Do Minimum Salaries Shorten Firm Tenure or Career Length?

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Abstract

I use data from the National Football League (NFL) to analyze the impact of minimum salaries on career length and firm tenure. A major advantage of using NFL data is that I am able to control for worker productivity. The NFL has a minimum salary schedule in which the minimum salary a player can receive increases with the player's years of experience. This salary structure provides an environment for studying the impact of minimum salaries. I find that when the minimum salary schedule forces a team to give a player a raise, the player's career is shortened by 3.6 seasons. I also find that when the minimum salary schedule forces a team to increase the mandatory raise by $10,000, the player's career is shortened by an additional two fifths of a season. Salary schedules similar to the NFL's exist in public education, the Episcopalian church, Secret Service, Internal Revenue Service, and other federal government agencies. Even though the magnitude of the salaries in the NFL differs from other industries, the results provide evidence that minimum salary schedules shorten careers.

Introduction

Over the years, both researchers and policymakers have spent time trying to measure the impact of minimum wages. Minimum wages have conventionally been thought to impact low skilled workers. Previous research has focused on the impact of minimum wages on employment (Brown et al, 1982; Card, 1992a; Card and Krueger, 1994) and on the earnings distribution (Behrman et al, 2001; Dickens et al, 1999; Johnson and Browning, 2001; Katz and Krueger, 1992; Neumark et al, 2004). A compensation structure similar to minimum wages is minimum salaries. Both minimum wages and minimum salaries restrict a firm's options to compensating workers to levels at or above the set minimum. The key difference is that minimum wages place a lower limit on the amount of compensation a worker can receive for an hour of work while minimum salaries place a lower limit on the amount of compensation a worker can receive for a year of work. This is an important distinction because firms that encounter minimum wages have the ability reduce the total yearly income paid to workers by reducing the worker's hours. Firms that encounter minimum salaries do not have the ability to reduce the total yearly income below the mandated minimum salary. This paper analyzes the impact of minimum salaries on firm tenures and career lengths in the National Football League (NFL).

In this paper I exploit the presence of a minimum salary schedule to measure the impact of minimum salaries. A minimum salary schedule is a compensation structure in which the minimum amount that can be paid to an employee on an annual basis is mandated at all levels of experience and increases with an employee's experience. Minimum salary schedules are usually negotiated to protect older, more experienced workers from having their incomes cut. Minimum salary schedules exist predominantly in unionized and government workplaces. These schedules

are present in public education, professional sports, the Episcopalian church, the Secret Service, the Internal Revenue Service, and other federal government agencies. In union jobs minimum salary schedules are typically negotiated between a labor organization representing a group of employees and a representative for the employers. In federal government jobs minimum salaries are determined by the General Schedule (GS) pay scale. Minimum salary schedules are viewed as being beneficial to employees because their existence places a lower limit on the salary employees might otherwise receive. This increases the income of workers who would have earned less than the minimum salary in the absence of the schedule if they are able to work for as many years as they would have without the constraint.

Firm tenure is the amount of time an employee spends with a particular firm while career length is the amount of time individuals are employed in a particular industry during their lifetimes. In the presence of a minimum salary schedule it is possible for the mandated salary to exceed the value of the employee's productivity to the firm. When the marginal cost of the employee to the firm is greater than the value of the employee's productivity, the firm will choose to dismiss the employee and hire a new employee when possible. The employee's dismissal from the firm is induced by the increase in the minimum salary that is mandated by the minimum salary schedule. Therefore, the presence of a minimum salary schedule could have a negative impact by shortening a productive employee's firm tenure or career length.

Firm tenure and career length are expected to be shortened when an employer is required by the minimum salary schedule to give an employee a raise. A raise is considered to be mandatory when the employee's salary has to be increased independent of other wage-determining factors. If the mandated minimum compensation in the minimum salary schedule is

set too high, the negative impact of shortening an employee's firm tenure or career length will be larger than the positive impact of increasing an employee's the income.

In many jobs where minimum salary schedules are utilized it is difficult to fire an employee. When mechanisms are in place making it difficult to fire an employee, it is possible that some employees receive salaries that are higher than their value to the firm. In this situation a firm may want to release an employee but it may be too difficult or costly. Besides shortening careers, minimum salary schedules can force firms to over-pay employees. It may be difficult to measure the workers' value to the firm when firms are able to dismiss employees. The existence of minimum salary schedules may also have an impact on hiring practices leading to less hiring. These things make it virtually impossible to measure the impact of minimum salary schedules on firm tenure and career length, as hiring and retention are both endogenous.

One advantage of using NFL data is that an employee's performance statistics are easily measured. This gives me the ability to control for a player's productivity. Another advantage is that in the NFL, contracts are not guaranteed. This gives the employer the ability to dismiss a player when his mandated minimum salary exceeds the value of his productivity. Although the NFL differs in various ways from other industries with minimum salary schedules, the results from this study should provide insight about the impact of minimum salary schedules on firm tenure and career length.

The NFL has a roster constraint of 53 players in place during the regular season. Due to this roster limit, no NFL team will ever have more than 53 players on its active roster. At any point during the regular season most teams will have the maximum number of players allowed on their active rosters. Since teams typically have no less than 53 players and are not allowed to have more than 53 players, increasing the price of a player as his level of experience increases

will not have a large impact on the number of players employed by the team. Increasing the price of a player as his level of experience increases can provide NFL teams with the incentive to substitute less experienced, cheaper players for more experienced expensive players. This incentive exists as long as the younger, inexperienced players are reasonable substitutes for the older, experienced players. Therefore, the NFL's minimum salary schedule can reduce firm tenure and career length through this incentive.

The contribution of this paper is that it is one of the first to measure the impact of minimum salaries on firm tenure and career length. I use data that allow us to see how minimum salary schedules impact firm tenure and career length when firms are able to dismiss employees. This enables us to see what could happen if it were easier for firms with a minimum salary schedule to dismiss employees. I find statistically significant evidence that careers are shortened when minimum salary schedules force an employer to give an employee a raise. On the other hand, I do not find any statistically significant evidence that minimum salary schedules shorten firm tenure.

Theoretical Model

A number of previous studies of professional sports leagues have made the assumption that teams maximize profits (Hamlen Jr., 2007; Fort and Quirk, 1995; Scully, 1974; Vrooman, 1995). I also assume that NFL teams maximize profits. The revenue generated by player *i* is equal to the value of the marginal product from employing player *i*, VMP_i. VMP_i is also the maximum amount a team is willing to pay player *i*. In a perfectly competitive industry an employee's salary is equal to the value of his marginal product. In the NFL, employers have some monopsony power because players chosen in the NFL draft can sign contracts only with

the team that drafts them.[1] Firms may still have monopsony power when players are free agents because there may not be another team willing to bid the player's salary up to the competitive level. Even though teams have some monopsony power, evidence reveals that player salaries are close to the value of their marginal products (MacDonald and Reynolds, 1994; Rosen and Sanderson, 2000). The salary paid to player *i*, S_i, is an amount that is negotiated between the player and the team (Conlin and Emerson, 2003). A player faces a different mandated minimum salary, MMS_i, at each level of experience. The player's negotiated salary is less than or equal to the value of marginal product and greater than or equal to his mandated minimum salary, $MMS_i \leq S_i \leq VMP_i$. I define profits per player as the difference between the value of a player's marginal product and the salary paid to him, $VMP_i - S_i$. Teams employ the 53 players for which the sum of profits per player is the largest. Therefore, each team's total profits are a function of profits per player,

(1) profits = $f(VMP_1 - S_1, VMP_2 - S_2, \ldots, VMP_{53} - S_{53})$
where $VMP_1 - S_1 > VMP_{54} - S_{54}$, $VMP_2 - S_2 > VMP_{54} - S_{54}$, …, $VMP_{53} - S_{53} > VMP_{54} - S_{54}$.

Even though the value of a player's marginal product may depend on the productivities of the other players employed by the team, team management has an idea of a player's value of marginal product given various combinations of players. Management ultimately chooses the combination of players in a manner that maximizes profits.

The minimum salary schedule has the ability to shorten firm tenure or career length of players through two mechanisms. The first mechanism operates when the minimum salary schedule causes the mandated minimum salary to exceed the player's value of marginal product.

[1] Draft picks in the NFL are initially assigned in a manner that the teams with the lowest winning percentages have the earlier picks in each of the seven rounds. The maximum length for a rookie contract is 6 years for players chosen in the first half of the first round of the NFL draft, 5 years for players chosen in the second half of the first round of the NFL draft, and 4 years for players chosen in the second through seventh rounds of the NFL draft. Each round of the NFL draft typically has 32 selections, one selection for each team. Any undrafted free agents with 3 years of experience or less can only negotiate with their initial team when their contracts expire if the initial team offers them a 1 year contract.

