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THE EFFECTS OF MINIMUM SALARIES ON FIRM TENURE, CAREER LENGTH, AND THE EXPERIENCE DISTRIBUTION: EVIDENCE FROM THE NATIONAL FOOTBALL LEAGUE

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ABSTRACT OF DISSERTATION

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The Graduate School

University of Kentucky

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ABSTRACT OF DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Business and Economics
at the University of Kentucky

By

Johnny C. Ducking

Lexington, Kentucky

Co-Directors: Dr. Christopher Bollinger, Gatton Endowed Professor of Economics
and   Dr. John Garen, Gatton Endowed Professor of Economics

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I use data from the National Football League (NFL) to analyze the impact of minimum salaries on an employee's firm tenure, an employee's career length, and an employer's distribution of employee experience. The NFL has a salary structure in which the minimum salary a player can receive increases with the player's years of experience. Salary schedules similar to the NFL's exist in public education, Secret Service, Internal Revenue Service, other federal government agencies, the Episcopalian church, and unionized industries. Even though the magnitude of the salaries in the NFL differs from other industries, this study provides insight to the impact of this type of salary structure firm tenure, career length, and the experience distribution.

In the first essay, I analyze the impact of minimum salaries on firm tenure and career length for six positional groups in the NFL, defensive backs, defensive linemen, linebackers, running backs, tight ends, and wide receivers. A major advantage of using NFL data is that I am able to control for a player's productivity. I find statistically significant evidence that minimum salaries shorten firm tenure and career length when they require teams to increase a player's base salary from year t to year t+1 or a player's total compensation from year t to year t+1.

In the second essay, I analyze the impact of minimum salaries on the experience distribution. I exploit the fact that the NFL's minimum salary schedule causes the relative minimum price between two experience levels to change over time. This provides teams with an incentive to substitute away from the experience level whose relative minimum price becomes more expensive. I find evidence that when relative minimum prices change, the experience distribution changes.

Johnny Ducking

September 30, 2011_____
Date

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1   Introduction to Dissertation

Over the years, researchers and policymakers have estimated the impact of minimum wages. Minimum wages have typically 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 to employ a worker for an entire year and reduce the total yearly income paid to the worker by reducing the worker's hours. Firms that encounter minimum salaries do not have the ability to employ the worker for an entire year and reduce the total yearly income below the mandated minimum salary. This dissertation analyzes the impact of minimum salaries on firm tenure, career length, and the experience distribution using data from the National Football League (NFL).

I find evidence that minimum salaries shorten an NFL player's firm tenure and career length. The advantage of using NFL data to study the impact of minimum salaries on firm tenure and career length is that it allows me to control for player and team productivity. Limitations of using NFL data include the fact that the industrial structure

differs from most industries, the minimum salaries are higher than most industries, and the data only includes males. Despite the differences between the NFL and other industries that employ minimum salaries, this evidence has implications for the NFL as well as other industries. This evidence provide implications for other industries because any time the salary structure force a firm to pay a worker more than the value of the worker to the firm, the worker's tenure in that particular firm is expected to be shortened.

The NFL's salary structure includes a minimum salary schedule which can be used to measure the impact of minimum salaries on firm tenure, career length, and the experience distribution. The NFL's salary structure consists of a minimum salary schedule, a total salary cap, and a total salary floor. 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. The NFL's minimum salary schedule provides the mandated minimum salary a player can receive based on the year and the player's number of credited seasons. A player earns a credited season when he is on a team's fifty-three player active roster or injured reserve for at least three of the sixteen games played. Table 1.1 shows the minimum salary schedule by credited seasons from 2000 to 2009. Table 1.2 adjusts for inflation and shows the minimum salary schedule by credited seasons from 2000 to 2009 in 2009 dollars. The salary cap places an upper limit on the total amount a team can spend on all of its players. The salary cap is considered to be a hard cap because teams are penalized for exceeding the salary cap value. 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 salary floor places a lower limit on the total amount a team can spend on all of its players. The salary floor is considered to be a hard floor because teams are penalized for spending less than the salary floor value.

Minimum salary schedules are usually negotiated to protect older, more experienced workers from receiving extremely low salaries. 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. In the NFL, the 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). Minimum salary schedules are viewed as being beneficial to employees because their existence places a lower limit on the salary employees are allowed to receive. This can increase the value of the career earnings of workers who would have earned less than the minimum salary in the absence of the minimum salary schedule if they are employed long enough for the value of their earnings with the minimum salary schedule in place to exceed the value of their career earnings without the minimum salary schedule in place.

I define firm tenure as the amount of time an employee spends employed by a particular firm without any interruptions. If an employee works for firm *A* for 1 year, leaves firm *A* to work for firm *B* for 2 years, then returns to firm *A* for 2 years, this employee is attributed with 3 separate firm tenures. When an employee returns to firm *A* after worker for another firm, the time with firm *A* is treated as 2 separate firm tenures. I define career length as the amount of time an employee spends in a particular industry. In the presence of a minimum salary schedule it is possible for the mandated salary in year *t+1* to exceed the value of the employee's productivity to the firm in year *t+1*. 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. In this situation, 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 on an employee by shortening their career length to a point in which the value of career earnings in the presence of the minimum salary schedule is less than the value of career earnings in the absence of the minimum salary schedule.

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. The level of the mandated minimum compensation at each experience level in the minimum salary schedule impacts whether employees experience the negative impact of having the value of their career earnings decreased or the positive impact of having the value of their career earnings increased.

A minimum salary schedule also has the ability to change the relative minimum prices between different experience levels. When the relative minimum price between two levels of experience change, firms have an incentive to substitute away from the experience level in which the relative minimum price becomes more expensive. Therefore, minimum salary schedules have the ability to change the experience distribution through changing the relative minimum prices.

In chapter two, I examine the impact of minimum salaries on a player's firm tenure and career length for six positional groups, defensive backs, defensive linemen, linebackers, running backs, tight ends, and wide receivers. I use two measures to examine the impact of minimum salaries on a player's firm tenure and career length, mandatory raise and income increase. I define a mandatory raise as the base salary increase a team must give to a player from year t to year $t+1$ in order for the player to earn the minimum salary for year $t+1$. I define income increase as the total increase in income a player must receive from year t to year $t+1$ in order for the player to earn the minimum salary for year $t+1$. The difference between these two measures is that a player requires a mandatory raise when his base salary is less than the next year's minimum salary but a player requires an income increase when his base salary plus bonuses is less than the next year's minimum salary. I find statistically significant evidence that minimum salaries shorten firm tenure by almost a year for tight ends and by more than two-thirds of a year for wide receivers when they force teams to give players a mandatory raise. I find statistically significant evidence that minimum salaries shorten firm tenure by more than two-thirds of a year for defensive linemen, by more than one-half of a year for linebackers, by more than one-third of a year for running backs, and by more than a

year for tight ends when they force teams to give players an income increase. I find statistically significant evidence that minimum salaries shorten career length by more than two years for defensive backs, by more than five years for defensive linemen, and by more than two years for running backs when they force teams to give players a mandatory raise. I find statistically significant evidence that minimum salaries shorten career length by more than three years for defensive backs, by more than three years for defensive linemen, by more than two years for linebackers, and by more than two years for running backs when they force teams to give players an income increase.

In chapter three, I examine the impact of minimum salaries on the experience distribution. I exploit the fact that the NFL's minimum salary schedule causes the relative minimum price between two experience levels to change over time. This provides teams with an incentive to substitute away from the experience level whose relative minimum price is becoming more expensive over time. I create the relative minimum price of all other experience levels in terms of 0 years of experience by dividing the minimum price for a particular level of experience by the minimum price for 0 years of experience. I find evidence that the experience distribution changes when relative minimum prices change.

