Winner Take All in the NFL

The Effect of the Salary Cap and Free Agency on the Compensation of Skill Position Players

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In an earlier paper, Kowalewski and Leeds showed that free agency and the salary cap brought profound changes to the level and nature of players' salaries in the National Football League (NFL). Their study is limited, however, by the fact that—unlike most other professional athletes—football players are evaluated by position-specific statistics. The authors improve on their earlier work by performing quantile regressions on data for specific positions to show how free agency and the salary cap affected compensation. They show that the new bargaining regime greatly increased the reward to performance.

In 1993, the National Football League (NFL) management and National Football League Players Association (NFLPA) entered into a new collective bargaining agreement, since renewed with no substantive changes. Kowalewski and Leeds (1999) showed that the agreement dramatically increased income inequality in the league and altered the criteria by which teams rewarded players. Under the new regime, the superstars and the veteran starters gained disproportionately at the expense of the rookies and marginal players. In addition, the pay structure under the new contract placed far less weight on a player's position and far greater weight on whether he was a starter than the previous contract had.

Kowalewski and Leeds's (1999) findings, however, are limited by the nature of the data they used. Because they used data for all players in the NFL, they could not use position-specific performance measures. More than the other major sports, in football one cannot compare the performance of two players at different positions. In all other sports, overall performance measures exist that one can compare across

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most positions. Batting and fielding statistics are reasonably comparable for all nonpitchers in baseball. Whereas individual basketball players may focus on specific skills, the same set of performance measures (e.g., points, rebounds, and steals) applies to all players. In hockey one can apply measures like the plus-minus rating for all players except goalies. Only football lacks any overall performance measure. As a result, one cannot directly compare the performance of a quarterback with that of a defensive lineman. In this article, we employ separate regressions for each of the so-called skill positions in football—quarterback, running back, wide receiver, and tight end—to test whether the conclusions reached in Kowalewski and Leeds (1999) hold when one uses more specific performance measures.

We consider the skill positions for two reasons. First, these positions are the most popular among fans and generally subject to more public scrutiny than other positions. More important, because the players at these positions handle the ball more frequently than players at other positions, they have more direct performance measures than other players, allowing us to establish better tests of the impact of personal performance. For some positions, such as offensive linemen, performance measures are hard to find. For other positions, such as defensive backs, the measures are hard to interpret. The very best defensive back, for example, may have very few interceptions because teams refuse to throw the ball in his direction. Although players at skill positions may occasionally be used as decoys, such difficulties in interpreting data generally do not exist for them.

The results provide a deeper insight into the impact of the new collective bargaining agreement. These findings will be of clear value to NFL executives seeking to plan their teams' financial futures. In addition, players and owners in other sports contemplating free agency (hockey) or a salary cap (baseball) would have yet another illustration of how they affect pay structures.

We find that the new bargaining agreement's impact varied by year, position, and quantile. A comparison of the results for 1992 and 1994 strongly reinforces the initial findings by Kowalewski and Leeds (1999). The advent of free agency and the salary cap reduced the returns to playing a specific position and increased the return to performance at that position. In general, the impact of performance was stronger at the .25 quantile than at the .75 quantile, suggesting that players who were underpaid for the level of their performance had greater returns to performance than highly paid players. Finally, we find that the impact of the performance in 1994 was less discernible for wide receivers than for quarterbacks or running backs and was still less discernible for tight ends, the least glamorous of the skill positions.

The remainder of this article is organized as follows. The next section outlines a simple model of salary determination and the changes that occur in the model due to the salary cap and free agency. We then describe our estimation method, data, and the variables used in the estimation, and present and interpret our results. The final section contains conclusions.[1]

THE MODEL

Unlike unions outside the sports industry, the NFLPA and other unions in professional sports bargain over a basic agreement that applies to all teams and players while players (and their agents) negotiate individual contracts with specific teams. Prior to the advent of free agency, a monopsony setting prevailed. Lacking mobility among teams, players had little countervailing market power. In the limit, the monopsonistic team would be constrained only by the fact that it must offer the player a salary greater than or equal to the player's salary in his next-best occupation. In fact, players—especially star players—can force owners to pay more than this because they possess unique skills and thus exert a degree of monopoly power.

