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Abstract

This research examines the contract year phenomenon in a new context, by evaluating player performance *relative* to other players, rather than the same player over time. Since ordinary least-squares (OLS) methods assume independent observations, results may be biased as player performance is dependent on other players. As such, a Bayesian approach to allow for non-independence among player performance is used to evaluate players in contract years relative to their peers. Using novel performance data of National Football League (NFL) players and controlling for player salary, position, experience, and team effects, the results show that contract year players under-perform relative to players not in a contract year. Furthermore, increasing salary exhibits a greater negative effect on the performance of contract year players. The findings suggest managers would get more performance from players, on average, by not having players play during a contract year.

Keywords: *Contract year, player performance, NFL, Bayesian*

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Research Problem Addressed

The purpose of this research is to look at the performance of contract year athletes relative to their non-contract year peers. This comparison is important to team managers as players have differing levels of cost and performance and managers face salary cap restrictions. Prior research into the contract year phenomenon has examined the player's prior year performance to performance in the contract year. Given the managerial focus on comparing across players, this research adds a new perspective by comparing the performance of contract year players to players not in a contract year.

This research also makes a contribution by using a novel data set of comprehensive player performance rather than outcome scoring statistics. Indeed, assessing the performance of players who are not directly tied to scoring metrics (such as cornerbacks and offensive lineman in American football) is challenging. An additional contribution is the use of Bayesian statistical techniques by allowing for non-independent observations. This avoids the bias in ordinary least-squares methods (OLS) in which observations are assumed to be independent. The results show that contract year players perform worse than players not in a contract year. This effect is further moderated by salary: While higher salaries are positively associated with performance, on average, contract year players who earn more money further under-perform.

This research is useful to managers in determining whether to retain players in the final year of their contract. Agents, coaches, and others who are involved in contracts, salary, and personnel decisions will also find this research to be of interest.

Background

In professional sports, players who are in the final year of their contract are "hungry" to perform. The incentive for higher performance achievement is rewarded through a new contract (and likely higher salary). By performing well, the player hopes to draw interest not only from his current team but from other potential teams. Prior research has shown that contract year performance improves over the prior year in the National Basketball Association (Stiroh, 2007; White & Sheldon, 2014), Major League Baseball (White & Sheldon, 2014), and German soccer (Frick, 2011).

However, these findings are rooted in the player's performance during the contract year when compared to the same player's performance in the prior year, or a measure *within* player. While team managers consider this reference point, another reference point is that player performance is relative to the other players. This comparison *between* players is rooted in the cost-benefit trade-off as to which players a team will offer contracts.

Recent sports phenomenon into player comparisons have become increasingly important for academics and managers. For instance, baseball statisticians

emphasize "wins above replacement" (WAR), which examines a player's performance relative to a replaceable player at minimum salary (Cameron, 2009). "Wins over replacement player" (WORP) has been similarly applied for hockey goalies (Shea & Baker, 2012). "Wins produced" (WP), as applied to basketball players, objectively ties player box score statistics to team wins to compare which players create more wins (Berri, 2008; Berri, 2015; Berri & Schmidt, 2010). Across all three measures, an emphasis is placed on evaluating player contributions relative to their peers.

Method

A key concern for managers is whether to sign players who are in their final year of a contract. To examine the performance of contract year players, a comprehensive data set was used. While outcome scoring metrics are useful—such as touchdowns in football, home runs in baseball, and goals in hockey—there are many plays in the game in which the player is not even touching the ball, let alone scoring. Indeed, measuring worker quality is difficult, and even key scoring metrics seem "inadequate" (DeBrock, Hendricks, & Koenker, 2004). Consider an offensive lineman in American football. Evaluating his performance is difficult (Byanna & Klabjan, 2016) because he does not throw, carry, or catch the football. Even metrics such as penalties or sacks allowed may not adequately measure the true performance of an offensive lineman. Complicating measurement is that player performance is interdependent with other players, namely their teammates and opponents.