Table 1.1: Minimum Salaries by Credited Seasons

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0 Seasons	193,000	209,000	225,000	225,000	230,000	230,000	275,000	285,000	295,000	310,000
1 Season	275,000	298,000	300,000	300,000	305,000	305,000	350,000	360,000	370,000	385,000
2 Seasons	358,000	389,000	375,000	375,000	380,000	380,000	425,000	435,000	445,000	460,000
3 Seasons	385,000	418,000	450,000	450,000	455,000	455,000	500,000	510,000	520,000	535,000
4 Seasons	413,000	448,000	525,000	530,000	535,000	540,000	585,000	595,000	605,000	620,000
5 or 6 Seasons	440,000	477,000	525,000	530,000	535,000	540,000	585,000	595,000	605,000	620,000
7, 8, or 9 Seasons	440,000	477,000	650,000	655,000	660,000	665,000	710,000	720,000	730,000	745,000
10 or more Seasons	440,000	477,000	750,000	755,000	760,000	765,000	810,000	820,000	830,000	845,000

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Table 1.2: Minimum Salaries by Credited Seasons in 2009 Dollars

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0 Seasons	240,451	253,180	268,320	262,341	261,215	252,655	292,647	294,890	293,951	310,000
1 Season	342,611	360,994	357,760	349,789	346,394	335,042	372,460	372,492	368,684	385,000
2 Seasons	446,018	471,230	447,201	437,236	431,573	417,430	452,273	450,095	443,417	460,000
3 Seasons	479,656	506,361	536,641	524,683	516,751	499,817	532,086	527,698	518,150	535,000
4 Seasons	514,540	542,702	626,081	617,960	607,609	593,190	622,540	615,647	602,848	620,000
5 or 6 Seasons	548,178	577,833	626,081	617,960	607,609	593,190	622,540	615,647	602,848	620,000
7, 8, or 9 Seasons	548,178	577,833	775,148	763,705	749,573	730,502	755,562	744,985	727,403	745,000
10 or more Seasons	548,178	577,833	894,401	880,301	863,145	840,352	861,979	848,455	827,047	845,000

2   Do Minimum Salaries Shorten Firm Tenure or Career Length?

In many jobs where minimum salary schedules are utilized, such as public education, federal government agencies, and unionized industries, 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 difficult 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, providing 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 if job protection were relaxed in public education and government agencies.

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 at a given time, 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 more profitable than 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 firm tenure and career length are shortened when minimum salaries force an employer to increase an employee's income.

2.1 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

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product. In the NFL, employers may have monopsony power because players chosen in the NFL draft can sign contracts only with the team that drafts them.

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.

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. 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. 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.[1] If this occurs, the team is going to dismiss player *i* and hire player *j*. 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) $VMP_i - MMS_i < VMP_j - S_j,$

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

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[1] 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 role 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.

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.

2.2 Literature

To date, there has not been much 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 an important research topic for many years because of the tension between the potential benefits as a tool to increase income and the potential costs in terms of employment levels. Minimum salary schedules are interesting because they too have a tension between the benefits to the employees from higher salaries and the costs both to the employer through higher earnings but also to the employee through shorter career. There has been little literature examining whether minimum salary schedules affect career length. 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

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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. Another advantage of sports data is that it has good measures of worker productivity.

2.3   Empirical Model

In order to analyze the impact of the NFL's salary structure on a player's firm tenure and career length, I estimate hazard models using a sample of NFL players. The hazard model estimates the impact of minimum salaries and other relevant explanatory variables on the length of time a player spends with a given team and the length of time a player spends in the NFL. A hazard model defines an event which ends a spell of time, and such an event is called a failure, which is a statistical term with no implication that the event is desirable or undesirable. The failure in this research is either the end of a player's firm tenure or the end of a player's NFL career. 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.

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 denoted by t, the set of covariates is denoted by $\mathbf{x}_j$, and the Weibull proportional hazard model is denoted by $h(t|\mathbf{x}_j)$. The parameter p describes the direct effect of time, net of other explanatory variables, in Weibull distributions. If p>1, the hazard increases over time, while if p<1, the hazard decreases over time. In sports, the hazard increases over time (p>1) because the hazard of ending a career is large and growing year by year, based on aging. The hazard is exponentiated because it must be positive to be a conditional probability of an event occurring at time t given that the event did not occur before t.

(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 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. There are many other possible functional forms, but the estimates from hazard models are not sensitive to these alternatives as long as there are no policy spikes, times at which many failures occur, such as 52 weeks of unemployment or the date of reauthorization of welfare benefits. See Manton, Singer, and Woodbury. There are no such fixed policy times in sports careers.

Two important terms in hazard models, also known as duration or survival time models, are right censoring and left censoring. Those terms are based on a left to right time scale as in a graph. Right censoring refers to incomplete spells, here career duration or job duration which is, happily for the player, continuing. That is handled by hazard models with the survivor function, which is the probability at time t that a spell has not ended by time t. Left censoring refers to a spell, here a career or job, which is already in progress when the data set begins. That can be modeled only by making an assumption about unseen data before the spell begins. Such assumptions are problematic and avoided whenever possible. Careers in professional football are short enough that the data set can be confined to spells beginning in 2000 or later without damaging the ability to estimate the model. There is no left censoring.

2.4   Data

I use NFL data on defensive backs, defensive linemen, linebackers, running backs, tight ends, and wide receivers from 2000 to 2008. I chose these six positional groups for two reasons: performance statistics that can be used to measure their productivity are readily available and there are typically at least 3 players that play these positions during the course of a football game. The first reason is important because the availability of performance statistics allow me to control for a player's productivity. The second reason is important because choosing positions where there is typically less than 3 players playing in a game will result in an extremely small sample size. This is because a large percentage of careers for players in positions where less than 3 players play in a game started prior to the 2000 football season. These left censored observations are excluded from the analysis leaving a small sample size. I exclude quarterbacks, punters, and kickers because typically only one player plays these positions during the course of a football season.   I exclude offensive linemen because they do not have any performance measures to control for productivity. Productivity, team, income, and demographic information are used to measure the impact of minimum salaries on firm tenure and career length for these six positional groups. In the firm tenure analysis, I also use information on the number of teams that previously employed the player to control for the tenures a player spent with other teams. I obtain data on player performance and demographic information from the NFL official website (www.nfl.com/players). I use the minimum salary schedule to determine a player's mandated minimum salary. I obtain salary data on a player's base salary, signing bonus, other bonuses from the *USA Today*'s

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NFL salary database (content.**usatoday**.com/sportsdata/football/**nfl**/**salaries**/team). I used the CPI with 2009 as the base year in order to adjust for inflation.

2.4.1 Failure and Explanatory 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. I determine which seasons a player plays in the NFL by the season variable that is included in both the NFL official website data and the USA Today NFL salary database. I determine which season is the player's last season in the NFL by identifying the last year indicated by the season variable in both the NFL official website data and the USA Today NFL salary database.

Player performance measures are time varying, while player demographic variables are fixed throughout the players tenure and career. The explanatory variables of interest in this analysis are mandatory raise and income increase. Mandatory raise and income increase are used to identify the impact of the minimum salaries on firm tenure and career length. Mandatory raise is defined as the base salary increase a team must give to a player from year t to year $t+1$ in order for the player to earn the minimum salary for year $t+1$. Income increase is defined as the total increase in income a player must receive from year t to year $t+1$ in order for the player to earn the minimum salary for year $t+1$. The difference between these two measures is that a player requires a mandatory

raise when his base salary is less than the next year's minimum salary but a player requires an income increase when his base salary plus bonuses is less than the next year's minimum salary.

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 set 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 units of $10,000. I also create a dummy variable, mandatory raise indicator, which is coded one when a player has to receive a mandatory raise and zero 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.