McLaughlin (1994) points out that in thin labor markets like those present in professional sports, heterogeneous workers and firms create rents if they are matched appropriately. For example, if player i plays position k for team j, he generates the value V_{ijk}. For our purposes, we think of V_{ijk} as player i's marginal revenue product.[2] In reality, income may be only one argument of a broader utility function that includes factors like the pleasure the player and owner take in having a winning team. Because no two players are exactly alike and no two teams' needs and opportunities are alike, V_{ijk} is a unique value for each player-team-position combination. For example, the value a team places on abilities at one position depends on the abilities present at other positions (e.g., a team with an outstanding quarterback may want offensive linemen who pass-block well, whereas a team with an outstanding runner may want offensive linemen who run-block well). An optimal match results in a return that is greater than either the player or the team could get elsewhere, so V_{ijk} is greater than other player-team-position combinations. Once matched, the team and player must divide this surplus return between the player V_i^{jk} and the team V_j^{ik}.

A simple bargaining model based on the classic Nash (1950) framework captures the forces at work in this bargaining setting. Nash showed that the solution to such a bargaining problem depends crucially on the two sides' respective threat points, the value each attaches to failing to make a deal. For example, if team j does not sign player i to play position k, it must make do with some other player who provides some lesser value, V_{jk}^0. The net value of the match with player i to team j is thus $(V_j^{ik} - V_{jk}^0)$, where V_{jk}^0 is the team's threat point. Similarly, if player i cannot reach an agreement with team j, he must go to some other team. Because there is no reason to believe that alternative opportunities outside of football differ systematically, we assume that the best opportunity outside of football is a constant, V^0. The net return of the match to the player is thus $(V_i^{jk} - V^0)$, where V^0 is the player's threat point.

The Nash (1950) solution to this bargaining problem maximizes the product $(V_i^{jk} - V^0)(V_j^{ik} - V_{jk}^0)$ subject to the constraint that $V_i^{jk} + V_j^{ik} \leq V_{ijk}$. This framework allows us to see the impact of free agency on the division of the surplus between the player and the team. Because free agency allows players to sell their services to any team in the league, the alternatives available to players now include the pay avail-

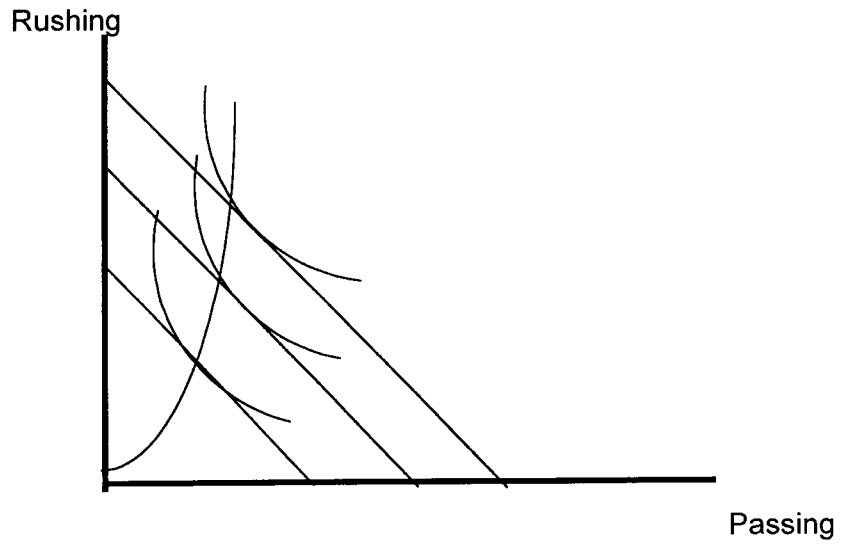

Figure 1: Mix of Running Backs and Quarterbacks With a Convex Expansion Path

able at another team, not just another occupation. This has two important effects on the model. First, it increases the threat point of the players in general, as their value to another NFL franchise is likely to be significantly greater than their value in an outside occupation. As a result, one would expect free agency to increase the pay of the typical player.

