Pay for Play: Shirking in the NFL

By: Greg Marks

Advised by: Dr. Donald Waldman, Economics

Committee Member: Dr. Peter J. Kratzke, Writing & Rhetoric

Committee Member: Dr. Terra McKinnish, Economics

University of Colorado, Boulder

Department of Economics

Defense Date:

Tuesday April 11, 2017

While there is extensive literature on shirking in sports, this is the first study to comprehensively examine shirking in the National Football League (NFL). Using a linear regression, player performance is regressed on numerous contract variables, including a contract dummy variable, total contract amount, contract length, and percent of salary that is guaranteed, along with several control variables. Although the results are not statistically significant, the direction of the relevant coefficients indicates that shirking may be occurring in the NFL. The complex nature of NFL contracts makes it difficult to discern the mechanism through which shirking may be occurring.

I. Introduction

To shirk is to put forth minimal effort when there is no chance of earning more money. Shirking in sports is a classic principal-agent problem that has been extensively researched. There are many ways that an athlete can shirk including missing practice, not taking care of one's body, or partying at the expense of game planning. The vast majority of studies focus on baseball or basketball, with little investigation of professional football. Contracts in Major League Baseball (MLB) and the National Basketball Association (NBA) are fully guaranteed, whereas contracts in the NFL are incentivized. This study will examine whether the NFL's incentivized contracts are effective at dissuading shirking in the NFL. This could have implications in the amount of guaranteed money that athletes in the NFL are offered, as well as implications for the structure of contracts in other professional sports.

II. Literature Review

Are salary incentives effective at deterring shirking in the NFL? To answer, one must consider the nature of contracts in the NFL, as well as how to accurately measure player performance across positions. In order to determine whether shirking is prevalent in the NFL, it is necessary to review the relevant literature.

First I examine studies concerning optimal incentive contracts, then go on to discuss models of player productivity and, lastly, I explore shirking in professional sports.

An optimal incentive contract aims to use monetary incentives to motivate a worker to be more productive. As Baker et al. (1994) noted, the success of these contracts depends on a number of economic, social, and psychological variables. Baker (2002) argues that a performance measure that has more error has less value in determining the total value of an incentive contract. This argument is supported by the findings in Hendricks et al. (2003), where they found that statistical discrimination involving uncertainty leads to inefficiency in the NFL draft. This inefficiency was further illustrated when Robbins (2010) demonstrated that performances in the NFL Combine, the foremost pre-draft workout, have little effect on draft position. Another study conducted by Lyons et al. (2009) found no significant link between player intelligence (as measured by the Wonderlic test) and player performance.

Despite having a plethora of data and player evaluations, the high level of uncertainty in the NFL draft process underscores the need for monetary incentives in NFL contracts. NFL players are compensated through a combination of signing bonuses: up-front payments for signing a contract, fixed payments: paid annually (but non-guaranteed), and performance bonuses: incentive payments based on individual and team achievements (Heubeck and Scheuer 2003). Team achievements include: winning games, winning in the playoffs, and team rankings in various statistical categories. Individual achievements include: statistical accomplishments, weight limits, and positional rankings (NFLPA 2006). In 2002,

salary incentives made up about five percent of total salary of all NFL players (Heubeck and Scheuer 2003). By 2006, salary incentives ballooned to account for 25 percent of total salary of all NFL players (Mondello and Maxcy 2009).

Agency theory suggests linking compensation to performance is, usually, an efficient and effective way to motivate employees. However, inefficiencies may arise when there is an inability to differentiate individual performance from team performance (Gibbons 1998). This highlights the need for an accurate model of player performance. Throughout sports history, many attempts have been made to model player productivity. Scully (1974), made a pivotal discovery when, while examining MLB data, he found that the marginal product of a professional athlete in a team sport could be determined by linking wins to player statistics. Scully's philosophy has been expanded to many other sports, including the NBA (Scott et al. 1985), the NHL (Jones and Walsh 1988), and golf (Shmanske 2000).

However, the nature of positions in the NFL makes it difficult to objectively evaluate every player on the same scale. Any player can take a shot or hit a homerun in the NBA and MLB respectively, but not every player can catch a pass in the NFL. First developed by a committee in the 1970s, the NFL's Quarterback Rating was the first metric of player performance in the NFL. Although still employed and frequently mentioned in the media, the measure is often regarded as being confusing, incomplete, and inconsistent (Berri and Burke 2011). Gerrard (2007) employed a measure of marginal product in soccer that examined wins as a function of points scored and points surrendered. When this model is applied to the NFL, 84% of a team's wins are explained by how many points a team scores and

surrenders in a season (Berri and Burke 2011). Berri and Burke use this information to develop a model of points scored by the offense and a model of points scored by the opponent's offense. By combining these two metrics, Berri and Burke are able to estimate a skill player's wins produced per 100 plays.