Income increase is created by taking the difference between the mandated minimum salary in year $t+1$ and the total compensation, base salary plus bonuses, in year t. When this difference is negative income increase is set equal to zero because a player does not have to receive an increase in income to remain employed in the NFL. When this difference is positive income increase is equal to the difference because this difference represents the additional income a player must receive in order for his total

compensation to equal his next mandated minimum salary. Although, the base salary reflects the marginal cost of employing a player, income increase captures the players who have to receive a mandatory raise whose total compensation in year t is less than their mandated minimum salary in year $t+1$. Income increase is measured in units of $10,000. I also create a dummy variable, income increase indicator, which is coded one when a player has to receive an income increase and zero when a player does not have to receive an income increase. Income increase is expected to have a negative impact on firm tenure and career length because it also increases the team's marginal cost without increasing the team's marginal revenue.

In both the firm tenure and career length analyses I include variables to control for a player's non-salary compensation. I control for the player's non-salary compensation because this allows me to control for the seasons when players receive small base salaries but a large amount of compensation in the form of bonuses. Even though some players receive large bonuses at various points throughout their careers, the player's salary in the years following a large bonus must be at least the minimum salary corresponding to the year and the player's experience level. This is important because when the value of the player's productivity falls below the mandated minimum salary the team will still have an incentive to release the player regardless of the size of bonuses in previous seasons. This study uses American football data, so the details of the statistics used to measure productivity in that sport are relevant. What follows is an introduction to the specialized positions and statistics used in American football. This will be very familiar to established fans of the sport.

The explanatory variables I choose to control for player productivity for the defensive positions, defensive backs, defensive linemen, and linebackers are games played, games started, tackles, sacks, passes defended, interceptions, and forced fumbles. Games played represents the number of games a player plays in a season. Games played is expected to have a positive impact on firm tenure and career length because 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 started represents the number of games a player plays at the beginning of the game for his given position. Games started are expected to have a positive impact on firm tenure and career length because the players who start are typically perceived to be better players by the coaches than the players who do not start. Tackles are defined as the total number of times a player tackles an opponent during a season. Sacks are defined as the total number of times a player tackles the quarterback behind the line of scrimmage during a season. Passes defended are defined as the total number of times a player breaks up a pass thrown by the quarterback. Interceptions are defined as the total number of times a defensive player catches a pass thrown by the quarterback. Forced fumbles are defined as the total number of times a defensive player causes an offensive player to lose the football. Tackles, sacks, passes defended, interceptions, and forced fumbles are expected to have a positive impact on firm tenure and career length because they measure the impact of the player's ability to help his team stop their opponent from scoring.

The explanatory variables I choose to control for player productivity for the offensive positions, running backs, tight ends, and wide receivers are games played, games started, touches, yards, touchdowns, fumbles, and fumbles lost. 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. Touches are expected to have a negative impact on firm tenure and career length because holding all other covariates constant, an additional touch is simply another opportunity for a player to get injured. Yards are defined as the sum of a player's rushing and receiving yards. Yards are expected to have a positive impact on firm tenure and career length because they measure the impact of the player's ability to help the team get closer to a scoring opportunity. Touchdowns are defined as the sum of a player's rushing and receiving touchdowns. Touchdowns are expected to have a positive impact on firm tenure and career length because they measure the impact of the player's ability to help the team score points. Fumbles represents the number of times a player has possession of the football and loses possession. Fumbles are expected to have a negative impact on firm tenure and career length because they allow the other team an opportunity to gain possession of the football. Fumbles lost are expected to have a negative impact on firm tenure and career length because they represent the number of times a player has possession of the football, loses possession, and the other team gains possession.

The explanatory variables I choose to control for the team are win percentage, playoff appearance, and millions under the salary cap. The winning percentage represents the percentage of games a team wins in a given year. Winning percentage is expected to have a positive impact on firm tenure and career length because teams with higher winning percentages appear to be more likely to keep the same composition of players from year to year. Playoff appearance is a dummy variable that is coded one when the team makes the playoffs and zero when the team does not make the playoffs.

Playoff appearance is expected to have a positive impact on firm tenure and career length because 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. Millions under the salary cap are the difference between the salary cap and the total payroll of a player's team. 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. Millions under the salary cap are expected to have a positive impact on firm tenure and career length because the more a team is under the salary cap, the more money they are allowed to spend on players.

The explanatory variables I choose to control for non-salary compensation are signing bonus, other bonuses, and pension eligibility. The signing bonus is a bonus a player receives when he signs a new contract with a team. Signing bonus is expected to have a positive impact on firm tenure and career length because teams are likely to give larger signing bonuses to players they expect to be top performers. Other bonuses typically are bonuses given to players when they achieve a specific goal outlined in their contract. Other bonuses are expected to have a positive impact on firm tenure and career length because players who receive other bonuses are meeting criteria that the team requires them to meet in order to receive additional compensation. Pension eligibility is a dummy variable indicating whether a player is eligible for the pension plan. NFL players are eligible for the pension plan after they earn four credited seasons. Pension eligibility can be coded as a dummy variable for four or more credited seasons or can be included in the time dependence, as it depends perfectly on time. The impact of pension eligibility is

ambiguous because once players are eligible for the pension plan they could either retire or play longer to increase their pension benefits.

The explanatory variables I choose to control for demographic information are height, weight, and age at the beginning of the career. The impact of height on firm tenure and career length is ambiguous because taller players are able to see over shorter players but they are more susceptible to having their legs hit. Weight is expected to have a positive impact on firm tenure and career length because heavier players are likely to absorb contact 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.

The explanatory variables I choose to control for the number of teams a player plays for are a set of dummy variables indicating whether a player is on his second team, third team, fourth team, fifth team, sixth team, or seventh team during a given season. I expect the impact of these variables to be negative compared to players on their first team because these players have already played for and left at least one other team, shortening their expected firm tenure on their next team.

2.4.2 Summary Statistics

Tables 2.1 through 2.6 display the defensive backs, defensive linemen, linebackers, running backs, tight ends, and wide receivers summary statistics for the covariates used in the firm tenure analysis and the seasons played variable. The seasons played variable in the firm tenure sample identifies which season a player is in during his tenure with a specific team. The average of the current seasons played variable is not the

same as the average number of seasons played by a player for a specific firm. Some of the data used in the firm tenure analyses are right-censored. The hazard model utilizes all of the observations, right-censored or complete spells. I have 1270 defensive back player years in the firm tenure sample because there are typically four defensive backs playing in a game at a time and occasionally there are five or six. I have 970 defensive linemen player years in the firm tenure sample because there are typically four defensive linemen playing in a game at a time. I have 871 linebacker player years in the firm tenure sample because there are typically three linebackers playing in a game at a time. I have 707 running back player years in the firm tenure sample because there are typically two running backs playing in a game at a time. I have 350 tight end player years in the firm tenure sample because there is typically one tight end playing in a game at a time. I have 682 wide receiver player years in the firm tenure sample because there are typically two wide receivers playing in a game at a time and occasionally there are three, four, or five. Players included in the firm tenure sample are players who began their tenures with a team between 2000 and 2008. Players who play for more than one team in a season or have a skipped season in the data are not included in the firm tenure analyses.

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 specific player's firm tenure may appear in this sample as many times as he move to a new team and the firm tenure is not left-censored (i.e. the beginning of the spell is always observed).

Generally speaking, in the firm tenure samples, about 62% of players have a mandatory raise, so only 38% earn salaries greater than their next mandated minimum salary. An income increase is required by over 30%, so less than 70% earn more income than their next mandated minimum salary. Teams win, of course, exactly 50% of their games, but the average for the average for the firm tenure samples deviates slightly from that number. Similarly, 37.5% of teams make the playoffs (12 out of 32 each year), but the average for the average for the firm tenure samples deviates slightly from that number. There are some differences between positions in average salary, average increase in salary, height and weight, as detailed in following paragraphs.