When the mandated minimum salary exceeds the value of player *i*'s marginal product, the team is going to dismiss player *i*. In this case player *i*'s firm tenure is shortened. Player *i*'s career length is shortened if no other team employs player *i*. Therefore, if

(2) $VMP_i - MMS_i < 0$,

player *i*'s firm tenure is shortened and career length also may be shortened. This mechanism can occur when a team is forced to give a player a mandatory raise that makes player *i*'s salary greater than his value of marginal product. This mechanism can also occur when player *i*'s value of marginal product decreases to a level lower than his mandated minimum salary. In this paper I am able to identify directly the situations when a team is forced to give a player a raise but I am not able to identify when a team would like to give a player a pay cut that is not allowed. If a team is not forced to give a player a mandatory raise or is allowed to give a player a pay cut it is assumed that the team is acting optimally. The NFL's wage structure artificially increases the minimum cost of an input for teams whether there is a corresponding increase in the value of the player or not.

The second mechanism operates when the minimum salary schedule causes the profits per player from hiring player *i* to fall below the profits per player from hiring player *j*. Player *j* is the individual with the largest profits per player not previously employed by the team who is capable of replacing player *i*'s duties on the team.[2] If this occurs, the team is going to dismiss player i. In this case player *i*'s firm tenure is shortened. Player *i*'s career length is shortened if no other team employs player *i*. Therefore, when

(3) $VMP_i - MMS_i < VMP_j - S_j$,

[2] The position of player j may depend on the position of player i. If the team is looking for a replacement player to perform player i's duties, the position of player j would be one of the positions capable of replacing player i's duties on the field. Depending on player i's roll on the team, there may be one of many positions capable of replacing player i's duties. If the team does not need a player to perform player i's specific duties, the team will simply employ the player with the highest profits per player who was not previously employed by the team.

player *i*'s firm tenure is shortened and career length may be shortened. This mechanism can occur when a team is forced to give a player a mandatory raise that makes the profits per player from employing player i less than the profits per player from employing player *j*. This mechanism can also occur when the value of player *i*'s marginal product decreases to a level that makes the profits per player from employing player *i* less than the profits per player from employing player *j*. If for all NFL teams, $VMP_j - S_j > 0$ the mechanism displayed in equation (3) is the only mechanism that is relevant.

When firm tenure or career length of a player is shortened total employment remains the same but the experience distribution of those employed is changed when the team hires a younger, cheaper player. This salary structure is mainly expected to impact an average or marginal player because the value of marginal product for a star player is significantly larger than his mandated minimum salary. If a player's salary is equal to or close to the mandated minimum salary, an additional year of experience could cause the player to lose his job due to the mechanisms in equation (2) or (3) listed above. The minimum salary schedule is also expected to reduce efficiency by eliminating a set of outcomes that could be mutually beneficial for both teams and players.

Literature

To date, there much been a lot of research analyzing the impact of minimum salary schedules on firm tenure or career length. Much of the research regarding minimum levels of compensation focus on whether raising the minimum wage reduces the level of employment. Minimum wage discussions have been a hot topic over the years because of the perceived benefits of the minimum wage to poverty stricken families. Minimum salary schedules are interesting because of their perceived benefits to employees. This paper will make a contribution

to the literature on minimum levels of compensation by looking at the impact of a minimum salary schedule on an employee's firm tenure and career length.

Brown et al. (1982) survey the minimum wage literature and indicate that time series studies typically find that a ten percent increase in the minimum wage reduces teenage employment by one to three percent. They indicate that the impact of the minimum wage on young adult employment is smaller than it is for teenagers. Johnson and Browning (1983) focus on the efficiency–equity tradeoff and develop estimates of the impact of an increase in the minimum wage on the level and distribution of income across households. They find that a minimum wage increase redistributes income downward even though there is a small net effect. They reveal that workers with the lowest initial wages experience greater disemployment. Katz and Krueger (1992) use a longitudinal survey of fast-food chains in Texas and analyze the impact of increases in the federal minimum wage on a low-wage labor market. They find that employment increased more in the firms that were most likely to have been impacted by the 1991 minimum wage increase. Card (1992a) looks at the April 1990 increase in the federal minimum wage and finds no evidence that the rise in the minimum wage significantly lowered teenage employment rates. Card (1992b) examines the impact of a 1988 twenty-seven percent increase in the California state minimum wage and finds no evidence of a decline in teenage employment. Card and Krueger (1994) examined the impact of a minimum wage increase in New Jersey by comparing employment growth at stores in New Jersey and Pennsylvania. They find no evidence that the rise in minimum wages reduced employment. Dickens et al. (1999) provide a theoretical model where employers have some monopsony power. Their model allows the minimum wage to have a positive, negative or neutral impact on employment. They use data from the New Earnings Survey (NES) and find that minimum wages compress the earnings

distribution but do not negatively impact employment. Cardoso and Portugal (2005) use a dataset from Portugal on workers, firms, and collective bargaining contracts. They find that the wage cushion stretches the returns to worker and firm attributes but shrinks the returns to union power. Conlin and Emerson (2003) test for a multidimensional separating equilibrium in contract negotiations and test for evidence of the moral hazard inherent in many contracts. They find that players use prolonged contract negotiations and incentives to reveal their private information. They also find that a player's effort level is dependent on the structure of his contract. Kahn (2000) emphasizes that the availability of sports data gives researchers a unique opportunity to test some parts of economic theory that are not feasible with other data sets. He also advises researchers to be careful before making generalizations about the general population using sports data. He focuses on four areas of economic theory that could be looked at in more detail using the sports industry: the impact of monopsony power on worker pay, the presence of discrimination, the Coase theorem, and the impact of supervision and incentives on behavior.

This literature provides evidence that when floors are placed on the level of compensation, the level of employment could increase, decrease, or remain the same. In the NFL the level of employment is basically fixed and teams are not likely to make adjustments along this margin. Given that teams are not likely to change the level of employment in the presence of these mandated minimum salaries, it is likely that the type of worker employed changes when a mandated minimum salary is binding. This literature also discusses the role of contract negotiations in the NFL and the advantages of using sports data. In my theoretical model the salary paid to the player is negotiated between representatives of the team and the player. Therefore, contract negotiations play a large role in determining a team's profits per player. One advantage is that sports data allow economists to test theories that other datasets do

not allow us to test. Another advantage of sports data is that it has good measures of worker productivity.

Empirical Strategy

In order to analyze the impact of the NFL's salary structure on a player's firm tenure and career length, I estimate Weibull proportional hazard models using a sample for firm tenure and a sample for career length. The Weibull proportional hazard model assumes that the baseline hazard function has a Weibull distribution and allows covariates to have a proportional impact on the hazard. The baseline hazard is denoted by $h_0(t)$, time is the denoted by t, the set of covariates is denoted by $\mathbf{x}_j$, and the Weibull proportional hazard model is denoted by $h(t|\mathbf{x}_j)$.

(4) $h_0(t) = pt^{p-1}\exp(\beta_0)$

(5) $h(t|\mathbf{x}_j) = h_0(t)\exp(\mathbf{x}_j\beta_x)$

(6) $h(t|\mathbf{x}_j) = pt^{p-1}\exp(\beta_0 + \mathbf{x}_j\beta_x)$

The basis for using a hazard model is that I am interested in measuring the impact of minimum salaries on the length of time a player spends with a given team and the length of time a player spends in the NFL. The hazard model calculates the conditional probability that the failure occurs between time period t and t+1, given that the failure has not occurred before time period t. In this paper, the failure is either the end of a player's firm tenure or the end of a player's NFL career. The Weibull distribution allows for flexibility in the baseline hazard and is an appropriate choice as long as the baseline hazard is monotonically increasing or decreasing. The proportional hazard model allows both time-varying and time invariant covariates to have a proportional impact on the baseline hazard.

Data

The NFL's salary structure consists of a minimum salary schedule, a total salary cap, and a total salary floor. The minimum salary schedule provides the mandated minimum salary a player can receive based on the year and his experience level. The salary cap places an upper limit on the total amount a team can spend on its players' combined salaries. The salary cap is considered to be a hard cap because teams are penalized for exceeding the salary cap value. The salary floor places a lower limit on the total amount a team can spend on its players' salaries. The salary floor is a hard floor. An exception to the salary cap is that veteran players who do not receive any bonuses are allowed to be paid the veteran minimum up to $810,000 and only count $425,000 against the team's salary cap value. For example, if a player is paid the veteran minimum of $720,000 in 2007, only $425,000 of $720,000 counts against the team's salary cap.