There are a few other well-known methods of measuring skill player performance in the NFL. Expected Points Added looks at how many points each play is expected to add; for example, a 15-yard completion may add 0.9 expected points to a team's net scoring expectancy (Berri and Burke 2011). Success Rate grades each play as either a success or a failure. The last measure is Win Probability Added, which measures how much every play affected each team's likelihood of winning the game (Berri and Burke 2011). These metrics can be easily applied to offensive skill positions, but it is considerably more difficult to measure the marginal production of defensive and special teams players. Another important aspect of measuring player performance is adjusting for managerial quality. Hadley et al. (2000) discovered that effective coaching in the NFL could account for three to four victories in a sixteen game season. According to Maier et al (2016), there are also organizational support variables that affect performance. These factors of player family integration and private problem support are strongly related to player job satisfaction, which is another measure that is highly correlated with individual performance.

Scully's (1974) seminal work did more than just develop a model of player productivity; it was also the first paper to compare compensation and performance in the sports realm. Studies based on Scully's work have shown that players' salaries are consistent with their marginal product in the NBA (Scott et al. 1985), NHL (Jones

and Walsh 1988), PGA, and LPGA (Shmanske 2000). However, opportunistic behavior can arise when the agent realizes he can shirk without repercussions (Berri and Krautmann 2006).

The principal-agent dilemma has been extensively researched in sports literature. There is conflicting evidence on whether shirking exists in professional sports. Maxcy et al. (2002) found no evidence of shirking after signing a long-term contract in the MLB. Berri and Krautmann (2006) found evidence both for and against shirking in the NBA, depending on what measure of player performance they utilized. Stiroh (2007) discovered evidence of increased performance the year before receiving a multi-year contract, and diminished performance after receipt of a multi-year contract in the NBA. Woolway (1997) found statistically significant evidence of disincentive performance effects associated with multi-year contracts in the MLB. McCannon et al. (2012) published evidence that the season following the receipt of a long-term contract, a quarterback is likely to see a reduction in quarterback rating, passing yards, and touchdowns thrown. These factors all point to a possible culture of shirking in the NFL.

There have been numerous studies conducted on both shirking in sports following the receipt of a multi-year contract, as well as on the modeling of performance in the NFL. However, there has yet to be a comprehensive study that examines shirking in the NFL following the receipt of a multi-year contract. This study builds on the existing measures outlined in Berri and Burke (2011) to obtain normalized data for each position in the NFL. This paper will then go on to utilize methods outlined by Berri and Krautmann (2006) and McCannon et al. (2012) to

analyze the data according to player performance before and after acceptance of a multi-year contract.

III. Methodology

The data utilized in this study consists of all NFL players who played in both the 2014 and 2015 seasons. This is the most recent range of seasons with available data. There are a total of 1,455 observations across these seasons.

Pro Football Focus's seasonal player grades are used as the performance metric. Pro Football Focus is a firm that grades every player on every play on a scale from -2 to 2. A player that receives a -2 on a play had the maximum negative impact on that play, for example a running back fumbling the ball. A player that receives a 2 had the maximum positive impact on that play, for example a quarterback tossing a 50-yard touchdown pass. A player that receives a 0 had no impact on the play, for example a cornerback that is uninvolved in a running play. These play grades are then summed across the course of each game and season. The minimum player season grade used is -50.6, while the maximum grade is 100.3. In order to create the dependent variable used in the regression, the difference in player grades between the latter (t) and former (t-1) seasons was calculated. This is considered to be a measure of the change in productivity (ΔPROD).

Contract data was collected from the comprehensive sports salary database, spotrac.com. The contract variables utilized are total contract amount (AMOUNT), contract length (LENGTH), percent of salary that is guaranteed (GTD), and a dummy variable that is 1 if a player received a new long-term (greater than one year) contract in 2015 (CONTRACT). All contract variables are valued at 0 if a player did

not receive a new contract in 2015. If shirking were prevalent, there would be a negative effect of the contract dummy variable on productivity (Berri and Krautmann 2006).

If shirking occurred as a result of receiving a long-term contract, we would expect to find that productivity falls as the percentage of guaranteed money, or the length of the contract increases. There may be an income effect at play as well. The income effect is the effect that an increase in income has on a consumer's choices. For instance, when an individual earns a higher income, the individual is more likely to substitute away from inferior goods. In this case, as athletes earn larger salaries they are more likely to substitute desired leisure activities for inferior training-related behaviors.