In the defensive back firm tenure sample, the average of the seasons played variable is 2.3. A mandatory raise is required by 62.3% of the sample. The average mandatory raise is $51,310. An income increase is required by 31.5% sample. The average income increase is $23,010. Players, on average, have 13.1 games played, 7.5 games started, 42.3 tackles, 0.3 sacks, 4.7 passes defended, 1.5 interceptions, and 0.5 forced fumbles. Pension eligibility is attained by 35.2%, 22.7% are on their second team, 7.6% are on their third team, 2.5% are on their fourth team, 0.9% are on their fifth team, 0.3% are on their sixth team, and 0.1% are on their seventh team. Teams, on average, win 50.6% of their games, make the playoffs 37.0% of the time, and are $2.4 million under the salary cap. Players, on average, receive a signing bonus of $924,740 and other bonuses of $274,910. The average age at the beginning of the NFL career is 22.5. The average height is 71.6 inches and the average weight is 200.4 pounds.

In the defensive linemen firm tenure sample, the average of the seasons played variable is 2.4. A mandatory raise is required by 56.0% of the sample. The average

mandatory raise is $46,430. An income increase is required by 27.1% of the sample. The average income increase is $19,350. Players, on average, have 12.9 games played, 7.9 games started, 28.4 tackles, 2.7 sacks, 1.4 passes defended, 0.09 interceptions, and 0.7 forced fumbles. Pension eligibility is attained by 41.4%, 23.3% are on their second team, 8.1% are on their third team, 3.5% are on their fourth team, 0.6% are on their fifth team, 0.3% are on their sixth team, and 0.4% are on their seventh team. Teams, on average, win 50.7% of their games, make the playoffs 36.9% of the time, and are $2.7 million under the salary cap. Players, on average, receive a signing bonus of $1,205,240 and other bonuses of $341,730. The average age at the beginning of the NFL career is 22.6. The average height is 75.6 inches and the average weight is 294.4 pounds.

In the linebacker firm tenure sample, the average of the current seasons played variable is 2.3. A mandatory raise is required by 62.0% of the sample. The average mandatory raise is $52,220. An income increase is required by 32.5% of the sample. The average income increase is $23,790. Players, on average, have 13.2 games played, 7.5 games started, 52.2 tackles, 1.2 sacks, 1.9 passes defended, 0.5 interceptions, and 0.7 forced fumbles. Pension eligibility is attained by 37.8%, 23.3% are on their second team, 7.8% are on their third team, 2.5% are on their fourth team, and 0.7% are on their fifth team. Teams, on average, win 50.1% of their games, make the playoffs 37.2% of the time, and are $3.2 million under the salary cap. Players, on average, receive a signing bonus of $885,630 and other bonuses of $221,230. The average age at the beginning of the NFL career is 22.6. The average height is 73.8 inches and the average weight is 240.7 pounds.

In the running back firm tenure sample, the average of the current seasons played variable is 2.3. A mandatory raise is required by 62.1% of the sample. The average mandatory raise is $54,540. An income increase is required by 37.3% of the sample. The average income increase is $29,010. Players, on average, have 11.9 games played, 4.7 games started, 96.7 touches, 456.5 yards, 2.9 touchdowns, 1.2 fumbles, and 0.7 fumbles lost. Pension eligibility is attained by 38.3%, 23.9% are on their second team, 6.5% are on their third team, 2.7% are on their fourth team, 0.8% are on their fifth team, 0.7% are on their sixth team, and 0.1% are on their seventh team. Teams, on average, win 49.1% of their games, make the playoffs 34.9% of the time, and are $2.5 million under the salary cap. Players, on average, receive a signing bonus of $704,850 and other bonuses of $267,540. The average age at the beginning of the NFL career is 22.5. The average height is 71.3 inches and the average weight is 225.3 pounds.

In the tight end firm tenure sample, the average of the current seasons played variable is 2.5. A mandatory raise is required by 60.6% of the sample. The average mandatory raise is $50,570. An income increase is required by 32.3% of the sample. The average income increase is $24,740. Players, on average, have 12.5 games played, 7.1 games started, 22.0 touches, 231.4 yards, 1.9 touchdowns, 0.3 fumbles, and 0.2 fumbles lost. Pension eligibility is attained by 35.1%, 18.6% are on their second team, 3.7% are on their third team, 1.7% are on their fourth team, and 0.6% are on their fifth team. Teams, on average, win 52.0% of their games, make the playoffs 40.9% of the time, and are $2.4 million under the salary cap. Players, on average, receive a signing bonus of $739,310 and other bonuses of $189,950. The average age at the beginning of

the NFL career is 22.8. The average height is 76.2 inches and the average weight is 255.2 pounds.

In the wide receiver firm tenure sample, the average of the current seasons played variable is 2.2. A mandatory raise is required by 63.2% of the sample. The average mandatory raise is $51,380. An income increase is required by 31.7% of the sample. The average income increase is $23,190. Players, on average, have 12.2 games played, 6.0 games started, 32.1 touches, 332.0 yards, 2.4 touchdowns, 0.8 fumbles, and 0.4 fumbles lost. Pension eligibility is attained by 33.1%, 17.3% are on their second team, 7.0% are on their third team, 2.2% are on their fourth team, 1.3% are on their fifth team, and 0.1% are on their sixth team. Teams, on average, win 49.7% of their games, make the playoffs 37.0% of the time, and are $2.7 million under the salary cap. Players, on average, receive a signing bonus of $1,132,730 and other bonuses of $334,190. The average age at the beginning of the NFL career is 22.5. The average height is 72.9 inches and the average weight is 201.3 pounds.

Tables 2.7 through 2.12 display the defensive backs, defensive linemen, linebackers, running backs, tight ends, and wide receivers summary statistics for the covariates used in the career length analysis and the seasons played variable. The seasons played variable in the career length sample identifies which season a player is in during his career in the NFL. The average of the current seasons played variable is not the same as the average number of seasons played by a player during his career. Some of the data used in the career length analyses are right-censored. The hazard model utilizes all observations when estimating the baseline hazard and coefficients. I have 957 defensive back player years in the career length sample because there are typically four

defensive backs playing in a game at a time and occasionally there are five or six. I have 729 defensive linemen player years in the career length sample because there are typically four defensive linemen playing in a game at a time. I have 670 linebacker player years in the career length sample because there are typically three linebackers playing in a game at a time. I have 526 running back player years in the career length sample because there are typically two running backs playing in a game at a time. I have 285 tight end player years in the career length sample because there is typically one tight end playing in a game at a time. I have 567 wide receiver player years in the career length sample because there are typically two wide receivers playing in a game at a time and occasionally there are three, four, or five. Players included in the career length sample are players who began their careers with a team between 2000 and 2008. None of the observations in the career length sample are left censored. The number of player years in the firm tenure analyses is greater than the number of player years in the career length analyses for each position because players who careers started prior to the 2000 season who had firm tenures that started after the 2000 season are included in the firm tenure samples but not the career length samples. Players who play for more than one team in a season or have a skipped season in the data are not included in the career length analyses.

Generally speaking, in the career length samples, over 64% of players have a mandatory raise, so less than 36% earn salaries greater than their next mandated minimum salary. An income increase is required by over 31%, so less than 69% earn more income than their next mandated minimum salary. Teams win, of course, exactly 50% of their games, but the average for the career length samples deviate slightly from

that number. Similarly, 37.5% of teams make the playoffs (12 out of 32 each year), but the average for the career length samples deviates slightly from that number. There are some differences between positions in average salary, average increase in salary, height and weight, for the career length samples as detailed in following paragraphs.