The NFL's minimum salary schedule is negotiated between the NFL's Players Association and the NFL's Management Council and is available in the NFL's Collective Bargaining Agreement (CBA). The NFL's minimum salary schedule is shown in Table1. The mandated minimum salary always increases when a player gains an additional credited season. A player earns a credited season if he is on the 53-man active roster or injured reserve for 3 out of the 16 games played. From 2000 to 2008, the average increase in the mandated minimum salary from year t to year $t+1$ is $73,136 for a player who enters the NFL in 2000 and earns the mandated minimum salary every year. The NFL's minimum salary schedule in 2009 dollars is shown in Table 2. The mandated minimum salary in 2009 dollars increases in 39 out of 45 situations when a player who enters the NFL in 2000 and earns the mandated minimum salary every year gains an additional credited season. From 2000 to 2008, the average increase in the

Table 1: Minimum Salaries by Credited Seasons

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0 Credited Seasons	193000	209000	225000	225000	230000	230000	275000	285000	295000	310000
1 Credited Season	275000	298000	300000	300000	305000	305000	350000	360000	370000	385000
2 Credited Seasons	358000	389000	375000	375000	380000	380000	425000	435000	445000	460000
3 Credited Seasons	385000	418000	450000	450000	455000	455000	500000	510000	520000	535000
4 Credited Seasons	413000	448000	525000	530000	535000	540000	585000	595000	605000	620000
5 Credited Seasons	440000	477000	525000	530000	535000	540000	585000	595000	605000	620000
6 Credited Seasons	440000	477000	525000	530000	535000	540000	585000	595000	605000	620000
7 Credited Seasons	440000	477000	650000	655000	660000	665000	710000	720000	730000	745000
8 Credited Seasons	440000	477000	650000	655000	660000	665000	710000	720000	730000	745000
9 Credited Seasons	440000	477000	650000	655000	660000	665000	710000	720000	730000	745000
10+ Credited Seasons	440000	477000	750000	755000	760000	765000	810000	820000	830000	845000

Table 2: Minimum Salaries by Credited Seasons in 2009 Dollars

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0 Credited Seasons	240451	253180	268320	262341	261215	252655	292647	294890	293951	310000
1 Credited Season	342611	360994	357760	349789	346394	335042	372460	372492	368684	385000
2 Credited Seasons	446018	471230	447201	437236	431573	417430	452273	450095	443417	460000
3 Credited Seasons	479656	506361	536641	524683	516751	499817	532086	527698	518150	535000
4 Credited Seasons	514540	542702	626081	617960	607609	593190	622540	615647	602848	620000
5 Credited Seasons	548178	577833	626081	617960	607609	593190	622540	615647	602848	620000
6 Credited Seasons	548178	577833	626081	617960	607609	593190	622540	615647	602848	620000
7 Credited Seasons	548178	577833	775148	763705	749573	730502	755562	744985	727403	745000
8 Credited Seasons	548178	577833	775148	763705	749573	730502	755562	744985	727403	745000
9 Credited Seasons	548178	577833	775148	763705	749573	730502	755562	744985	727403	745000
10+ Credited Seasons	548178	577833	894401	880301	863145	840352	861979	848455	827047	845000

mandated minimum salary from year *t* to year *t+1* in 2009 dollars is $67,370 for a player who enters the NFL in 2000 and earns the mandated minimum salary every year.

I use NFL data on running backs from 2000 to 2008. Productivity, team, income, and demographic information are used to measure the impact of minimum salary schedules on firm tenure and career length. The NFL's official website is used to obtain a player's performance and demographic information. The NFL's minimum salary schedule is used to determine a player's mandated minimum salary. The *USA Today*'s NFL salary database has salary data on a player's base salary, signing bonus, other bonuses, total salary, and salary cap value. In order to account for inflation all dollar values are adjusted to 2009 dollars.

Failure and Independent Variables

The failure variable used to indicate whether a player's firm tenure ends is a set of dummy variables representing each season a player played for a specific team. It is coded 1 for the season a player exits that specific team and 0 for all seasons the player does not exit that team. The failure variable used to indicate whether a player's career length ends is a set of dummy variables representing each season a player played in the NFL. It is coded 1 for the season a player exits the NFL and 0 for all seasons the player does not exit the NFL.

All of the independent variables chosen for this analysis are time varying except for the demographic variables. The independent variable of interest in this analysis is mandatory raise. Mandatory raise is used to identify the impact of the minimum salary schedule on firm tenure and career length. Mandatory raise is the salary increase a team must give to a player from year *t* to year *t+1* in order for the player to remain employed in the NFL. Mandatory raise is created by taking the difference between the mandated minimum salary in year *t+1* and the base salary in year *t*. When this difference is negative mandatory raise is equal to zero because a player does

not have to receive a salary increase to remain employed in the NFL. When this difference is positive mandatory raise is equal to the difference because this difference represents the amount a player must receive in order to reach his next mandated minimum salary and remain employed in the NFL. The base salary reflects the marginal cost of employing a player. The minimum salary schedule causes an increase in the marginal cost of a player when the next mandated minimum salary is greater than the base salary. Mandatory raise is measured in ten thousands of dollars. I also create a dummy variable (mandatory raise indicator) that is coded 1 when a player has to receive a mandatory raise and 0 when a player does not have to receive a mandatory raise. Mandatory raise is expected to have a negative impact on firm tenure and career length because it increases the team's marginal cost without increasing the team's marginal revenue.

The independent variables chosen to control for player productivity are games played, games started, touches, yards, touchdowns, fumbles, and fumbles lost. Games played represent the number of games a player plays. The players who play in the game at a given position are typically perceived to be better players by the coaches than players who do not play in the game. Games played are expected to have a positive impact on firm tenure and career length. Games started represent the number of games a player plays at the beginning of the game for his given position. The players who start are typically perceived to be better players by the coaches than the players who do not start. Games started are expected to have a positive impact on firm tenure and career length. Touches are defined as the sum of a player's rushing attempts and receptions. Touches account for the number of opportunities a player has to gain yards. Holding all other covariates constant, an additional touch is simply another opportunity for a player to get injured. Therefore, touches are expected to have a negative impact on firm tenure and career length. Yards are defined as the sum of a player's rushing and receiving yards. They measure

the impact of the player's ability to help the team get closer to a scoring opportunity. Yards are expected to have a positive impact on firm tenure and career length. Touchdowns are defined as the sum of a player's rushing and receiving touchdowns. They measure the impact of the player's ability to help the team score points. Touchdowns are expected to have a positive impact on firm tenure and career length. Fumbles represents the number of times a player has possession of the football and loses possession. Fumbles allow the other team and opportunity to gain possession of the football. Fumbles are expected to have a negative impact on firm tenure and career length. Fumbles lost represent the number of times a player has possession of the football, loses possession, and the other team gains possession. Fumbles lost are expected to have a negative impact on firm tenure and career length.

The independent variables chosen to control for the team are winning percentage, playoff appearance, and expenditures over the salary cap. The winning percentage represents the percentage of games a team wins in a given year. Teams with higher winning percentages appear to be more likely to keep the same composition of players from year to year. Winning percentage is expected to have a positive impact on firm tenure and career length. Playoff appearance is a dummy variable that is coded 1 when the team makes the playoffs and zero when the team does not make the playoffs. Teams that make the playoffs appear to be more likely to keep the same composition of players from year to year than teams that do not make the playoffs. Playoff appearance is expected to have a positive impact on firm tenure and career length. Expenditures over the salary cap are the difference between the total payroll of a player's team and the salary cap. Due to the exception in the salary cap that allow veterans to receive the minimum salary up to 810,000 and only count $425,000 against the salary cap, a team's total payroll is allowed to be larger than the salary cap value without incurring a penalty. This

expenditure measure accounts for a team's ability to spend money on players. Expenditures over the salary cap are expected to have a positive impact on firm tenure and career length.

The independent variables chosen to control for non-salary income are signing bonus and other bonuses. The signing bonus is a bonus a player receives when he signs a new contract with a team. Teams are likely to give larger signing bonuses to players they expect to be top performers for a number of years. Signing bonus is expected to have a positive impact on firm tenure and career length. Other bonuses typically are bonuses given to players when they achieve a specific goal outlined in their contract. Players who receive other bonuses are meeting criteria that the team requires them to meet in order to receive additional compensation. Other bonuses are expected to have a positive impact on firm tenure and career length.