Free agency also introduces a new source of heterogeneity to wages. Free agency allows a player's threat point to become the value of his employment with another NFL franchise, rather than just his value outside the sport. Because specific positions and specific players may have radically different alternatives throughout the league, individual threat points become individual and position-specific, V_{ik}^{0}, and may vary dramatically across positions and across individuals at specific positions.

In addition to free agency, the new agreement introduced a salary cap designed to keep each team's salary bill within a relatively narrow range. Although in fact teams seek out ways to circumvent this limit, we shall assume for illustrative purposes that all teams' salaries equal a specific amount. The salary cap thus forms an additional constraint so that the bargaining solution for team j and player i maximizes $(V_i^{jk} - V_{ik}^{0})(V_j^{ik} - V_{jk}^{0})$ subject to $V_i^{jk} + V_j^{ik} \leq V_{ijk}$ for each individual contract and $\sum_{i,k} V_{ijk} < C$ for each team, where C is the salary cap.

The salary cap does not have a predictable impact on the distribution of salaries for a given team. If the salary bill that the team would choose in the absence of outside constraints lies within the band permitted by the salary cap, then the cap has no impact. The cap could also have no impact if restricting expenditure (again, we

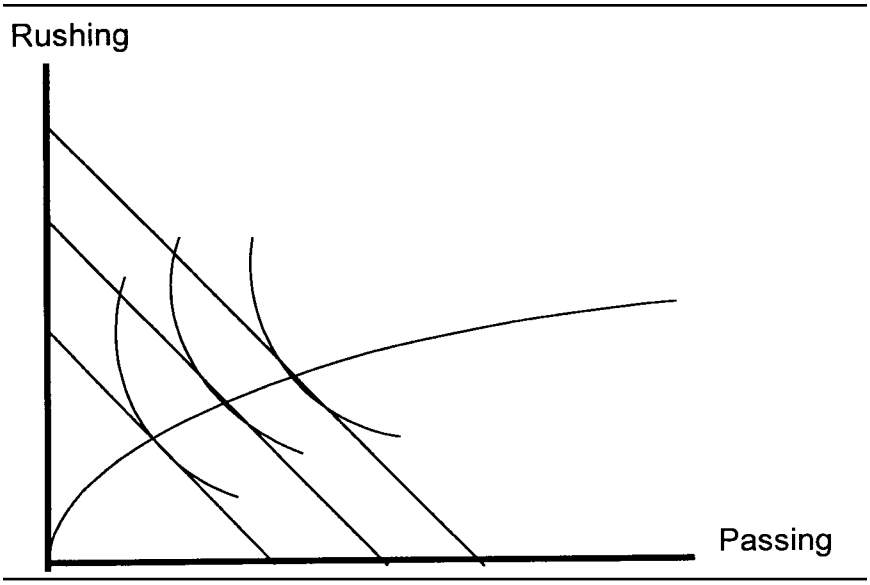

Figure 2: Mix of Running Backs and Quarterbacks With a Concave Expansion Path

ignore the possibility that a team would have to increase its expenditures) affects the demand for all position-skill combinations in the same proportion.

The cap affects a team's distribution of salaries when restricting expenditure changes its optimal position-skill combinations. A simple example appears in Figures 1 and 2, where we assume for simplicity that the team is choosing between passing and running inputs (provided by a talented quarterback and running back) in the production of wins. The optimal combination of passing and rushing is given by the tangency of an isoquant (representing the production of wins) and a team's expenditure constraint. Figure 1 shows that a salary cap causes a team to cut back more severely on its demand rushing yardage when its expenditure expansion path is convex. In this case, the salary cap causes the team to forego star running backs in favor of a star quarterback.