In the defensive back career length sample, the average of the current seasons played variable is 2.9. A mandatory raise is required by 71.8% of the sample. The average mandatory raise is $58,540. An income increase is required by 35.7% of the sample. The average income increase is $25,560. Players, on average, have 13.1 games played, 7.1 games started, 42.2 tackles, 0.3 sacks, 4.9 passes defended, 1.4 interceptions, and 0.5 forced fumbles. Pension eligibility is attained by 18.5%. Teams, on average, win 51.1% of their games, make the playoffs 38.8% of the time, and are $3.1 million under the salary cap. Players, on average, receive a signing bonus of $930,340 and other bonuses of $270,729. The average age at the beginning of the NFL career is 22.6. The average height is 71.7 inches and the average weight is 200.4 pounds.

In the defensive linemen career length sample, the average of the current seasons played variable is 3.2. A mandatory raise is required by 64.9% of the sample. The average mandatory raise is $53,280. An income increase is required by 31.8% of the sample. The average income increase is $23,070. Players, on average, have 12.9 games played, 7.4 games started, 29.1 tackles, 2.7 sacks, 1.4 passes defended, 0.09 interceptions, and 0.7 forced fumbles. Pension eligibility is attained by 25.0%. Teams, on average, win 51.0% of their games, make the playoffs 38.0% of the time, and are $3.2 million under the salary cap. Players, on average, receive a signing bonus of $1,182,630 and other

bonuses of $352,720. The average age at the beginning of the NFL career is 22.6. The average height is 75.6 inches and the average weight is 295.4 pounds.

In the linebacker career length sample, the average of the current seasons played variable is 3.1. A mandatory raise is required by 70.3% of the sample. The average mandatory raise is $56,930. An income increase is required by 35.8% of the sample. The average income increase is $25,500. Players, on average, have 13.2 games played, 7.4 games started, 52.9 tackles, 1.2 sacks, 2.0 passes defended, 0.5 interceptions, and 0.7 forced fumbles. Pension eligibility is attained by 22.4%. Teams, on average, win 50.4% of their games, make the playoffs 38.4% of the time, and are $3.5 million under the salary cap. Players, on average, receive a signing bonus of $876,630 and other bonuses of $256,870. The average age at the beginning of the NFL career is 22.6. The average height is 73.8 inches and the average weight is 240.1 pounds.

In the running back career length sample, the average of the current seasons played variable is 3.0. A mandatory raise is required by 72.2% of the sample. The average mandatory raise is $61,050. An income increase is required by 41.3% of the sample. The average income increase is $32,310. Players, on average, have 12.1 games played, 4.4 games started, 95.9 touches, 454.7 yards, 2.9 touchdowns, 1.2 fumbles, and 0.7 fumbles lost. Pension eligibility is attained by 21.9%. Teams, on average, win 48.8% of their games, make the playoffs 34.2% of the time, and are $2.5 million under the salary cap. Players, on average, receive a signing bonus of $758,740 and other bonuses of $281,400. 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.

In the tight end career length sample, the average of the current seasons played variable is 3.1. A mandatory raise is required by 64.2% of the sample. The average mandatory raise is $52,840. An income increase is required by 34.7% of the sample. The average income increase is $26,190. Players, on average, have 12.7 games played, 7.1 games started, 23.1 touches, 244.1 yards, 1.9 touchdowns, 0.4 fumbles, and 0.2 fumbles lost. Pension eligibility is attained by 24.6%. Teams, on average, win 52.4% of their games, make the playoffs 41.4% of the time, and are $2.7 million under the salary cap. Players, on average, receive a signing bonus of $805,820 and other bonuses of $227,730. The average age at the beginning of the NFL career is 22.7. The average height is 76.1 inches and the average weight is 255.7 pounds.

In the wide receiver career length sample, the average of the current seasons played variable is 2.9. A mandatory raise is required by 70.7% of the sample. The average mandatory raise is $58,500. An income increase is required by 35.3% of the sample. The average income increase is $26,120. Players, on average, have 12.0 games played, 5.6 games started, 30.6 touches, 313.6 yards, 2.3 touchdowns, 0.8 fumbles, and 0.4 fumbles lost. Pension eligibility is attained by 21.2%. Teams, on average, win 49.1% of their games, make the playoffs 36.0% of the time, and are $2.9 million under the salary cap. Players, on average, receive a signing bonus of $805,820 and other bonuses of $227,730. The average age at the beginning of the NFL career is 22.4. The average height is 72.9 inches and the average weight is 201.6 pounds.

Tables 2.13 through 2.24 provide detailed information on the percentage of players who require a mandatory raise or an income increase in the firm tenure samples. A player requires a mandatory raise when his year t salary is less than his year $t+1$

mandated minimum salary. A player requires a total income increase when the sum of his year *t* salary and bonuses is less than his year *t+1* mandated minimum salary. 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 the firm tenure samples, players who require a mandatory raise or a total income increase have fewer average games played, games started, tackles, sacks, passes defended, interceptions, forced fumbles, touches, yards, fumbles, and fumbles lost than the players who do not require a mandatory raise or an income increase. In the firm tenure samples, players who require a mandatory raise or an income increase also have lower average bonuses than the players who do not require a mandatory raise or an income increase. In tables 2.13 through 2.24 I show the percentage of players in the firm tenure samples requiring a mandatory raise and an income increase that is greater than $0, greater than $50,000, greater than $75,000, and greater than $100,000. These tables provide the reader with more information about the size and frequency of mandatory raises and income increases. There are some differences between positions in the size and frequency of mandatory raises and income increases for the firm tenure samples as detailed in following paragraphs.

Table 2.13 displays the percentage of defensive backs requiring a mandatory raise for the firm tenure sample: 62.4% require a mandatory raise, 55.5% require a mandatory raise greater than $50,000, 41.6% require a mandatory raise greater than $75,000, and 12.2% require a mandatory raise greater than $100,000. Table 2.14 displays the percentage of defensive backs requiring an income increase for the firm tenure sample: 31.5% require an income increase, 26.4% require an income increase greater than

$50,000, 14.5% require an income increase greater than $75,000, and 4.6% require an income increase greater than $100,000.

Table 2.15 displays the percentage of defensive linemen requiring a mandatory raise for the firm tenure sample: 56.0% require a mandatory raise, 49.5% require a mandatory raise greater than $50,000, 37.4% require a mandatory raise greater than $75,000, and 12.1% require a mandatory raise greater than $100,000. Table 2.16 displays the percentage of defensive linemen requiring an income increase for the firm tenure sample: 27.1% require an income increase, 21.6% require an income increase greater than $50,000, 12.5% require an income increase greater than $75,000, and 4.7% require an income increase greater than $100,000.

Table 2.17 displays the percentage of linebackers requiring a mandatory raise for the firm tenure sample: 62.0% require a mandatory raise, 55.7% require a mandatory raise greater than $50,000, 41.2% require a mandatory raise greater than $75,000, and 13.3% require a mandatory raise greater than $100,000. Table 2.18 displays the percentage of linebackers requiring an income increase for the firm tenure sample: 32.5% require an income increase, 27.8% require an income increase greater than $50,000, 15.8% require an income increase greater than $75,000, and 5.3% require an income increase greater than $100,000.

Table 2.19 displays the percentage of running backs requiring a mandatory raise for the firm tenure sample: 63.1% require a mandatory raise, 58.3% require a mandatory raise greater than $50,000, 46.0% require a mandatory raise greater than $75,000, and 15.0% require a mandatory raise greater than $100,000. Table 2.20 displays the percentage of running backs requiring an income increase for the firm tenure sample:

37.3% require an income increase, 32.8% require an income increase greater than $50,000, 21.9% require an income increase greater than $75,000, and 7.2% require an income increase greater than $100,000.