The independent variables chosen to control for demographic information are height, weight, and age at the beginning of the career. Height is expected to have a negative impact on firm tenure and career length because taller players have longer legs which are more susceptible to being hit. Weight is expected to have a positive impact on firm tenure and career length because heavier players are likely to absorb hits better than lighter players. Age at the beginning of the career is expected to have a negative impact on firm tenure and career length because older players who enter the NFL are likely to have suffered from the wear and tear of additional college seasons.

Summary Statistics

Table 3 and Table 4 display the summary statistics for the covariates and the number of seasons played for the firm tenure and the career length sample. The data used in the analysis are right-censored. The hazard model utilizes the right-censored observations when estimating the baseline hazard, but it does not utilize them when estimating coefficients. The firm tenure

Table 3—Summary Statistics: Firm Tenure Sample

Variables	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Total Income Increase Required		Total Income Increase Not Required	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Seasons Played	2.3	1.7	1.9	1.2	3	1.9	1.9	1	2.6	1.8
Mandatory Raise Indicator	.64	.48	1	0	0	0	1	0	.42	.49
Mandatory Raise (in 10000s)	5.5	4.8	8.7	3.1	0	0	8.8	2.9	3.5	4.7
Games Played	11.9	4.9	11.7	5	12.4	4.6	10.9	5.3	12.6	4.4
Games Started	4.6	5.4	3.6	5	6.5	5.6	2.3	3.9	6.1	5.7
Touches	96.2	112.3	79.1	103.1	126.4	121.5	51.7	79.8	123.7	120.6
Yards	453.7	535.2	382.6	504	579.9	565.6	252.2	396.8	578.7	571
Touchdowns	2.9	4.3	2.5	4	3.6	4.6	1.6	3	3.7	4.7
Fumbles	1.2	1.6	1.1	1.5	1.5	1.7	.8	1.3	1.5	1.7
Fumbles Lost	.74	1.1	.66	1.1	1.5	1.8	.5	.98	.89	1.2
Team Win Percentage	49.2	19.2	49.1	19.2	49.3	19.1	49.5	18.3	49	19.7
Team Playoff Appearance Indicator	.35	.47	.35	.48	.36	.48	.35	.48	.35	.48
Signing Bonus (in 10000s)	73.1	180.7	45.7	138.4	121.9	230.2	.61	1.8	118.1	218.2
Other Bonuses (in 10000s)	26	91.4	16	81.9	43.7	104	.49	1.5	41.8	113.5
Expenditures Over Salary Cap (in millions)	-2.4	13.4	-2.6	13.9	-2	12.5	-2.3	14	-2.5	13.1
Age at Beginning of Career	22.6	1	22.6	1.1	22.5	1	22.8	1.1	22.4	1
Height (in inches)	71.3	1.6	71.2	1.6	71.4	1.5	71.2	1.6	71.3	1.6
Weight	225.3	17.5	224.5	17.5	226.6	17.4	224.4	17.8	225.7	17.3
Number of Observations	768		491		277		294		474	

Table 4—Summary Statistics: Career Length Sample

Variables	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Total Income Increase Required		Total Income Increase Not Required	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Seasons Played	3	2	2.2	1.5	5	1.7	2.1	1.2	3.5	2.3
Mandatory Raise Indicator	.72	.45	1	0	0	0	1	0	.53	.50
Mandatory Raise (in 10000s)	6.1	4.2	8.4	2.3	0	0	8.7	2.0	4.3	4.5
Games Played	12.1	4.8	11.9	4.9	12.6	4.5	11.2	5.4	12.7	4.3
Games Started	4.4	5.3	3.6	4.9	6.6	5.5	2.4	4.0	5.9	5.6
Touches	95.9	108.4	84.2	102.7	126.6	117	55	79.2	124.7	116.7
Yards	454.7	515.5	406.8	498.6	579.4	539.1	271.7	399.5	583.2	548.5
Touchdowns	2.9	3.9	2.7	3.9	3.5	3.9	1.8	3	3.7	4.3
Fumbles	1.2	1.6	1	1.5	1.5	1.7	.76	1.2	1.4	1.7
Fumbles Lost	.71	1.1	.65	1	.88	1.2	.46	.86	.89	1.2
Team Win Percentage	48.8	19.4	48.8	19.6	48.8	19.1	49.3	18.7	48.4	19.9
Team Playoff Appearance Indicator	.34	.47	.34	.47	.36	.48	.35	.48	.34	.47
Signing Bonus (in 10000s)	75.9	179.7	51.8	151.2	138.6	228.5	.51	1.5	128.8	220.2
Other Bonuses (in 10000s)	28.1	101.1	18.8	91.2	52.5	120	.33	.55	47.7	128.4
Expenditures Over Salary Cap (in millions)	-2.5	13.7	-2.7	14.1	-2	12.7	-2.1	13.9	-2.7	13.6
Age at Beginning of Career	22.6	1.1	22.6	1.1	22.4	1.1	22.8	1.1	22.4	1
Height (in inches)	71.2	1.6	71.2	1.7	71.1	1.4	71.2	1.6	71.2	1.6
Weight	225.5	16.4	225	16.8	226.6	15.2	225.5	16.8	225.5	16.1
Number of Observations	526		380		146		217		309	

sample has 331 players for a total of 768 observations. Players included in the firm tenure sample are players who began their tenures with a team between 2000 and 2008. Some of these players began their careers prior to the 2000 season but they are included in the firm tenure sample as long as their first season with a new team occurred between 2000 and 2008. Even if a player enters the NFL in 1990, only the seasons for the teams in which his firm tenure is not left-censored are included in the sample. A player may appear in this sample as many times as they move to a new team and the firm tenure is not left-censored. The most time a player appears in this sample is seven. The career length sample has 166 players for a total of 526 observations. Players included in the career length sample are players who began their careers in the NFL between 2000 and 2008.

In the full firm tenure sample, players played an average of 2.3 seasons. Sixty-four percent of the sample requires a mandatory raise. The average mandatory raise is $55,000. Players, on average, played in 11.9 games, started 4.6 games, had 96.2 touches, 453.7 yards, 2.9 touchdowns, 1.2 fumbles, and .74 fumbles lost. Teams, on average, win 49.2% of their games, make the playoffs 35% of the time, and are $2.4 million under the salary cap. Players, on average, receive a signing bonus of $731,000 and other bonuses of $260,000. The average age at the beginning of the NFL career is 22.6. The average height is 71.3 inches and the average weight is 225.3 pounds. In the full career length sample, players played an average of 3 seasons. Seventy-two percent of the sample requires a mandatory raise. The average mandatory raise is $61,000. Players, on average, played in 12.1 games, started 4.4 games, had 95.9 touches, 454.7 yards, 2.9 touchdowns, 1.2 fumbles, and .71 fumbles lost. Teams, on average, win 48.8% of their games, make the playoffs 34% of the time, and are $2.5 million under the salary cap. Players, on average, receive a signing bonus of $759,000 and other bonuses of $281,000. The

average age at the beginning of the NFL career is 22.6. The average height is 71.2 inches and the average weight is 225.5 pounds.

I also split the firm tenure sample by whether or not a player requires a mandatory raise and by whether or not a player requires a total income increase. A player needs a mandatory raise when his year t salary is less than his year t+1 mandated minimum salary. A player needs a total income increase when the sum of his year t salary and bonuses is less than his year t+1 mandated minimum salary. The total income increase gives us an indicator of the players who would need a mandatory raise if all income was in the form of salary income. For instance, a large number of star players require a mandatory raise because they receive a large amount of their income in bonuses. Only a few star players require a total income increase. In both the firm tenure and career length samples, players who require a mandatory raise or a total income increase have fewer average seasons played, games played, games started, touches, yards, fumbles and fumbles lost than the players who do not require a mandatory raise or a total income increase. In both the firm tenure and career length samples, players who require a mandatory raise or a total income increase also have lower average bonuses than the players who do not require a mandatory raise or a total income increase.