Several control variables were also used. To account for age, I averaged each player's age over the 2014 and 2015 seasons (AGE). This term was then squared to account for the peak age of performance (AGE^2). Controlling for normalized age controls for both the deteriorating effects of aging, as well as the beneficial effects of gaining experience (Garner et al. 2016). The change in games played from 2014 to 2015 was also measured (ΔGP). A decrease in games played is associated with an increase in injuries, which results in a net reduction in productivity (Berri and Krautmann 2006). In order to control for team quality, Pro Football Focus's team rankings were used. These rankings are on a scale of 1 to 32, where 1 is the best team and 32 is the worst team. If a player played on more than one team during the course of a season, they were assigned a team value of 33. To measure the change in team quality, team ranking in 2014 was subtracted from team ranking in 2015

(ΔTEAM). A negative sign on the coefficient of this variable would mean that player performance decreases when a player is on a worse team.

Players 2014 grades were added to control for the players initial level of play (GRADE2014). The final control variables are a set of dummy positional variables. The positions used are quarterback, running back, fullback, wide receiver, tight end, offensive lineman, defensive end, linebacker, defensive tackle, cornerback, safety, kicker, punter, and long snapper. Quarterback, the highest paid and most important position could be reasoned to have the largest effect of the positional dummy variables.

Given these variables, the estimated model is:

$$\Delta PROD = \beta_1 AGE + \beta_2 AGE^2 + \beta_3 \Delta GP + \beta_4 \Delta TEAM + \beta_5 GRADE2014 + \beta_6 CONTRACT + \beta_7 LENGTH + \beta_8 AMOUNT + \beta_9 GTD + \beta_{10\text{-}23} POSITION + \varepsilon.$$

IV. Empirical Results

TABLE 1: Summary Statistics Over Reception of a Long-Term Contract in 2015

	Full Sample	New Long-Term Contract in 2015	No New Long-Term Contract in 2015
Change in Player Performance	-0.77	-3.18	-0.49
	(10.27)	(12.37)	(9.963)
Player Performance in 2014	1.36	8.25	0.55
	(10.97)	(12.85)	(10.44)
Average Age	26.75	27.27	26.69
	(3.148)	(2.494)	(3.211)
Change in Games Played	-0.24	-0.06	-0.26
	(5.719)	(4.660)	(5.832)
Change in Team Quality	0.60	2.37	0.39
	(11.71)	(11.31)	(11.75)
N	1443	152	1291

mean coefficients; sd in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1 provides a comparative summary of the means and standard deviations of relevant variables, as they vary over reception of a new contract in 2015. There are a few items of note from this table. On average, players who received a new long-term contract performed over 2.5 points worse in the following season than players who did not receive a new long-term contract. Players who received a new long-term contract in 2015 are also less likely to miss games and more likely to be on a worse team. This is logical, since teams are more likely to offer long-term contracts to healthy players. Additionally, bad teams typically spend the most in free agency.

The largest difference comes from 2014 player grades. Players who received a new contract in 2015 performed significantly better in 2014 than those who did not receive a new contract. This means that players coming off of a great season are more likely to receive a long-term contract.

Table 2: Regression Estimates

	Model 1 b/se/p	Model 2 b/se/p	Model 3 b/se/p
Contract Dummy Variable	-0.289	-5.215	-4.636
	(3.86)	(3.61)	(3.34)
	0.940	0.149	0.166
Contract Length	-0.549	0.872	0.911
	(0.97)	(0.92)	(0.85)
	0.571	0.341	0.283
Total Contract Amount	0.009	0.025	0.020
	(0.02)	(0.02)	(0.02)
	0.725	0.295	0.381
Percent Guaranteed	-0.014	0.017	0.013
	(0.06)	(0.05)	(0.05)
	0.808	0.757	0.804
Age		-0.867	-0.594
		(1.06)	(0.98)
		0.413	0.544
Age Squared		0.011	0.007
		(0.02)	(0.02)
		0.551	0.671
Difference in Games Played		-0.002	-0.013
		(0.05)	(0.04)
		0.961	0.770
Difference in Team Quality		-0.118***	-0.096***
		(0.02)	(0.02)
		0.000	0.000
Grade in 2014		-0.346***	-0.402***
		(0.03)	(0.02)
		0.000	0.000
QB		17.964	12.086
		(14.75)	(13.65)
		0.223	0.376
RB		15.597	11.152
		(14.79)	(13.68)
		0.292	0.415
WR		15.296	10.882
		(14.79)	(13.69)
		0.301	0.427
TE		13.774	9.137
		(14.85)	(13.74)
		0.354	0.506
OL		12.188	7.601