Table 2.21 displays the percentage of tight ends requiring a mandatory raise for the firm tenure sample: 60.6% require a mandatory raise, 54.3% require a mandatory raise greater than $50,000, 41.7% require a mandatory raise greater than $75,000, and 12.0% require a mandatory raise greater than $100,000. Table 2.22 displays the percentage of tight ends requiring an income increase for the firm tenure sample: 32.3% require an income increase, 28.9% require an income increase greater than $50,000, 17.1% require an income increase greater than $75,000, and 5.7% require an income increase greater than $100,000.

Table 2.23 displays the percentage of wide receivers requiring a mandatory raise for the firm tenure sample: 63.2% require a mandatory raise, 55.6% require a mandatory raise greater than $50,000, 43.0% require a mandatory raise greater than $75,000, and 12.8% require a mandatory raise greater than $100,000. Table 2.24 displays the percentage of wide receivers requiring an income increase for the firm tenure sample: 31.7% require an income increase, 26.0% require an income increase greater than $50,000, 16.3% require an income increase greater than $75,000, and 5.4% require an income increase greater than $100,000.

Tables 2.25 through 2.36 provide detailed information on the percentage of players who require a mandatory raise or an income increase in the career length samples. In the career length samples, players who require a mandatory raise or a total income increase have fewer average games played, games started, tackles, sacks, passes

defended, interceptions, forced fumbles, touches, yards, fumbles, and fumbles lost than the players who do not require a mandatory raise or an income increase. In the career length samples, players who require a mandatory raise or an income increase also have lower average bonuses than the players who do not require a mandatory raise or an income increase. In tables 2.25 through 2.36 I show the percentage of players in the firm tenure samples requiring a mandatory raise and an income increase that is greater than $0, greater than $50,000, greater than $75,000, and greater than $100,000. These tables provide the reader with more information about the size and frequency of mandatory raises and income increases. There are some differences between positions in the size and frequency of mandatory raises and income increases for the career length samples as detailed in following paragraphs.

Table 2.25 displays the percentage of defensive backs requiring a mandatory raise for the career length sample: 71.8% require a mandatory raise, 66.5% require a mandatory raise greater than $50,000, 49.2% require a mandatory raise greater than $75,000, and 13.1% require a mandatory raise greater than $100,000. Table 2.26 displays the percentage of defensive backs requiring an income increase for the career length sample: 35.7% require an income increase, 30.2% require an income increase greater than $50,000, 16.3% require an income increase greater than $75,000, and 5.1% require an income increase greater than $100,000.

Table 2.27 displays the percentage of defensive linemen requiring a mandatory raise for the career length sample: 64.9% require a mandatory raise, 59.5% require a mandatory raise greater than $50,000, 44.3% require a mandatory raise greater than $75,000, and 12.5% require a mandatory raise greater than $100,000. Table 2.28

displays the percentage of defensive linemen requiring an income increase for the career length sample: 31.8% require an income increase, 26.5% require an income increase greater than $50,000, 15.0% require an income increase greater than $75,000, and 5.5% require an income increase greater than $100,000.

Table 2.29 displays the percentage of linebackers requiring a mandatory raise for the career length sample: 70.3% require a mandatory raise, 64.6% require a mandatory raise greater than $50,000, 46.7% require a mandatory raise greater than $75,000, and 12.4% require a mandatory raise greater than $100,000. Table 2.30 displays the percentage of linebackers requiring an income increase for the career length sample: 35.8% require an income increase, 31.0% require an income increase greater than $50,000, 17.2% require an income increase greater than $75,000, and 4.9% require an income increase greater than $100,000.

Table 2.31 displays the percentage of running backs requiring a mandatory raise for the career length sample: 72.2% require a mandatory raise, 68.6% require a mandatory raise greater than $50,000, 52.7% require a mandatory raise greater than $75,000, and 15.4% require a mandatory raise greater than $100,000. Table 2.32 displays the percentage of running backs requiring an income increase for the career length sample: 41.3% require an income increase, 38.4% require an income increase greater than $50,000, 24.9% require an income increase greater than $75,000, and 8.0% require an income increase greater than $100,000.

Table 2.33 displays the percentage of tight ends requiring a mandatory raise for the career length sample: 64.2% require a mandatory raise, 59.3% require a mandatory raise greater than $50,000, 44.2% require a mandatory raise greater than $75,000, and

11.6% require a mandatory raise greater than $100,000. Table 2.34 displays the percentage of tight ends requiring an income increase for the career length sample: 34.7% require an income increase, 31.2% require an income increase greater than $50,000, 17.9% require an income increase greater than $75,000, and 5.6% require an income increase greater than $100,000.

Table 2.35 displays the percentage of wide receivers requiring a mandatory raise for the career length sample: 70.7% require a mandatory raise, 65.1% require a mandatory raise greater than $50,000, 50.1% require a mandatory raise greater than $75,000, and 14.3% require a mandatory raise greater than $100,000. Table 2.36 displays the percentage of wide receivers requiring an income increase for the career length sample: 35.3% require an income increase, 29.8% require an income increase greater than $50,000, 18.7% require an income increase greater than $75,000, and 6.3% require an income increase greater than $100,000.

2.4.3 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. Figures 2.1 through 2.12 show the Kaplan Meier survival estimates for the firm tenure sample for all six positions. The survival estimates are split by whether a player never required a mandatory raise and by whether a player never required an income increase. Players who require a mandatory raise have a higher survival rate with a given firm than players who do not require a mandatory raise for all six positions. This is an unexpected result because one would expect that if the salary structure is forcing the firm to give the worker a raise, firm tenure is shortened. This result could be driven by the fact that some star players receive the minimum salary

and receive the rest of their compensation in the form of bonuses. This result could also be driven by the fact that these Kaplan Meier survival estimates are only controlling for whether a player receive a mandatory raise. Players who require an income increase have a lower survival rate with a given firm than players who never require an income increase for all six positions. These results are exactly what one expects when the salary structure forces a firm to increase a worker's income without an increase in productivity. Without controlling for any covariates other than mandatory raise and income increase, these Kaplan Meier survival estimates provide evidence that players who are required by minimum salaries to receive an income increase have shorter tenures with a given team.

Figures 2.13 through 2.24 show the Kaplan Meier survival estimates for the career length sample for all six positions. The survival estimates are split by whether a player never required a mandatory raise and by whether a player never required an income increase. Players who require a mandatory raise have a lower survival rate during their careers than players who never require a mandatory raise for all six positions. Players who require an income increase also have a lower survival rate during their careers than players never require an income increase for all six positions. These results are also exactly what one expects when the salary structure forces a firm to increase a worker's salary and total income without an increase in productivity. Without controlling for any covariates other than mandatory raise and income increase, these Kaplan Meier survival estimates provide evidence that players who are required by minimum salaries to receive a mandatory raise or an income increase have shorter careers.

2.5 Results

I estimate four basic models for each position's firm tenure sample. Two models (labeled (1) and (3) in the tables) use the indicator for mandatory raise and income increase as the variable of interest. Models (2) and (4) use the values of mandatory raise and income increase in $10,000s as the variable of interest. Table 2.37 through 2.42 display the Weibull regression results for the firm tenure sample for all six positions. Mandatory raise indicator is negative and statistically significant for only tight ends and wide receivers. It is negative and statistically insignificant for defensive linemen, linebackers, and running backs. It is positive and statistically insignificant for defensive backs. Mandatory raise in $10,000s is negative and statistically significant for only wide receivers. It is negative and statistically insignificant for defensive linemen, linebackers, running backs, and tight ends. It is positive and statistically insignificant for defensive backs. Income increase indicator is negative and statistically significant for defensive linemen, linebackers, running backs, and tight ends. It is negative and statistically insignificant for defensive backs and wide receivers. Income increase in $10,000s is negative and statistically significant for defensive linemen, linebackers, and wide receivers. It is negative and statistically insignificant for defensive backs, running backs, and tight ends. Most of the control variables in the firm tenure analyses had the expected sign even though some were statistically insignificant. All of the variables that are statistically significant in the firm tenure samples have the expected sign except for games started for defensive backs, linebackers, and wide receivers. The signs and the statistical significance of the variables of interest in tables 2.37 through 2.42 provide

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evidence that minimum salaries shorten firm tenure for all positions except for defensive backs.