If the expansion path is concave, as in Figure 2, then the team responds to a salary cap by cutting back more severely on its demand for quarterbacks to assure itself of a star runner. When the production function is homothetic (not shown here), the expansion path is linear and the salary cap does not alter the optimal mix of inputs. If all teams face similar expansion paths, then restricting expenditure affects the overall demand for—and value of—specific positions and skills. The empirical results thus reflect in part the shape of the *n*-dimensional expenditure expansion path. We have no a priori beliefs as to the shape of this expansion path.

In some sports, such as baseball and basketball, the above model would apply only to players who are free agents, as players and teams under contract generally cannot renegotiate their contracts. However, the nature of the labor market in the

NFL allows us to apply the model to all players, not just free agents. Star players sometimes force their teams to renegotiate contracts in response to a good season. More important, the NFL does not allow players and teams to sign guaranteed contracts. This leaves teams free to revise contracts downward for players who are no longer worth the salary in the original contract. Players in the NFL thus face an asymmetric situation in which star players can revise their contracts upward, whereas lesser players may see their contracts revised downward.

EMPIRICAL MODEL AND DATA

Several testable hypotheses follow from the model presented above. First, the model suggests that the new collective bargaining agreement will cause greater income inequality among players due to the greater heterogeneity in the players' threat points. In their study of all players in the NFL, Kowalewski and Leeds (1999) found some evidence that free agency caused teams to link salaries more closely to performance. We test this hypothesis on a position-by-position basis.

At first glance, the test for changes in the salary structure seems straightforward: One simply compares separate OLS regressions for years prior to and following the change in regime. Koenker and Bassett (1978) and Buchinsky (1994) have pointed out, however, that OLS may not be the appropriate tool for the job. OLS may be a good predictor of the mean of the dependent variable conditional on the values of the independent variables, but it does not accurately predict the dependent variable for large segments of the income distribution. Because one of our premises is that free agency has distended the distribution of wages and altered the returns to performance, a quantile regression procedure is more appropriate. In addition, the residuals in our regression may be correlated with omitted variables (e.g., charisma, leadership, or marketability) that enhance the bargaining power of an individual player.[3] This implies that the return to a given characteristic may vary with a player's position in the conditional distribution of salaries. Because OLS estimates provide a single value for the return to a given characteristic, they may yield an inaccurate picture of what confronts individual players.

In light of the above drawbacks to the standard OLS approach, we estimate the impact of performance on a player's compensation by employing quantile regressions for the 25th and 75th percentile of the conditional wage distribution for 1992 and 1994. This enables us to contrast players who are relatively high-paid with those who are comparatively low-paid. We can thus compare players within each year as well as between years, rather than having to make just one grand comparison. Quantile regressions also allow us to see what characteristics, if any, are affected by our unobserved measures of bargaining power in any given year.

We estimate the model using salary data from articles in *USA Today* (see the tables accompanying Wire Service Reports [1993] and McLean [1995a, 1995b]). We used data for all quarterbacks, running backs, wide receivers, and tight ends who were on a team's roster at the start of the season. Because of the difficulty in

organizing data on players who were traded during the regular season or the preseason, we excluded them from the sample. Because our performance measures are based on performance in NFL games, we excluded all 1992 and 1994 rookies and players who were on rosters in 1991 or 1993 but who did not have any receptions, rushing attempts, or passes that year. Some of the data reflect the roster moves; for example, our sample of quarterbacks is smaller in 1994 than it was in 1992.