		(14.84)	(13.73)
		0.412	0.580
FB		13.545	9.078
		(15.02)	(13.89)
		0.367	0.514
DE		18.155	13.077
		(14.83)	(13.72)
		0.221	0.341
LB		14.384	9.353
		(14.81)	(13.70)
		0.331	0.495
DT		18.379	11.536
		(14.85)	(13.73)
		0.216	0.401
CB		14.301	9.768
		(14.82)	(13.71)
		0.335	0.476
S		14.946	10.461
		(14.83)	(13.72)
		0.314	0.446
K		20.029	15.795
		(14.59)	(13.49)
		0.170	0.242
P		16.211	12.112
		(14.83)	(13.72)
		0.274	0.377
LS		16.404	11.202
		(14.90)	(13.78)
		0.271	0.416
Constant	-0.199		
	(0.30)		
	0.508		
R-sqr	0.005	0.167	0.211
dfres	1450	1432	1420
BIC	11096.5	10971.7	10649.6

* p<0.05, ** p<0.01, *** p<0.001

Table 2 consists of three sets of linear regression coefficient estimates. All three regressions use the difference in Pro Football Focus's player grades from 2014 to 2015 as a measure of productivity. The first set regresses player performance only on the contract related variables. The second set includes the control variables for age, games played, team quality, position, and player performance in 2014. The third set drops the most egregious outliers: twelve observations with an absolute value studentized residual greater than three.

There are several results of interest derived from Table 2. When controls are added, the sign on percent guaranteed changes from negative to positive, although this coefficient is not statistically significant either before or after the addition of controls. This means that when controlling for age, games played, team quality, position, and player performance in 2014, an increase in guaranteed salary is associated with an increase in player performance. This would be contrary to the shirking hypothesis, where more guaranteed salary would lead to increased incentive to shirk.

The sign on total contract amount also changed when the controls were added, although the coefficient remained statistically insignificant. If significant, an increase in total salary would be predicted to increase player performance. This would suggest that there is no income effect at play. Also statistically insignificant, a longer contract was predicted to increase player performance in the year following receipt of a new long-term contract.

The coefficient on the contract dummy variable can be considered marginally significant. Players who received a new contract in 2015 were predicted to perform 4.64 points worse than players who did not receive a new long-term contract. This result supports the shirking hypothesis.

Although statistically insignificant, the coefficient on average age indicates that players get worse as they age. Using the coefficients on average age and average age squared, it can be determined that players get worse throughout the course of their careers. This goes against conventional wisdom, where players improve over the first few seasons of their career before their skills deteriorate.

The coefficient on the change in games played indicates that playing more games actually decreases productivity. This is contrary to popular belief, where playing more games would give a player more chances to contribute. The nature of the player grades means that bad players missing games counteracts the effects of good players missing games. Thus, the variable does not actually measure the impact of injuries as intended. The descending order of the team quality variable means that, on average, players who perform worse are on teams who perform worse. This could be either the team or the player making the other appear worse.

Player performance in 2014 is a strong predictor of the difference in player performance from 2014 to 2015. A player who performs 1 point better in 2014 would be predicted to decrease player performance by 0.4. This implies that players who had a great season are more likely to regress back towards the mean. The positional dummy variables had varied effects. None of the positional effects were statistically significant.

V. Conclusions

While only marginally significant by conventional standards, the results of this study indicate that shirking may be occurring in the NFL following the reception of a long-term contract. The coefficient on the contract dummy variable suggests that other untested effects are at play within the contract variable. This could be that certain types of omitted contract incentives are more effective than others. If incentives related to winning games were more effective at preventing shirking, the coefficient on the contract variable would be positively biased.

The insignificant nature of many of the contract variables makes it impossible to tell whether NFL contracts are efficient from this study. The insignificance of the contract effects could be due to the fact that players who are considered to be "sure-things" usually get longer, and larger, contracts with more guaranteed money; while good players who are considered to be more risky often get one-year deals. However, there are myriad aspects to an NFL contract. While this data is not publicly available, NFL contracts are laden with different types of incentives. One potential avenue of future research could be into whether teams front-load contracts in order to save cap room in future years. This would allow teams to cut players who are no longer performing with minimal repercussions. In turn this would provide teams with a tremendous amount of negotiating power, which would act as another deterrent to shirking.