The coefficient in the tight ends sample indicates that a tight end who receives a mandatory raise has his firm tenure shortened by 0.99 of a season. The coefficient in the defensive linemen sample indicates that a defensive lineman who receives an income increase has his firm tenure shortened by 0.65 of a season. The coefficient in the defensive linemen sample indicates that a defensive lineman's firm tenure is shortened by an additional 0.10 of a season when income increase in $10,000s increase by $10,000.

The games played variable is statistically significant for running backs, tight ends, and wide receivers. The games started variable is statistically significant for defensive backs, linebackers, running backs and wide receivers. The tackles variable is statistically significant for defensive linemen and linebackers. The sacks variable is statistically significant for defensive backs. The passes defended variable is statistically significant for defensive backs. The interceptions variable is statistically significant for defensive backs and linebackers. The forced fumbles variable is statistically significant for linebackers. The touches variable is statistically significant for running backs and tight ends. The yards variable is statistically significant for running backs, tight ends, and wide receivers. The touchdowns variable is statistically significant for wide receivers.

The pension eligibility variable is statistically significant for running backs. The second team, third team, fourth team, and fifth team variables are statistically significant for all positions. The sixth team variable is statistically significant for defensive backs, defensive linemen, and wide receivers. The seventh team variable is statistically significant for defensive backs, defensive linemen, and running backs. The win

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percentage variable is statistically significant for linebackers and wide receivers. The signing bonus variable is statistically significant for all positions. The other bonuses variable is statistically significant for defensive backs, defensive linemen, and wide receivers. The age at the beginning of the career variable is statistically significant for defensive backs, linebackers, and wide receivers. The weight variable is statistically significant for defensive linemen and linebackers.

The results for the defensive backs firm tenure sample for models (1) and (2) are inconsistent with expectations. One possible explanation for why a mandatory raise increases firm tenure is that the majority of defensive backs who require a mandatory raise are players who receive a large part of their compensation in the form of bonuses. If a player earns the minimum salary but receives the majority of his compensation in bonuses, he will require a mandatory raise but his value to the team could be higher than his next minimum salary. Another explanation for why a mandatory raise increases firm tenure is that defensive backs who require a mandatory raise may be worth the next minimum salary to their current team but not to any other team in the league.

The player performance measures games played, games started, tackles, sacks, passes defended, interceptions, and forced fumbles are included in the models for defensive players to account for productivity. The player performance measures games played, games started, touches, yards, touchdowns, fumbles, and fumbles lost are included in the models for offensive players to account for productivity. The team performance measures win percentage and playoff appearance variables account for any team synergies that occur from the combination of a specific group of players. These two sets of variables together capture the impact of productivity on a player's firm tenure.

The statistical insignificance of some variables and the unexpected sign of the games started variable could be due to the fact that some of these variables might be collinear. In this analysis, it is okay if the variables are collinear because the main goal of including these variables is to account for productivity. If someone is interested in specific performance measures they would need to be more careful with the specification.

I estimate four basic models for each position's career length sample. Two models (labeled (1) and (3) in the tables) use the indicator for mandatory raise and income increase as the variable of interest. Models (2) and (4) use the values of mandatory raise and income increase in $10,000s as the variable of interest. Tables 2.43 through 2.48 display the Weibull regression results for the career length sample for all six positions. Mandatory raise indicator is negative and statistically significant for defensive backs, defensive linemen, and running backs. It is negative and statistically insignificant for linebackers, tight ends, and wide receivers. Mandatory raise in $10,000s is negative and statistically significant for defensive backs, defensive linemen, running backs, and wide receivers. It is negative and statistically insignificant for linebackers and tight ends. Income increase indicator and income increase in $10,000s are negative and statistically significant for defensive backs, defensive linemen, linebackers, and running backs. They are both negative and statistically insignificant for tight ends and wide receivers. Most of the control variables in the career length analyses had the expected sign even though some were statistically insignificant. All of the variables that are statistically significant in the career length samples have the expected sign except for games started and playoff appearance. The signs and the statistical significance of the variables of interest in tables

2.43 through 2.48 provide evidence that minimum salaries shorten career length for all positions except for tight ends and wide receivers.

The coefficient in the defensive backs sample indicates that a defensive back who receives a mandatory raise has his career length shortened by 2.26 seasons. The coefficient in the defensive backs sample indicates that a defensive back's career length is shortened by an additional 0.29 of a season when mandatory raise increases by $10,000. The coefficient in the defensive backs sample indicates that a defensive back who receives an income increase has his career length shortened by 3.49 seasons. The coefficient in the defensive backs sample indicates that a defensive back's career length is shortened by an additional 0.44 of a season when income increase increases by $10,000.

The games played variable is statistically significant for running backs, tight ends, and wide receivers. The games started variable is statistically significant for linebackers. The tackles variable is statistically significant for defensive backs, defensive linemen, and linebackers. The sacks variable is statistically significant for defensive linemen. The passes defended variable is statistically significant for defensive backs. The touches and yards variables are statistically significant for running backs.

The pension eligibility variable is statistically significant for running backs and wide receivers. The win percentage variable is statistically significant for defensive linemen and linebackers. The playoff appearance variable is statistically significant for defensive linemen. The signing bonus variable is statistically significant for wide receivers. The other bonuses variable is statistically significant for defensive linemen. The age at the beginning of the career variable is statistically significant for all positions

except for linebackers and tight ends. The height variable is statistically significant for defensive linemen, linebackers, and running backs. The weight variable is statistically significant for defensive linemen and running backs.

The coefficient on the win percentage variable appears to be unusually large because it indicates that a one unit change in win percentage will increase career length by twenty years. The issue here is that the win percentage does not typically increase by an entire unit. It is more realistic to think about a tenth of a point increase in win percentage. A tenth of a point increase in win percentage leads to a 2.03 year increase in career length.

The results for the tight ends career length sample for all four models appear to be improbable. One thing to notice is that the p-values for the coefficients on all the explanatory variables are close to one, indicating that the estimates are imprecisely estimated. One possible explanation for these results is that tight ends typically have the responsibilities of two positions, wide receivers and offensive linemen. There are few tight ends that have touches, yards, and touchdowns that are similar to some of the most productive wide receivers. The majority of tight ends have touches, yards, and touchdowns that are either close to zero or equal to zero because their function on a team is more like an offensive linemen. I believe that it is these outliers that are driving these improbable results.

The player performance measures and the team performance measures capture the impact of productivity on a player's career length. The statistical insignificance of some variables and the unexpected sign of the games started and playoff appearance variables could be due to the fact that some of these variables might be collinear. In this analysis,

it is okay if the variables are collinear because the main goal of including these variables is to account for productivity. If someone is interested in specific performance measures they would need to be more careful with the specification.