Table 5 displays the percentage of players requiring a mandatory raise for the firm tenure sample: 63.9% require a mandatory raise, 59.9% require a mandatory raise greater than $45,000, 46.7% require a mandatory raise greater than $75,000, 23.3% require a mandatory raise greater than $90,000, and 15.5% require a mandatory raise greater than $100,000. Table 6 displays the percentage of players requiring a total income increase for the firm tenure sample. 38.3% require a total income increase, 34.2% require a total income increase greater than $45,000,

Table 5—Percentage of Players Requiring a Mandatory Raise: Firm Tenure Sample

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $45,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $90,000 Required	Mandatory Raise > $100,000 Required
1	331	75.2%	71.3%	59.8%	32.6%	23.3%
2	180	71.1%	68.9%	52.2%	17.8%	7.8%
3	112	67%	65.2%	37.5%	21.4%	12.5%
4	63	36.5%	31.8%	30.2%	14.3%	14.3%
5	37	13.5%	2.7%	2.7%	2.7%	2.7%
6	23	17.4%	4.35%	4.35%	4.35%	0%
7	15	33.3%	33.3%	26.7%	26.7%	26.7%
8	6	16.7%	0%	0%	0%	0%
9	1	100%	0%	0%	0%	0%
Total	768	63.9%	59.9%	46.7%	23.3%	15.5%

Table 6—Percentage of Players Requiring a Total Income Increase: Firm Tenure Sample

Season	Number of Players	Total Income Increase Required	Total Income Increase > $45,000 Required	Total Income Increase > $75,000 Required	Total Income Increase > $90,000 Required	Total Income Increase > $100,000 Required
1	331	41.1%	35.05%	27.2%	11.8%	9.4%
2	180	49.4%	48.3%	28.3%	5%	4.4%
3	112	47.3%	42.9%	13.4%	8.9%	8.9%
4	63	19%	15.9%	14.3%	7.9%	7.9%
5	37	5.4%	0%	0%	0%	0%
6	23	4.3%	4.3%	4.3%	4.3%	0%
7	15	6.7%	6.7%	6.7%	6.7%	6.7%
8	6	0%	0%	0%	0%	0%
9	1	0%	0%	0%	0%	0%
Total	768	38.3%	34.2%	21.7%	8.6%	7.3%

21.7% require a total income increase greater than $75,000, 8.6% require a total income increase greater than $90,000, and 7.3% require a total income increase greater than $100,000.

Table 7 displays the percentage of players requiring a mandatory raise for the career sample: 72.2% require a mandatory raise, 68.8% require a mandatory raise greater than $45,000, 52.7% require a mandatory raise greater than $75,000, 24.9% require a mandatory raise greater than $90,000, and 15.4% require a mandatory raise greater than $100,000. Table 8 displays the percentage of players requiring a total income increase for the career length sample: 41.3% require a total income increase, 38.8% require a total income increase greater than $45,000, 24.9% require a total income increase greater than $75,000, 9.3% require a total income increase greater than $90,000, and 8% require a total income increase greater than $100,000.

Kaplan Meier Survival Estimates

The Kaplan Meier survival estimates used in this analysis estimate the probability of a player's survival past a certain time without controlling for covariates. Figure 1 shows the Kaplan Meier survival estimates for the firm tenure sample split by whether a player required a mandatory raise or not. Players who require a mandatory raise have a higher survival rate with a given firm than players who do not require a mandatory raise. Figure 2 shows the Kaplan Meier survival estimates for the firm tenure sample split by whether a player required a total income increase or not. Players who require a total income increase have a higher survival rate with a given firm than players who do not require a total income increase.

Figure 3 shows the Kaplan Meier survival estimates for the career length sample split by whether a player required a mandatory raise or not. Players who require a mandatory raise have a lower survival rate in the NFL than players who do not require a mandatory raise. Figure 4 shows the Kaplan Meier survival estimates for the career length sample split by whether a player

Table 7—Percentage of Players Requiring a Mandatory Raise: Career Length Sample

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $45,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $90,000 Required	Mandatory Raise > $100,000 Required
1	166	96.4%	96.4%	80.1%	40.4%	25.9%
2	110	96.4%	95.5%	69.1%	20.9%	6.36%
3	78	82.1%	80.8%	46.2%	26.9%	14.1%
4	57	43.9%	42.1%	40.4%	19.3%	19.3%
5	44	11.4%	0%	0%	0%	0%
6	30	20%	0%	0%	0%	0%
7	23	43.5%	39.1%	34.8%	34.8%	34.8%
8	13	15.4%	0%	0%	0%	0%
9	5	40%	0%	0%	0%	0%
Total	526	72.2%	68.8%	52.7%	24.9%	15.4%

Table 8—Percentage of Players Requiring a Total Income Increase: Career Length Sample

Season	Number of Players	Total Income Increase Required	Total Income Increase > $45,000 Required	Total Income Increase > $75,000 Required	Total Income Increase > $90,000 Required	Total Income Increase > $100,000 Required
1	166	45.2%	41%	31.9%	12.1%	9%
2	110	68.2%	68.2%	40.9%	8.2%	6.4%
3	78	57.7%	55.1%	20.5%	12.8%	12.8%
4	57	28.1%	24.6%	22.8%	14%	14%
5	44	2.3%	0%	0%	0%	0%
6	30	0%	0%	0%	0%	0%
7	23	17.4%	17.4%	17.4%	8.7%	8.7%
8	13	0%	0%	0%	0%	0%
9	5	20%	0%	0%	0%	0%
Total	526	41.3%	38.78%	24.9%	9.3%	8%