The dependent variable in our regressions is the natural logarithm of the player's salary plus bonus payments. Unfortunately, the reporting method for bonuses changed slightly between 1992 and 1994, largely because of the salary cap rules. The data for 1992 consisted of yearly pay per player, computed as base salary plus most bonuses including signing, reporting, and roster bonuses for the 1992 season. The 1994 salary data were calculated using the same method the NFL uses to determine team salary caps. They consisted of yearly pay per player, computed as base salary plus most bonuses, with the exception of signing bonuses. The exception was based on the fact that signing bonuses are prorated during the life of multiyear contracts and thus should not be included as a lump sum. For example, if a player signed a 4-year contract with an $8 million signing bonus, the salary cap would regard his total yearly salary to be his base salary plus $2 million (one quarter of the signing bonus). Although we do not expect the change in the treatment of signing bonuses to have a severe impact on our results, they do force us to regard the results with some humility.

All other data, including experience, games played, games started, and performance statistics came from *The Sporting News Pro Football Guide* (Carter, 1992, 1994) for the 1991 and 1993 seasons. Because our years bracket the new Collective Bargaining Agreement, they may not fully reflect the impact of the changed market conditions. However, as noted earlier, the lack of guaranteed contracts in the NFL and the tendency of star players to renegotiate their contracts suggest that the impact of the change in the bargaining setting would have a more immediate impact than in baseball or basketball, in which a substantial number of players have long-term, guaranteed contracts.

In addition to position-specific performance variables, we included several general measures. "NFL experience," measured as the number of years a player had been in the NFL, reflects the effect of experience on salary. "NFL experience squared" captures nonlinearities in the returns to experience. We expect the quadratic term to be negative, reflecting the fact that the returns to experience decrease with years of experience.

We expect the number of games played and started by a player to have a positive impact on his salary. To account for these effects, we include the number of regular season games in which a player appeared in 1991 and 1993, as well as those in which he was in the starting lineup. For all players except the quarterback, we also included a dummy variable that shows whether a player appeared in the 1991 or 1993 Pro Bowl. Because participating in the Pro Bowl certifies a player as being among the best at his position, this dummy variable captures superstar effects. We

TABLE 1: Relevant Means for Quarterbacks

Variable	*1992*	*1994*
Games played	7.97	9.78
Games started	5.96	7.33
Experience	5.78	7.33
Passing yards	1,297.33	1,490.33
Salary[a]	$1.065 million	$1.393 million
Median salary	$800,000	$862,000

a. In all tables, salary includes bonus.

TABLE 2: Relevant Means for Running Backs

Variable	*1992*	*1994*
Games played	12.42	12.96
Games started	5.55	6.0
Experience	4.44	4.20
Rushing attempts	78.89	96.41
Rushing yards	332.52	386.24
Receptions	17.48	23.13
Receiving yards	144.22	188.89
Salary	$485,000	$594,819
Median salary	$405,000	$348,500

expect this variable to have a strong positive impact on salaries. Perhaps because our measure of the quarterback rating already captured Pro Bowl quarterbacks, this variable did not have any impact on quarterback salaries and is not reported in the quarterback equations.

Because quarterbacks are evaluated along many dimensions, the NFL computes a summary statistic for their performance. A quarterback's rating is a weighted average of completion percentage, passing yards, interceptions, and touchdowns. A quarterback who is in the top 10 in rating points is likewise considered to be very skilled at his position. Ratings points can be misleading for a quarterback who sees highly limited action. We therefore consider a quarterback for inclusion in the top 10 only if he had at least 100 passing attempts in the previous year. We expect to see strong positive coefficients on this dummy variable as well.

Performance variables for running backs included rushing yards and receiving yards. We expected the coefficients on both of these variables to be positive. Performance for both sets of receivers consisted of the number of receptions and kickoff returns, yards gained receiving, and the average length of a kickoff return.

Tables 1 to 4 show mean values for several key performance variables and salary (including bonuses) by position. Because the median salary lies well below the

TABLE 3: Relevant Means for Wide Receivers

Variable	*1992*	*1994*
Games played	12.94	9.63
Games started	6.51	5.14
Experience	4.82	3.69
Receptions	30.95	28.69
Kick returns	2.98	3.88
Receiving yards	434.65	394.77
Average kick return[a]	18.23	18.75
Salary	$513,524	$513,726
Median salary	$400,000	$335,000

a. Conditional on having returned a kickoff.