One data source that addresses this is ProFootballFocus.com (PFF), where staff members examine every player on every single play. Two experts at PFF grade each player on every play on a scale of -2 to +2 in 0.5 increments. A third expert is brought in when the first two experts differ. For example, a "check-down" pass by a quarterback for a short gain might have a minimal positive rating (+0.5), whereas a deep pass with a degree of difficulty might be judged +1.5 or +2.0. Even a throw-away incomplete pass to avoid a sack or stop the clock might be graded as neutral rather than purely negative. All players are graded. Offensive guards will earn positive grades for making blocks, more so if they can continue blocking downfield for the ball carrier. Cornerbacks receive highest grades for making an interception, positive grades for deflecting a pass, positive or perhaps neutral grades for stopping a ball carrier for no gain, and negative grades for missing a tackle that should have been made. By summing each player's performance on every single play of every single game, a comprehensive view of player performance is taken.

The data used here covers all plays from the 2008 regular season of the National Football League (NFL), the only year that had been made publicly available upon request. Additional years of data are feasibly available only to the teams, agents, media, and investors. For the analysis, players who played at least 25% of team snaps (plays) are included. This threshold retains the bulk of meaningful players, omitting players who may have played in only a few games or those who are

involved in only a few plays in each game (such as punters and placekickers). While longitudinal data has its benefits, of interest here is player performance relative to other players in the same season.

The determination of whether a player was playing in a contract year comes from KFFL.com (which has since been acquired by *USA Today* newspapers and renamed TheHuddle.com). This denotes whether the player is in the final year of their contract or not. For instance, a rookie in the last year of their rookie contract is a contract year player.

Several other control variables are considered that might account for player performance. One is salary. Player salary for the 2008 season comes from Spotrac.com, a website dedicated to sports salary and contract information. As a financial incentive to perform, higher paid players are typically expected to have higher performance.

Two, performance may be attributed to the player's position on the field. Since player performance is influenced by the other players, of critical importance is the quarterback. Quarterbacks are the highest paid players in the league (Weintraub, 2007), touching the ball on almost every single offensive play. Hence, their performance will impact every other player on the field, often making quarterbacks the "face of the franchise" (Berri et al., 2007).

Three, prior research has shown experience to be related to performance (Krautmann & Solow, 2009; Scully, 1989; Sommers, 2008). Performance should improve over time as the player learns and gains experience. Beyond a certain point, however, play will drop off. This has been similarly found regressing age on performance (Fair, 2008; Schell, 2005), and is not surprising since age and experience are likely highly correlated. To account for these effects of diminishing performance over time, experience (EXPER) and its squared term (EXPER2) are included (e.g., Berri and Simmons, 2009a).[1] Table 1 presents descriptive statistics of the variables.

A total of 1,007 players were retained for analysis. Player grades (PERFORM) for the regular season ranged from -42.2 to +58.1 with a mean of +1.39. Although sports are typically zero-sum games, the player average is slightly positive. Players who especially underperform are at risk of being benched or outright released by the team. Thus, teams will replace these players and take a chance on a player who might perform better. Player salary (LNSALARY) is the player's salary, log-transformed to account for skewness. Salaries ranged from a league minimum of $295,000 to as much as $18.7 million. The mean salary was $2.4 million. Fifteen players with no salary data were entered at the league minimum. A further justification for separating out the quarterback position (QB) is that quarterbacks had a mean average performance score of 22.2. Excluding quarterbacks, the average performance is 0.60 and close to zero for every other position.

[1]A fourth control variable, the player's draft position, was considered but not utilized, as prior research (Berri & Simmons, 2009b) has shown no statistical relation between draft pick and NFL performance of quarterbacks, which is the focal player position here.