Figure 1—Kaplan-Meier Survival Estimates by Mandatory Raise: Firm Tenure

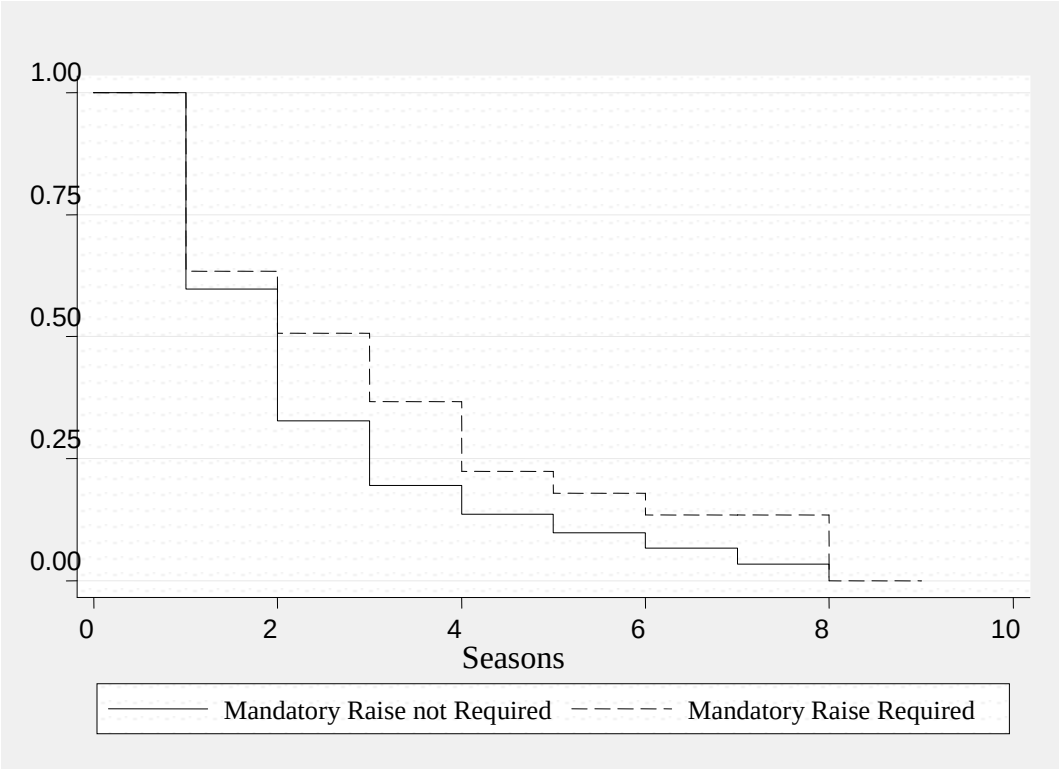


Figure 2—Kaplan-Meier Survival Estimates by Total Income Increase: Firm Tenure

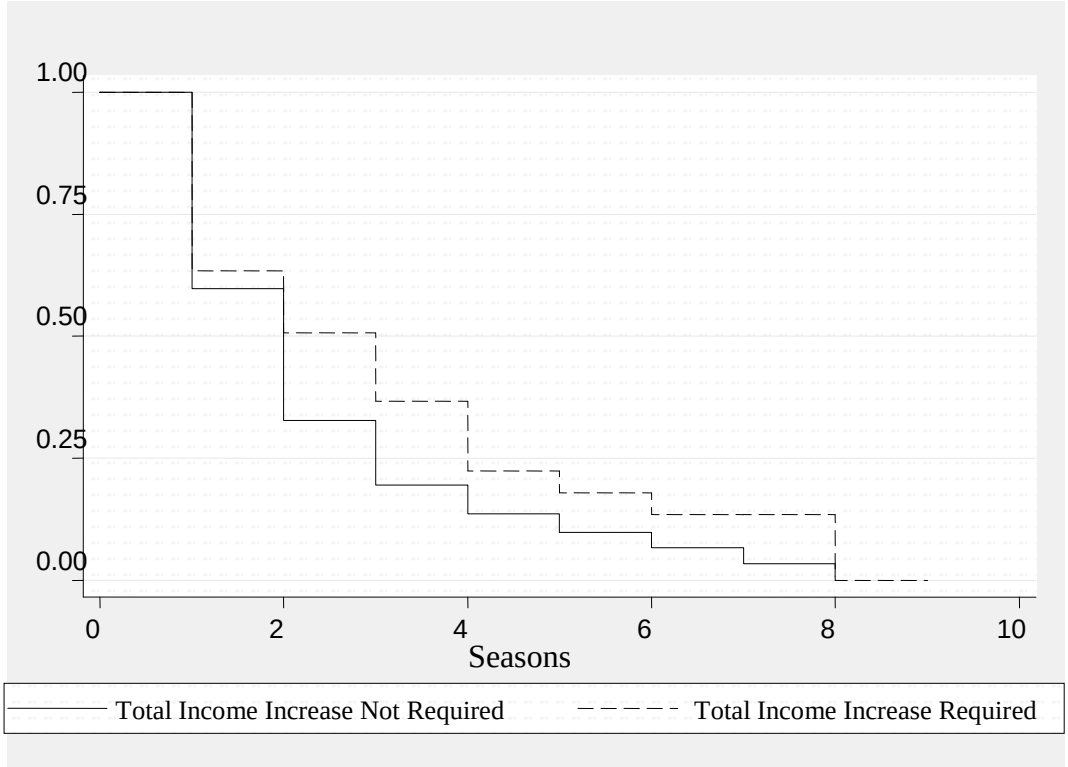


Figure 3—Kaplan-Meier Survival Estimates by Mandatory Raise: Career Length

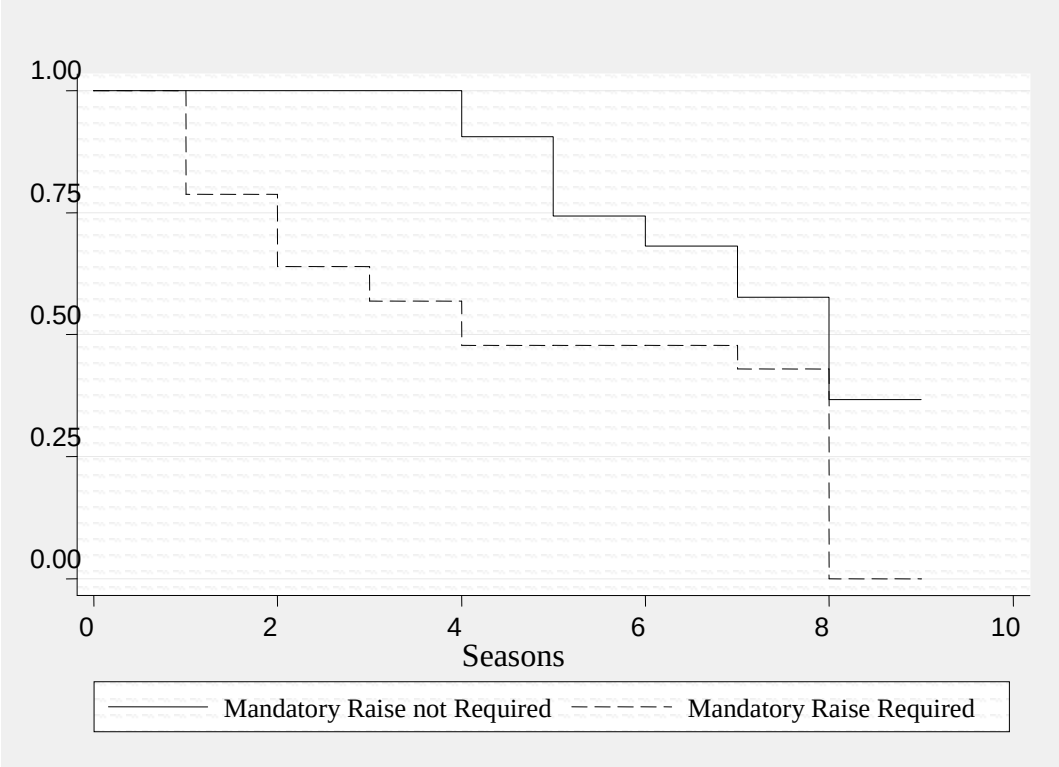
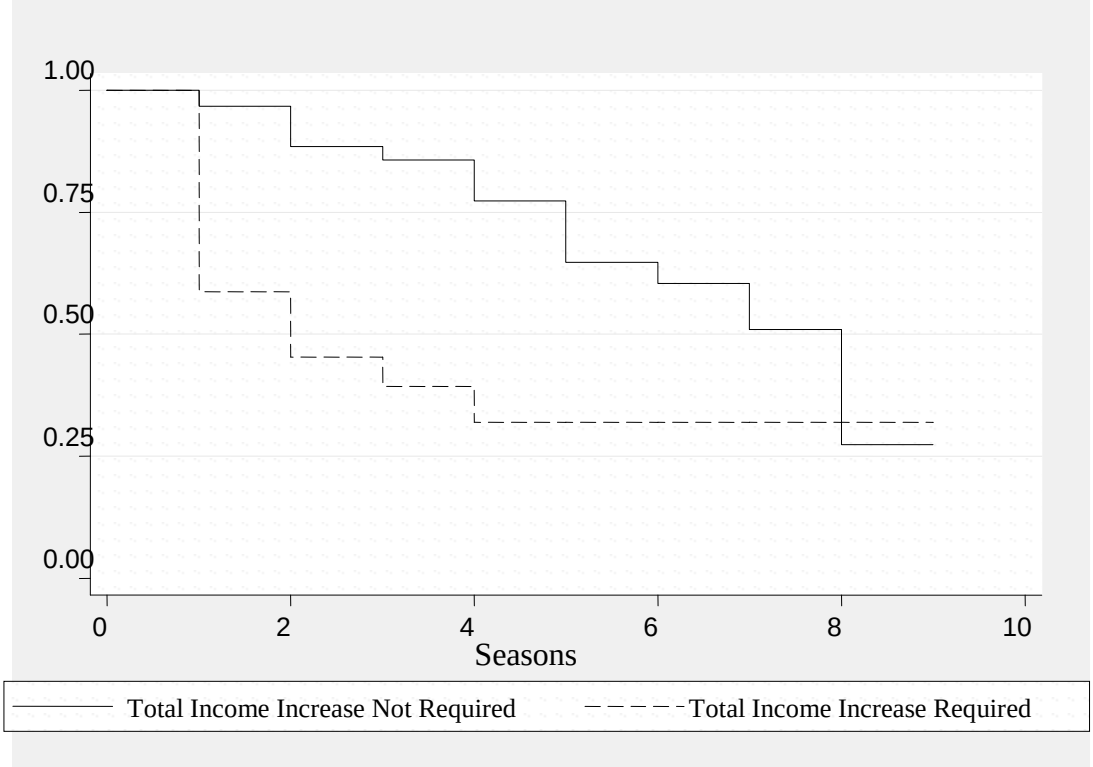


Figure 4—Kaplan-Meier Survival Estimates by Total Income Increase: Career Length



required a total income increase or not. Players who require a total income increase have a lower survival rate in the NFL than players who do not require a total income increase.