The trends illuminated in this study should be further investigated through additional research. Obtaining detailed contract data and adding copious contract-related control variables would eliminate a significant amount of omitted variable bias. There are a multitude of factors that influence efficient contract design. Although the NFL appears to have relatively efficient contracts, there is evidently room for improvement. This study has done little to settle the debate about shirking in sports. However, this paper lays down the groundwork for further investigation of shirking in the NFL.

References

Baker, G., Gibbons, R., & Murphy, K. (1994). Subjective Performance Measures in Optimal Incentive Contracts. *The Quarterly Journal of Economics*.

Baker, G. (2002). Distortion and Risk in Optimal Incentive Contracts. *The Journal of Human Resources, 37*(4), 728.

Berri, D. J., & Krautmann, A. C. (2006). Shirking on the Court: Testing for the Incentive Effects of Guaranteed Pay. *Economic Inquiry, 44*(3), 536-546.

Berri, D. J., & Burke, B. (2011). Measuring Productivity of NFL Players. *The Economics of the National Football League,* 137-158.

Garner, J., Humphrey, P. R., & Simkins, B. (2016). The Business of Sport and the Sport of Business: A Review of the Compensation Literature in Finance and Sports. *International Review of Financial Analysis, 47*, 197-204.

Gerrard, B. (2007). Is the Moneyball Approach Transferable to Complex Invasion Team Sports? *International Journal of Sports Finance* 2:214–228

Gibbons, R. (1998). Incentives in organizations, *The Journal of Economic Perspectives*, 12 (4), 115-32.

Hadley, L., Poitras, M., Ruggiero, J., & Knowles, S. (2000). Performance Evaluation of National Football League Teams. *Managerial and Decision Economics Manage. Decis. Econ., 21*(2), 63-70.

Hendricks, W., Debrock, L., & Koenker, R. (2003). Uncertainty, Hiring, and Subsequent Performance: The NFL Draft. *Journal of Labor Economics, 21*(4), 857-886.

Heubeck, T. & Scheuer, J. (2003). Incentive clauses in players' contract in team sports – theory and practice, *German working papers in Law and Economics*. 1-30.

Jones, J. & Walsh, W.D. (1988). Salary Determination in the National Hockey League: The Effects of Skills, Franchise Characteristics, and Discrimination *Industrial and Labor Relations Review*, 41 592–604

Lyons, B. D., Hoffman, B. J., & Michel, J. W. (2009). Not Much More Than g? An Examination of the Impact of Intelligence on NFL Performance. *Human Performance, 22*(3), 225-245.

Maier, C., Woratschek, H., Ströbel, T., & Popp, B. (2016). Is It Really All About Money? A Study on Incentives in Elite Team Sports. *European Sport Management Quarterly,* 1-21.

Maxcy, J., R. Fort, and A. Krautmann. (2002). The Effectiveness of Incentive Mechanisms in Major League Baseball, *Journal of Sports Economics*, 3(3), 246–55.

McCannon, B. C., O'Laughlin, K., & Scott, Z. (2012). The Disincentive of Salary Increases: Evidence from NFL Quarterback Performances. *SSRN Electronic Journal*.

Mondello, M., & Maxcy, J. (2009). The Impact of Salary Dispersion and Performance Bonuses in NFL Organizations. *Management Decision, 47*(1), 110-123.

NFLPA (2006), Collective Bargaining Agreement between The NFL Management Council and The NFL Players Association. *NFL Collective Bargaining Agreement*, 24(4),

Robbins, D. W. (2010). The National Football League (NFL) Combine: Does Normalized Data Better Predict Performance in the NFL Draft? *Journal of Strength and Conditioning Research, 24*(11), 2888-2899.

Scott, F.J, Long, J.E., & Somppi, K. (1985). Salary vs. Marginal Revenue Product Under Monopsony and Competition: The Case of Professional Basketball *Atlantic Economic Journal*, 13. 50–59

Scully, Gerald W, (1974), Pay and Performance in Major League Baseball, *American Economic Review*, 64(6), 915-30.

Shmanske, Stephen (2000). Gender, Skill, and Earnings in Professional Golf . *Journal of Sports Economics*. 385-400,

Stiroh, K. J. (2007). Playing For Keeps: Pay and Performance in the NBA. *Economic Inquiry, 45*(1), 145-161.

Woolway, M. D. (1997). Using an Empirically Estimated Production Function for Major League Baseball to Examine Worker Disincentives Associated with Multi-Year Contracts. *The American Economist, 41*(2), 77-83.