Table 1
Descriptive Statistics for the Variables of Interest

Variable	*N*	Median	Mean	St. Dev	Min	Max
PERFORM	1,007	0.1	1.39	11.50	-42.2	58.1
CONTRACTYR	284	-1.2	-0.41	9.44	-28.7	33.4
QB	37	21.0	22.22	16.68	-1.5	58.1
SALARY ($ mil)	1,007	1.56	2.40	2.37	0.30	18.70
EXPER (years)	1,007	5	5.18	3.33	0	18

In the data, 284 players (or 28.2% of the players analyzed) were in their contract year (CONTRACTYR). The descriptive statistics for these contract year players is also listed in Table 1. One question may be whether team managers "lock up" the better players on the roster to contracts, leaving the lesser-talented players to play through a contract year. This is not always the case, as teams sometimes let Pro Bowl players play out the last year of their contracts to see how they perform. For instance, in the first week of the 2017 NFL free agency period, Pro Bowl players Dontari Poe, Jay Cutler, Alshon Jeffery, Cordarrelle Patterson, Adrian Peterson, and Andrew Whitworth were not signed by their respective teams as those teams signed arguably lesser talented players to fill their positions. This further emphasizes that team managers weigh the player against their peers amid costs. The contract year players also had a range of experience: their league experience ranged from 1 to 18 years, with a mean average of 6.2 years (SD = 3.33). In fact, 21.8% of contract year players had three or less years in the league, while 28.9% of contract year players had eight or more years of NFL experience.

The performance of player i is modeled as a linear model (e.g., Torgler & Schmitt, 2007) as shown in Equation 1. The model captures team-level fixed effects (α) for each team, j, as differences in cultures and coaching may be a factor of performance:

$$PERFORM_{ij} = \alpha_j + \beta_0 + \beta_1{*}(CONTRACTYR_{ij}) + \beta_2{*}(LNSALARY_{ij}) + \beta_3{*}(QB_{ij}) + \beta_4{*}(CONTRACTYR_{ij}{*}LNSALARY_{ij}) + \beta_5{*}(EXPER_{ij}) + \beta_6{*}(EXPER2_{ij}) + e_{ij} \quad (1)$$

Results

Since a player's performance is correlated to his teammates and opposing players, observations are not independent. As such, non-independence of observations violates a key assumption of traditional ordinary least-squares (OLS) methods and will result in biased estimates. An approach that accommodates this is a Bayesian estimation that uses a Gibbs sampler of the entire player space

to borrow information and shrink the estimates. The Bayesian method uses a uniform (uninformative) prior, with a burn-in of 1,000 iterations and 20,000 iterations after burn-in.

Table 2 gives the results of successive model building of Equation 1, reporting the coefficient estimates, posterior distributions of the Bayesian analysis, and measures of model fit (Deviance Information, Criterion, or DIC). Model 1a shows the effect of just contract year status on performance ($\beta = -2.10$, $p < .01$), indicating that contract year players, on average, under-perform non-contract year players by more than two performance points. When salary is considered (Model 1b), contract year players still under-perform ($\beta = -2.00$, $p < .05$). Model 1c accounts for the importance of quarterbacks, again finding that contract year players under-perform their contracted peers ($\beta = -1.59$, $p < .05$).

Model 1d includes an interaction term between contract year status and

Table 2

Estimation Results. Dependent Variable: Player Performance

	Model 1a			Model 1b			Model 1c		
Variable	Coefficient	SD		Coefficient	SD		Coefficient	SD	
Intercept	-0.10	1.97		-1.69	1.93		-2.05	1.81	
CONTRACTYR	-2.10	0.79	***	-2.00	0.78	**	-1.59	0.72	**
LNSALARY				2.35	0.35	***	1.81	0.34	***
QB							20.01	1.73	***
CONTRACTYR*LNSALARY									
EXPER									
EXPER2									
DIC	7,731.6			7,688.5			7,559.1		