Results

Table 9 displays the Weibull regression results for the firm tenure sample and Table 10 shows the Weibull regression results for the career length sample. The models reveal that minimum salary schedules decrease career length but not firm tenure. A reason why minimum salary schedules impact career length but not firm tenure is that players who require a mandatory raise may also have an incentive to change teams even when it is profitable for the old team to retain their services. This incentive exists when a player's skills are better suited for another team. The NFL's draft system gives the rights of a player to the team that drafts him for the first few years of his career. It is possible that players may not always be best suited to play for the teams that draft them and this induces them to change teams. Models (1) and (2) estimate the marginal effects at the means of the full sample, model (3) estimates the marginal effects at the means of the sample that requires a salary increase, model (4) estimates the marginal effects at the means of the sample that does not require a salary increase, model (5) estimates the marginal effects at the means of the sample that requires a total income increase, and model (6) estimates the marginal effects at the means of the sample that does not require a total income increase.
In Table 9, the mandatory raise variable is statistically insignificant in models (1) – (6). The games played variable is statistically significant at the 1% level in models (1) – (6). The coefficient on games played in model (2) indicates that a 1-game increase in games played increases firm tenure by .076 of a season. The games started variable is statistically significant at the 10% level in models (1) – (6). The coefficient on games started in model (2) indicates that a

Table 9— Weibull Regression Results: Firm Tenure Sample

Variables	Full Sample (1)	Full Sample (2)	Salary Increase Required (3)	Salary Increase Not Required (4)	Total Income Increase Required (5)	Total Income Increase Not Required (6)
Mandatory Raise Indicator	.280					
	(.281)					
Mandatory Raise (in 10000s)		.017	.017	.019	.014	.020
		(.525)	(.531)	(.519)	(.530)	(.522)
Games Played	.075***	.076***	.071***	.084***	.060***	.088***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Games Started	.082*	.078*	.075*	.087*	.062*	.091*
	(.059)	(.067)	(.067)	(.063)	(.065)	(.069)
Touches	-.040***	-.040***	-.038***	-.044***	-.032***	-.046***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Yards	.010***	.010***	.009***	.011***	.008***	.012***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Touchdowns	.033	.035	.033	.039	.028	.041
	(.661)	(.639)	(.640)	(.638)	(.639)	(.640)
Fumbles	-.048	-.057	-.054	-.063	-.045	-.066
	(.803)	(.768)	(.768)	(.768)	(.768)	(.768)
Fumbles Lost	-.008	.003	.003	.003	.002	.003
	(.975)	(.991)	(.991)	(.991)	(.991)	(.991)
Number of Observations	768	768	768	768	768	768

Marginal effects are evaluated at the means of the samples listed in models (1) – (6) for all continuous variables. Marginal effects represent a discrete change from 0 to 1 for all dummy/indicator variables. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 9 continued— Weibull Regression Results: Firm Tenure Sample

Variables	Full Sample (1)	Full Sample (2)	Salary Increase Required (3)	Salary Increase Not Required (4)	Total Income Increase Required (5)	Total Income Increase Not Required (6)
Team Win Percentage	.007	.007	.007	.008	.005	.009
	(.471)	(.450)	(.450)	(.450)	(.451)	(.450)
Team Playoff Appearance	.277	.269	.256	.298	.213	.313
	(.499)	(.507)	(.508)	(.508)	(.507)	(.508)
Signing Bonus (in 10000s)	.003**	.002**	.002**	.003**	.002**	.003**
	(.019)	(.020)	(.019)	(.017)	(.016)	(.023)
Other Bonuses (in 10000s)	.002	.002	.002	.002	.002	.003
	(.282)	(.301)	(.301)	(.300)	(.297)	(.304)
Expenditures Over Salary Cap (in millions)	.013	.013	.012	.014	.010	.015
	(.136)	(.148)	(.149)	(.145)	(.149)	(.148)
Age at Beginning of Career	-.120	-.121	-.115	-.135	-.010	-.141
	(.292)	(.282)	(.283)	(.282)	(.281)	(.284)
Height	-.214**	-.207**	-.197**	-.230**	-.164**	-.241**
	(.020)	(.023)	(.025)	(.021)	(.024)	(.024)
Weight	.009	.009	.009	.010	.007	.010
	(.269)	(.289)	(.290)	(.286)	(.290)	(.289)
Number of Observations	768	768	768	768	768	768

Marginal effects are evaluated at the means of the samples listed in models (1) – (6) for all continuous variables. Marginal effects represent a discrete change from 0 to 1 for all dummy/indicator variables. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 10— Weibull Regression Results: Career Length Sample

Variables	Full Sample (1)	Full Sample (2)	Salary Increase Required (3)	Salary Increase Not Required (4)	Total Income Increase Required (5)	Total Income Increase Not Required (6)
Mandatory Raise Indicator	-3.634***					
	(.008)					
Mandatory Raise (in 10000s)		-.395***	-.315***	-.746***	-.233***	-.579***
		(.000)	(.000)	(.000)	(.000)	(.001)
Games Played	.388***	.400***	.319***	.755***	.236***	.586***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Games Started	.243	.187	.149	.353	.110	.274
	(.232)	(.337)	(.334)	(.318)	(.329)	(.346)
Touches	-.100**	-.098**	-.078**	-.185**	-.058**	-.144**
	(.037)	(.036)	(.036)	(.013)	(.028)	(.047)
Yards	.026**	.026**	.021**	.050***	.016**	.039**
	(.021)	(.018)	(.017)	(.003)	(.011)	(.027)
Touchdowns	-.077	-.075	-.060	-.142	-.044	-.110
	(.821)	(.816)	(.815)	(.817)	(.816)	(.816)
Fumbles	-.441	-.444	-.355	-.840	-.262	-.652
	(.621)	(.598)	(.600)	(.597)	(.599)	(.601)
Fumbles Lost	.784	.822	.656	1.554	.485	1.206
	(.520)	(.478)	(.481)	(.475)	(.480)	(.482)
Number of Observations	526	526	526	526	526	526

Marginal effects are evaluated at the means of the samples listed in models (1) – (6) for all continuous variables. Marginal effects represent a discrete change from 0 to 1 for all dummy/indicator variables. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 10 continued— Weibull Regression Results: Career Length Sample

Variables	Full Sample (1)	Full Sample (2)	Salary Increase Required (3)	Salary Increase Not Required (4)	Income Increase Required (5)	Income Increase Not Required (6)
Team Win Percentage	.030	.029	.023	.055	.017	.042
	(.328)	(.327)	(.327)	(.322)	(.328)	(.329)
Team Playoff Appearance	-.600	-.726	-.579	-1.375	-.428	-1.065
	(.641)	(.563)	(.563)	(.565)	(.563)	(.563)
Signing Bonus (in 10000s)	.014	.013	.010	.025*	.008*	.019
	(.122)	(.115)	(.104)	(.085)	(.076)	(.146)
Other Bonuses (in 10000s)	-.0001	-.002	-.001	-.003	-.001	-.002
	(.987)	(.804)	(.804)	(.803)	(.804)	(.804)
Expenditures Over Salary Cap (in millions)	.018	.017	.014	.033	.010	.025
	(.550)	(.538)	(.538)	(.536)	(.537)	(.540)
Age at Beginning of Career	-.961***	-.930***	-.743***	-1.758***	-.549***	-1.365***
	(.006)	(.005)	(.005)	(.003)	(.004)	(.009)
Height	-.440	-.504*	-.402*	-.954*	-.298*	-.741*
	(.168)	(.088)	(.087)	(.075)	(.084)	(.095)
Weight	.081**	.082**	.065**	.154**	.048**	.120**
	(.025)	(.017)	(.017)	(.013)	(.016)	(.020)
Number of Observations	526	526	526	526	526	526

Marginal effects are evaluated at the means of the samples listed in models (1) – (6) for all continuous variables. Marginal effects represent a discrete change from 0 to 1 for all dummy/indicator variables. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

1-game increase in games started increases firm tenure by .078 of a season. The touches variable is statistically significant at the 1% level in models (1) – (6). The coefficient on touches in model (2) indicates that 1 more touch shortens firm tenure by .04 of a season. The yards variable is statistically significant at least at the 1% level in models (1) – (6). The coefficient on yards in model (2) indicates that a 1-yard increase reduces firm tenure by .01 of a season. Signing bonus is statistically significant at the 5% level in models (4) and (5). The coefficient on signing bonus indicates that a $10,000 increase in the signing bonus increases firm tenure by .002 of a season. Height is statistically significant at the 5% level in all models except for model (1). The coefficient on height in model (2) indicates that a 1-inch increase in height reduces firm tenure by .207 of a season. Touchdowns, fumbles, fumbles lost, team winning percentage, team playoff appearance, other bonuses, and expenditures over the salary cap, age at the beginning of the career, and weight are all statistically insignificant in models (1) – (6).

