.00466**	0.00614**	0.00934**
	(0.00174)	(0.00189)	(0.00220)	(0.00246)	(0.00367)
Sacks	0.0126	0.0258**	0.0216	0.0446***	0.0302
	(0.0107)	(0.0116)	(0.0138)	(0.0167)	(0.0212)
passesdefended	0.000989	0.0107	0.0114	0.0260	0.0117
	(0.0134)	(0.0201)	(0.0201)	(0.0243)	(0.0368)
Interceptions	0.0928	0.0777	0.0523	0.0573	0.224
	(0.0654)	(0.0736)	(0.0911)	(0.143)	(0.157)
forcedfumbles	-0.0101	-0.000561	0.0449	0.0670*	0.0401
	(0.0180)	(0.0287)	(0.0358)	(0.0393)	(0.0539)
Constant	12.21***	12.31***	12.61***	12.57***	13.25***
	(0.268)	(0.218)	(0.259)	(0.365)	(0.986)
R^2(pseudo)	0.487	0.51	0.54	0.515	0.453
Observations	728	728	728	728	728

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 --year dummies included

Table 7: Quantile Regression Results for Defensive Backs					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	q10	q25	q50	q75	q90
Nonblack	-0.0489	-0.0210	-0.00485	0.0427	-0.0762
	(0.0966)	(0.0421)	(0.0536)	(0.0692)	(0.118)
Draft number	-0.00374***	-0.00351***	-0.00352***	-0.00449***	-0.00500***
	(0.000510)	(0.000236)	(0.000204)	(0.000274)	(0.000431)
BMI	0.0177	0.0141*	0.00887	0.0155	0.0197
	(0.0115)	(0.00795)	(0.0130)	(0.0140)	(0.0235)
Tenure	0.241***	0.181***	0.185***	0.260***	0.375***
	(0.0369)	(0.0393)	(0.0420)	(0.0480)	(0.0776)
Tenuresq	-0.0128**	0.00424	0.0106	0.00431	-0.0116
	(0.00643)	(0.00656)	(0.00655)	(0.00665)	(0.0112)
Gamesplayed	0.0273***	0.0109***	0.00446	0.00421	-0.0115
	(0.0102)	(0.00344)	(0.00411)	(0.00618)	(0.00878)
Tackles	-0.000300	-0.000863	0.000169	0.00145	0.00357
	(0.000656)	(0.000621)	(0.00115)	(0.00160)	(0.00263)
Sacks	-0.0172	-0.00621	-0.0178	-0.0112	0.0528
	(0.0173)	(0.0197)	(0.0349)	(0.0412)	(0.0918)
passesdefended	0.00650	0.0155***	0.0268***	0.0367***	0.0485***
	(0.00485)	(0.00512)	(0.00726)	(0.00867)	(0.0138)
Interceptions	0.000293	0.00651	0.0327*	0.0184	-0.00762
	(0.00845)	(0.0123)	(0.0173)	(0.0169)	(0.0371)
forcedfumbles	0.00268	-0.00776	-0.00505	-0.0109	-0.0396
	(0.0102)	(0.0155)	(0.0294)	(0.0269)	(0.0543)
Constant	11.80***	12.18***	12.58***	12.64***	12.82***
	(0.384)	(0.236)	(0.373)	(0.414)	(0.631)
R^2(pseudo)	0.479	0.483	0.501	0.524	0.497
Observations	951	951	951	951	951

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 --year dummies included