	Model 1d			Model 1e			Model 1f		
Variable	Coefficient	SD		Coefficient	SD		Coefficient	SD	
Intercept	-2.18	1.81		-2.18	1.92		-2.22	2.04	
CONTRACTYR	-1.06	0.78		-1.07	0.81		-1.09	0.84	
LNSALARY	2.18	0.39	***	2.18	0.48	***	2.17	0.54	***
QB	19.85	1.73	***	19.85	1.75	***	19.86	1.75	***
CONTRACTYR*LNSALARY	-1.34	0.74	*	-1.34	0.74	*	-1.33	0.78	*
EXPER				-0.00	0.13		0.03	0.38	
EXPER2							-0.00	0.03	
DIC	7,557.8			7,559.9			7,561.9		

Note: posterior standard deviation (SD) reported as credible intervals. Team-level fixed effects not sh

*** Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level

salary. One consideration for its inclusion is that contract year players may exhibit differences in performance due to salary. Its inclusion absorbs some of the main effect ($\beta = -1.06, p > .10$) as contract year status remains negative and the interaction shows negative effects ($\beta = -1.34, p < .10$) on performance. Model 1e brings player experience into the equation, while Model 1f further adds the experience-squared term to account for declining performance over a player's career. In both models, contract year players still under-perform non-contract year players. Among the six models estimated, Model 1d had the best fit (DIC = 7,557.8).[2] Across models, there is support that contract year players perform worse than players not playing in a contract year, and that the effect is further moderated by salary.

Several robustness checks were conducted. Model 1c was re-estimated for all player positions, but QB was the only significant position ($p < .05$); this model had worse fit (DIC = 7,565.4) compared to just including QB. For most positions, the mean performance was closer to zero, unlike that of quarterbacks. Model 1f was re-estimated without team-level fixed effects and instead used two proxies for team success: team wins in the prior season or making the playoffs in the prior season. The results do not change for the focal variables, and provide worse model fit than the team-level fixed effects (DIC = 7,613.9 and 7,614.9, respectively). A final consideration is that teams may be forward-looking to "lock up" players to contract extensions before the player enters their contract year. By including the performance of these players, it may be skewing the comparison of contract year players to all players. Data from Spotrac found only 15 contract extensions and/or restructurings for the 2008 NFL season. The performance of these players ranged from -13.1 to 29.5 (inclusive of quarterbacks), with an average performance of 2.6 (inclusive of quarterbacks). Model 1f was re-estimated excluding these players; the results were not substantially different from the current reporting.[3]

Implications

Managers are interested in a player's performance relative to other players. This study contributes to our understanding of contract year players by examining the phenomenon between players rather than within a player. When viewed in this way, contract year players achieve worse performance than their non-contract year peers. Furthermore, as player salary increases, contract year player performance decreases.

One explanation for this contract year effect is that professional athletes are

[2]Due to the non-independence issues, a traditional R^2 cannot be reported. As a point of interest, the R^2 in Model 1d using OLS and team fixed effects is .251.

[3]Additionally, a *t*-test was estimated comparing the performance of players who received a contract extension to all players ($t = .44, p > .66$), as well as comparing their performance to contract year players ($t = 1.29, p > .19$). In neither instance were the means significantly different, although caution should be exercised on making an inference from such a small sample size.

under pressure to perform. The contract year (and heightened expectations that come with higher salaries) raises expectations to succeed, which in turn raise performance pressures (e.g., Baumeister, Hamilton, & Tice, 1985). These pressures may be too much for most athletes in their contract year. Another explanation may be that managers allow players to play out their contract years as an option to reduce uncertainty: the manager knows something about the player's abilities, so the manager may take a "wait-and-see" approach to the player's performance.