In Table 10, the mandatory raise variable is statistically significant at the 1% level in models (1) – (6). The coefficient on the mandatory raise indicator in model (1) indicates that a player's career length is shortened by 3.6 years when he is required to receive a mandatory raise. The coefficient on mandatory raise in model (2) indicates that a $10,000 increase in the mandatory raise shortens career length by an additional .395 of a season. The games played variable is statistically significant at the 1% level in models (1) – (6). The coefficient on games played in model (2) indicates that a 1-game increase in games played increases career length by .4 of a season. The touches variable is statistically significant at the 5% level in models (1) – (6). The coefficient on touches in model (2) indicates that 1 more touch shortens careers by .1 of a season. The yards variable is statistically significant at least at the 5% level in models (1) – (6). The coefficient on yards in model (2) indicates that a 1-yard increase reduces careers by .026 of a

season. Signing bonus is statistically significant at the 10% level in models (4) and (5). The coefficient on signing bonus indicates that a $10,000 increase in the signing bonus increases career length by .025 of a season. Age at the beginning of the career is statistically significant at the 1% level in models (1) – (6). The coefficient on age at the beginning of the career in model (2) indicates that entering the NFL 1 year older shortens career length by .93 of a season. Height is statistically significant at the 10% level in all models except for model (1). The coefficient on height in model (2) indicates that a 1 inch increase in height reduces career length by .504 of a season. Weight is statistically significant at the 5% level in models (1) – (6). The coefficient on weight in model (2) indicates that a 1-pound increase in weight reduces firm tenure by .082 of a season. Games started, touchdowns, fumbles, fumbles lost, team winning percentage, team playoff appearance, other bonuses, and expenditures over the salary cap are all statistically insignificant in models (1) – (6).

Conclusion

In conclusion, the fact that the mandatory raise variable is negative and statistically significant provides evidence that minimum salary schedules have a negative impact on career length. Figure 5 controls for other covariates and shows the Weibull survival estimates for the career length sample split by whether a player required a mandatory raise or not. Players who require a mandatory raise have a lower survival rate in the NFL than players who do not require a mandatory raise. Figure 6 controls for other covariates and shows the Weibull survival estimates for the career length sample split by whether a player required a total income increase or not. Players who require a total income increase have a lower survival rate in the NFL than players who do not require a total income increase. These results have important implications for other industries. Any industry that has a minimum salary schedule in place should be aware

Figure 5—Survival Estimates by Mandatory Raise: Career Length

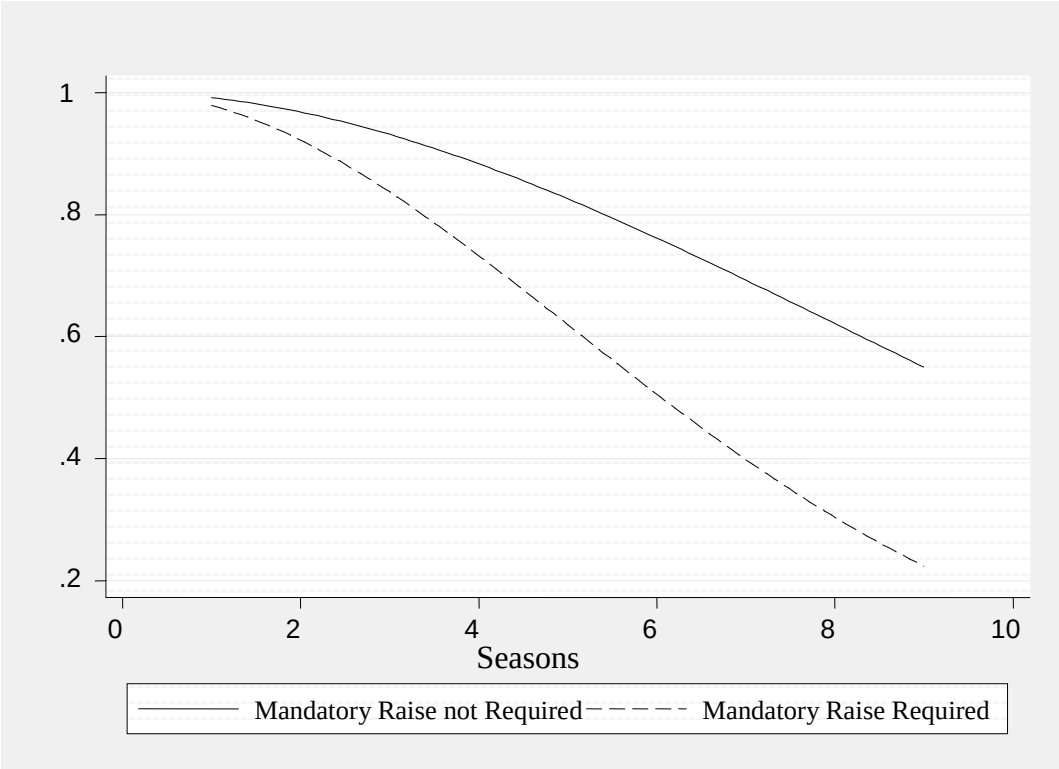
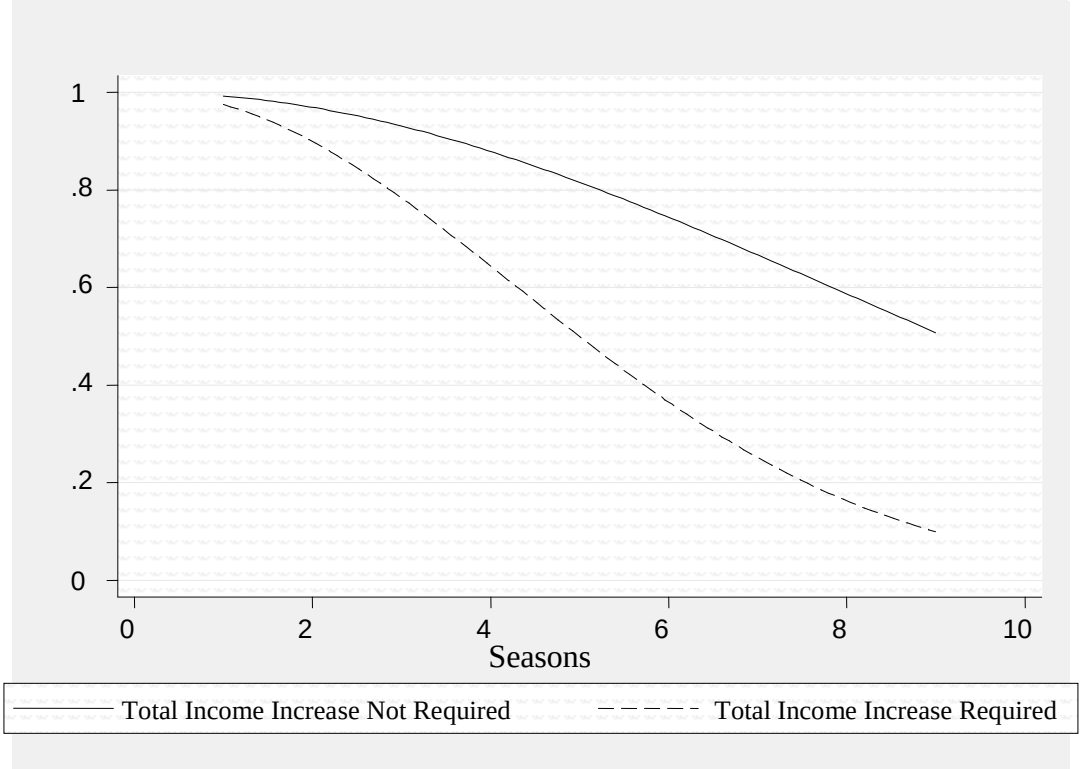


Figure 6—Survival Estimates by Total Income Increase: Career Length



that this salary structure shortens the careers of employees when it forces employers to pay employees more than the values of their marginal products.

In many school districts, primary and secondary education teachers face a minimum salary schedule. Unlike the NFL, in primary and secondary education it is difficult to fire employees if the value of their productivity is less than their mandated minimum salary. There have been recent discussions about making it easier to fire teachers because of low student achievement. If laws are put in place to make it easier to fire teachers, viable teachers' careers may be shortened due to the minimum salary schedule. One way to reduce the impact of minimum salary schedules shortening a teacher's career is to allow some flexibility in the schedule once the teacher reaches a given level of level of experience. Such flexibility could entail having one minimum salary for average teachers and another minimum salary for above-average teachers with a larger minimum for above average teachers. Similar flexibility in the NFL's minimum salary structure can reduce the negative impact of minimum salary schedules on career length.

In future research, I plan to estimate the income loss to players due to the minimum salary schedule and determine whether players are made better off or worse or worse off by the presence of the minimum salary schedule. I also plan to measure the impact of matching player characteristics with teams that value their productivity by exploiting free agency.

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