TABLE 4: Relevant Means for Tight Ends

Variable	*1992*	*1994*
Games played	11.89	10.03
Games started	6.79	4.94
Experience	5.45	3.80
Receptions	14.49	16.64
Kick returns	0.21	0.34
Receiving yards	161.82	187.70
Average kick return[a]	10.42	7.81
Salary	$400,541	$416,641
Median salary	$375,000	$222,500

a. Conditional on having returned a kickoff.

mean salary, one can conclude that the salary structure for all positions is skewed to the right. Free agency had very different impacts on salary for the different positions. All positions saw their mean salaries rise, but only quarterbacks saw an increase in their median salaries. This suggests that the salary distributions of running backs, wide receivers, and tight ends became extremely distended as a result of free agency, a fact confirmed by the sometimes dramatic rise in the measure of skewness.[4]

RESULTS

Several patterns become immediately apparent from the quantile regression results in Tables 5 to 8. These patterns generally support the conclusion in Kowalewski and Leeds (1999) that free agency made performance a much more important factor in determining a player's pay. Kowalewski and Leeds found that,

TABLE 5: Determinants of Salary for Quarterbacks (*t* statistics in parentheses)

	1992 (n = *69*)				*1994* (n = *54*)			
Variable	*.25 Quantile*		*.75 Quantile*		*.25 Quantile*		*.75 Quantile*	
Constant	11.6502**	(38.00)	12.1501**	(46.20)	11.2752**	(17.86)	12.6507**	(16.99)
Games played	–0.0205	(0.62)	–0.0623*	(1.91)	0.0109	(0.19)	0.0210	(0.24)
Games started	–0.052	(0.05)	0.0643	(0.98)	–0.0336	(0.47)	0.0859	(0.87)
Experience	0.2487**	(2.01)	0.4133**	(3.63)	0.2924*	(1.71)	0.1841	(1.07)
Experience^2	–0.0122	(1.41)	–0.0192**	(2.53)	–0.0143	(1.23)	–0.0104	(1.05)
Passing yards	0.0005	(1.02)	0.0002	(0.62)	0.0006**	(1.91)	–0.00007	(0.19)
Top 10	0.2520	(0.56)	0.1304	(0.49)	0.4375	(0.94)	1.0471**	(2.24)
R^2	0.4421		0.4831		0.4217		0.3543	

*Significant at 10%. **Significant at 5%.

TABLE 6: Determinants of Salary for Running Backs (*t* statistics in parentheses)

	1992 (n = *103*)				*1994* (n = *86*)			
Variable	*.25 Quantile*		*.75 Quantile*		*.25 Quantile*		*.75 Quantile*	
Constant	11.2531**	(43.56)	12.1445**	(49.20)	10.7296**	(31.34)	11.0087**	(20.80)
Games played	–0.0128*	(1.86)	–0.0132	(0.83)	–0.0048	(0.26)	–0.0084	(0.29)
Games started	0.0145	(1.16)	0.0263	(1.51)	–0.0127	(0.52)	–0.0135	(0.65)
Experience	0.4100**	(4.56)	0.2883**	(2.90)	0.5538**	(3.42)	0.5825**	(3.42)
Experience^2	–0.198**	(2.84)	–0.0148**	(2.10)	–0.036**	(2.12)	–0.0363**	(2.14)
Receptions	0.0093	(1.25)	0.0031	(0.29)	0.0219	(1.22)	0.0268	(1.53)
Receiving yards	–0.0008	(0.97)	–0.0006	(0.51)	–0.0017	(0.82)	–0.0019	(1.05)
Rushing attempts	–0.0006	(0.13)	–0.0002	(0.05)	–0.0072	(1.29)	0.0018	(0.38)
Rushing yards	0.0005	(0.50)	0.0006	(0.56)	0.0027**	(2.09)	0.0009	(0.77)
Pro Bowl	–0.1480	(0.56)	0.0143	(0.05)	0.6837*	(1.76)	0.3750	(0.84)
R^2	0.4709		0.4399		0.4901		0.5251	

*Significant at 10%. **Significant at 5%.

prior to the new agreement, players were rewarded more for the position they played rather than how well they played it.