The findings indicate managers should reconsider the value of contract year players and their ability to perform. In particular, an average effect of increasing salary corresponds to even worse performance for contract year players. This suggests contract year players should not be highly paid; teams may be better served by restructuring the contracts of highly paid players in the final year of their contract to extend the player's contract. One consideration may be for managers to substantially reduce the number of contract year players on its team. Doing so, however, will limit the manager's options to add or eliminate players from the roster. As such, an optimal number of contract year players on a roster may exist that balances these trade-offs, presenting an avenue for future research in this area.

References

Baumeister, R. F., Hamilton, J. C., & Tice, D. M. (1985). Public versus private expectancy of success: Confidence booster or performance pressure? *Journal of Personality and Social Psychology*, 48(6), 1447–1457.

Berri, D. J. (2008). A simple measure of worker productivity in the National Basketball Association. in B. Humphreys & D. Howard (Eds.), *The business of sport* (Vol. pp. 1–40). Westport, CT: Praeger.

Berri, D. J. (2015). Think you know basketball? You need to know the numbers to know the game. *Sports and Entertainment Review, 1*(1), 7–14.

Berri, D. J., & Schmidt, M. B. (2010). *Stumbling on wins: Two economists explore the pitfalls on the road to victory in professional sports*. Princeton, NJ: Financial Times Press.

Berri, D. J., & Simmons, R. (2009a). Race and the evaluation of signal callers in the National Football League. *Journal of Sports Economics, 10*(1), 23–43.

Berri, D. J., & Simmons, R. (2009b). Catching a draft: On the process of selecting quarterbacks in the National Football League amateur draft. *Journal of Productivity Analysis*, *35*(1), 37–49.

Berri, D. J., Simmons, R., Van Gilder, J., & O'Neill, L. (2011). What does it mean to find the face of the franchise? Physical attractiveness and the evaluation of athletic performance. *Economics Letters*, 111, 200–202.

Byanna, N., & Klabjan, D. (2016). Evaluating the performance of offensive line-

men in the NFL. Northwestern University working paper.
Cameron, D. (2009, October 7). *WAR: It works*. Retrieved from http://www.fangraphs.com/blogs/war-it-works/
DeBrock, L., Hendricks, W., & Koenker, R. (2004). Pay and performance: The impact of salary distribution on firm-level outcomes in baseball. *Journal of Sports Economics*, *5*(3), 243–261.
Fair, R. (2008). Estimated age effects in baseball. *Journal of Quantitative Analysis in Sports, 4*(1), 1–39.
Frick, B. (2011). Performance, salaries, and contract length: empirical evidence from German soccer. *International Journal of Sport Finance*, 6, 87–118.
Krautmann, A. C., & Solow, J. L. (2009). The dynamics of performance over the duration of Major League Baseball long-term contracts. *Journal of Sports Economics, 10(1), 6-22.*
Schell, M. (2005). *Baseball's all-time best sluggers*. Princeton, NJ: Princeton University Press.
Scully, G. (1989). *The business of baseball*. Chicago, IL: University of Chicago Press.
Shea, S. M., & Baker, C. E. (2012). Calculating wins over replacement player (WORP) for NHL goaltenders. *Journal of Quantitative Analysis in Sports*, *8*(1), pp. 1–18.
Sommers, P. (2008). The changing hitting performance profile in Major League Baseball, 1966-2006. *Journal of Sports Economics, 9*(4), 435–440.
Stiroh, K. J. (2007). Playing for keeps: Pay and performance in the NBA. *Economic Inquiry, 45*(1), 145–161.
Torgler, B., & Schmidt, S. L. (2007). What shapes player performance in soccer? Empirical findings from a panel analysis. *Applied Economics, 39*(18), 2355–2369.
Weintraub, R. (2007). What's the most valuable position in pro football? Retrieved from http://www.slate.com/articles/sports/sports_nut/2007/09/most_valuable_position.html
White, M. H., & Sheldon, K. M. (2014). The contract year syndrome in the NBA and MLB: A classic undermining pattern. *Motivation and Emotion, 38*(2), 196–205.