One can find evidence that pay more accurately reflected pay in 1994 just by looking at the constant terms in Tables 5 to 8. The constant term is almost uniformly smaller for the 1994 regressions. For several of the 1992 regressions, the constant term is the only statistically significant coefficient. This suggests that, prior to 1994, players' salaries often reflected having made the team at a specific position. As we shall see, the smaller constant term was generally accompanied by a greater dependence on the performance variables.

Table 5 presents the results of the .25 and .75 quantile regressions for quarterbacks in 1992 and 1994. The results show that performance mattered much more for quarterbacks in 1994 than it did in 1992, though the precise nature of the impact

TABLE 7: Determinants of Salary for Wide Receivers (*t* statistics in parentheses)

	1992 (n = *125)*				*1994* (n = *120)*			
Variable	*.25 Quantile*		*.75 Quantile*		*.25 Quantile*		*.75 Quantile*	
Constant	11.6054**	(133.69)	12.3843**	(52.69)	11.3829**	(101.71)	11.7962**	(46.50)
Games played	–0.0176	(1.01)	–0.0050	(0.30)	–0.0061	(0.67)	0.0018	(0.09)
Games started	0.0305	(1.23)	0.0184	(1.29)	0.0020	(0.09)	–0.0047	(0.24)
Experience	0.619**	(3.78)	0.1646**	(2.47)	0.2399**	(2.95)	0.2627**	(2.18)
Experience^2	–0.0119**	(2.39)	–0.0079	(1.57)	–0.0128	(1.51)	–0.0148*	(1.89)
Receptions	0.0101	(1.03)	0.0116	(1.26)	0.0213**	(1.99)	0.0179	(1.59)
Kick returns	0.0085	(0.61)	0.0096	(0.98)	0.0010	(0.10)	0.0302**	(2.18)
Receiving yards	–0.0002	(0.40)	–0.0003	(0.49)	0.000005	(0.01)	0.0003	(0.30)
Average kick return	0.0046	(0.38)	–0.0134	(1.44)	0.0028	(0.35)	–0.0226**	(2.73)
Named to Pro Bowl	0.2821	(1.51)	0.2064	(1.07)	–0.0571	(0.15)	–0.2584	(0.74)
R^2	0.3898		0.4700		0.5298		0.5083	

*Significant at 10%. **Significant at 5%.

TABLE 8: Determinants of Salary for Tight Ends (*t* statistics in parentheses)

	1992 (n = *68)*				*1994* (n = *68)*			
Variable	*.25 Quantile*		*.75 Quantile*		*.25 Quantile*		*.75 Quantile*	
Constant	11.6638**	(56.23)	12.85**	(41.94)	11.4043**	(64.88)	11.3557**	(41.20)
Games played	–0.0301**	(2.28)	–0.179	(0.89)	–0.0046	(0.26)	0.0240	(1.05)
Games started	0.0114	(0.69)	0.0047	(0.33)	0.074*	(1.76)	0.04138*	(1.93)
Experience	0.2278**	(2.72)	0.0575	(0.58)	0.2413*	(1.78)	0.3068*	(1.92)
Experience^2	–0.0080	(1.20)	–0.0003	(0.04)	–0.0156	(1.47)	–0.0225**	(1.97)
Receptions	0.0209	(0.90)	–0.0042	(0.22)	–0.0292	(1.18)	0.0102	(0.37)
Kick returns	–0.2296	(0.70)	–0.5779	(0.13)	0.0839	(0.22)	–0.2040	(0.39)
Yards receiving	–0.00003	(0.01)	0.0013	(0.79)	0.0028	(1.45)	0.0010	(0.45)
Average kick return	0.0158	(0.33)	–0.0071	(0.12)	–0.0308	(0.48)	0.0962	(0.95)
Named to Pro Bowl	–0.7619	(1.39)	–0.0902	(0.21)	0.2378	(0.34)	–0.1714	(0.36)
R^2	0.4230		0.3082		0.4205		0.5451	

*Significant at 10%. **Significant at 5%.

depended on one's place in the distribution of salaries. Aside from the constant term, the only statistically significant coefficient in the 1992 regressions was for experience, suggesting a reward for seniority rather than active contributions. In 1994, performance mattered (though in different ways) for the two quantiles. At the lower end of the distribution, passing yardage mattered (as did experience). At the high end of the distribution, being among the elite in terms of quarterback rating mattered more than any specific performance measure. The bargaining power of a player thus seems negatively correlated with passing yards and positively correlated with being among the top passers, as measured by the official NFL ratings.

As was true for quarterbacks, performance measures had no real impact on the pay of running backs in 1992. Aside from experience, the only statistically significant coefficient in 1992 was on games played for the .25 quantile, and it was negative. Unlike quarterbacks, performance had no effect on pay for the .75 quantile in 1994 either.[5] Several variables did have a positive impact on pay for the .25 quantile in 1994. The impact of yards rushing had a positive, significant impact that was several times larger than for any other regression. Similarly, the impact of making the Pro Bowl was almost twice as large for the .25 quantile in 1992 as it was for the .75 quantile, which in turn was much larger than for either quantile in 1992.

Table 7 shows that wide receivers also followed a different regime in the wake of the new bargaining agreement. Again, experience was the only factor to affect the pay of either quantile in 1992. Experience played a roughly similar role in 1994. By contrast, the number of receptions played a much larger role in 1994, though its impact was significant at the 10% level for only the .25 quantile.[6] The coefficients on the number of receptions were so close for the two quantiles in 1994, however, that one cannot conclude that the impact was any greater at the low end of the distribution. The pay of players in the .75 quantile also rose with the number of kickoff returns, suggesting that versatility may affect the bargaining power of wide receivers. However, the negative impact of the average length of a kick return contradicts such a conclusion.

Aside from experience, almost none of the variables affected the pay of tight ends in either year. The number of games played in 1991 actually reduced pay for players in the .25 quantile in 1992. The only other variable to come close to having an impact on pay was yards gained receiving for the .25 quantile in 1994. Although not significant at the 10% level, the value of the coefficient and *t* statistic are dramatically larger than for any other regression for tight ends.[7] Thus, with the possible exception of yards receiving, performance variables did not have much more of an impact in 1994 than in 1992. Moreover, there is little evidence that bargaining power is related to any of our performance measures for tight ends.

CONCLUSION

The results show that the new collective bargaining agreement dramatically changed the criteria by which teams rewarded their players, particularly at lower levels of pay. Players in the .25 quantile could drastically increase their pay by improving their performance in key categories: passing yardage for quarterbacks, rushing yardage for running backs, receiving yardage for tight ends, and number of receptions for wide receivers. The relationship between performance and pay seems intuitively obvious, but none of the performance measures affected pay under the old regime in 1992.

Although players in the .25 quantile could clearly improve their lot in 1994, this was less true for players in the .75 quantile. These players, who were already rela-

tively well-off, generally got less benefit from performing at higher levels than did players who were relatively underpaid. This suggests that a player's bargaining power from having a good year is greater when he is relatively underpaid than when he is relatively highly paid.

NOTES

1. For a brief history of free agency and a detailed description of the collective bargaining agreement, see Kowalewski and Leeds (1999, sect. 2).

2. Although revenues in football are far more equal than in other sports, we find that a team's record has a statistically significant, positive impact on its revenues. Results are available on request.

3. For an application of this concept in a very different context, see Mwabu and Schultz (1996).

4. Measures are available on request.

5. The impact of the number of receptions was positive and significant at the 12.9% level.

6. In 1994, it was significant at the 11.5% level.

7. It is significant at the 15.2% level.

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