In order to estimate the impact of the player performance measures and the team performance measures on firm tenure and career length, I perform a joint test of significance with the player performance measures and the team performance measures for each model. Table 2.49 shows the results from the joint test of significance for the player and team performance measures in the firm tenure samples. Table 2.50 shows the results from the joint test of significance for the player and team performance measures in the career length samples. The Chi-square statistics and their corresponding p-values from the joint test are reported. In each model estimated, the player and team performance measures are jointly significant at the 0.001% significance level. These results show that even though individual player or team performance measures are statistically insignificant, the joint collection of these variables is statically significant indicating that collectively, they have predictive power. The Chi-square statistics from the joint test of all the variables included in the model are larger than the Chi-square statistics from the joint test of the player and team performance measures. The Chi-square statistics from the joint test of the player and team performance measures are large enough to indicate that the joint test for all the variables is at least statistically significant at the 0.005% significant level even though the test for all the variables in the model has 9 more degrees of freedom.

Comparing the results from the firm tenure analyses to the career length analyses, the coefficients on the four variables of interest in the career length results have a larger

magnitude than the same variables in the firm tenure results. Hence, the negative impact of mandatory raise indicator, mandatory raise in $10,000, income increase indicator, and income increase in $10,000 is larger in the career length analyses. This is expected because careers are typically longer than tenures with specific teams. Therefore, the potential for the minimum salary structure to shorten a career is greater than the potential for the minimum salary structure to shorten firm tenure.

The Weibull Regression survival estimates used in this analysis estimate the probability of a player's survival past a certain time controlling for all other covariates. Figures 2.25 through 2.36 show the Weibull Regression survival estimates for the firm tenure sample for all six positions. These figures show the survival rate simulated by the hazard model for players who require a mandatory raise and for players who require an income increase. Players who require a mandatory raise have a lower survival rate with a given firm than players who do not require a mandatory raise for all positions except for defensive backs. Compared to the Kaplan-Meier survival estimates the results for the impact of mandatory raise on firm tenure change for all positions except for defensive backs. Players who require an income increase have a lower survival rate with a given firm than players who do not require an income increase for all six positions. These results are consistent with the results from the Kaplan-Meier survival estimates. Controlling for other covariates, these Weibull regression survival estimates provide evidence that players who are required by minimum salaries to receive a mandatory raise or an income increase have shorter tenures with a given team.

Figures 2.37 through 2.48 show the Weibull regression survival estimates for the career length sample for all six positions. These figures show the survival rate simulated

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by the hazard model for players who require a mandatory raise and for players who require an income increase. Players who require a mandatory raise have a lower survival rate during their careers than players who do not require a mandatory raise for all six positions. Players who require an income increase also have a lower survival rate during their careers than players who do not require an income increase for all six positions. Both of these results are consistent with the results from the Kaplan-Meier survival estimates. Controlling for other covariates, these Weibull regression survival estimates provide evidence that players who are required by minimum salaries to receive a mandatory raise or an income increase have shorter careers.

2.6 Conclusion

The fact that the mandatory raise variable and the income increase variable is negative and statistically significant for some of the positions provides evidence that minimum salaries have a negative impact on firm tenure and career length. This study of minimum salaries on firm tenure and career length reveals that when the salary structure forces a firm to pay a worker more than the value of the worker to the firm, the worker's firm tenure and career length are shortened. These results have important implications for the NFL and other industries employing minimum salary schedules.

The magnitude of the minimum salaries in the NFL is far greater than the magnitude of the minimum salaries in most other industries. The market structure in the NFL differs from most other market structures that employ minimum salary schedules. The NFL only employs males but other industries with minimum salary schedules employ both males and females. In spite of all of these differences between the NFL and any other industry that utilizes a minimum salary schedule, I argue that firm tenures and

career lengths will be shortened any time the employer has the ability to dismiss or fire workers and the salary structure forces the firm to pay the worker more than the value of the worker to the firm. Therefore, any industry that has a minimum salary schedule in place should be aware that this salary structure has the ability to shorten firm tenures and career lengths of an employee when it forces the employer to pay the employee more than the employee's value to the firm.

Given that minimum salary schedules have the ability to shorten firm tenures and career lengths, they have the ability to give more players an opportunity to play in the NFL if older players' careers end prematurely. If some players' careers are shortened due to the salary structure, other players who would not have had an opportunity to play in the NFL get a chance to play in the NFL. If the goal of the NFL Management Council (the representative for owners) and the NFL Players Association (the representative for the players) is to increase the total number of players who have an opportunity to play in the NFL, minimum salaries are an effective policy tool. If the goal of the NFL Management Council and the NFL Players Association is to put the best or more profitable players on the football field, minimum salaries are an ineffective policy tool. This is because minimum salaries force firms to replace productive players who would be profitable in the absence of the minimum schedule with less productive players who are only more profitable because of the presence of the minimum salary schedule.

Two other potential drawbacks of this study are: 1) I do not control for injuries and 2) player performance measures and team performance measures are collinear. The first potential drawback is not a serious problem for this study because injuries are mostly important when they cause players to miss games. The fact that the player is injured is

not going to shorten a player's career. What shortens the player's career is the fact that the player is injured and not able to perform at a level to warrant the coach putting him in the game. When players are injured and do not miss games due to pain killer injections, intense rehab, or the ability to perform at a higher level than the next best player, the fact that the player is injured does not directly have an impact on firm tenure and career length. The second potential drawback is not a serious problem for this study because even if player performance measures and team performance measures are collinear, as long as they collectively account for productivity they accomplish their objective for being included in the models.

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 and other industries that employ minimum salary structures can reduce the negative impact of minimum salary schedules on career length.

Figure 2.1: Kaplan-Meier Survival Estimates for Defensive Backs by Mandatory Raise (Firm Tenure)
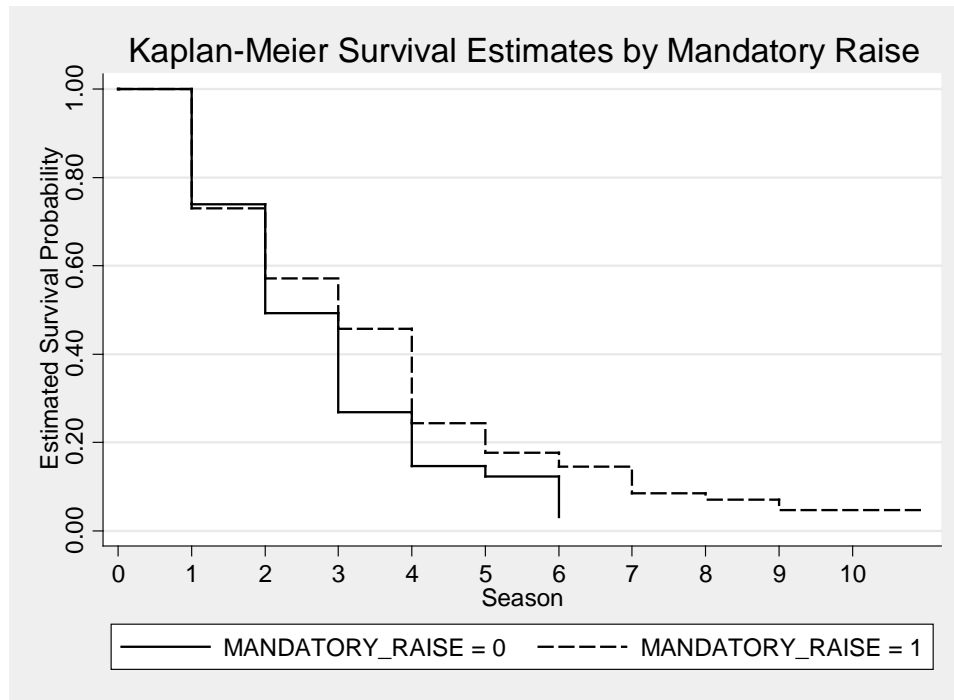
Figure 2.2: Kaplan-Meier Survival Estimates for Defensive Backs by Income Increase (Firm Tenure)
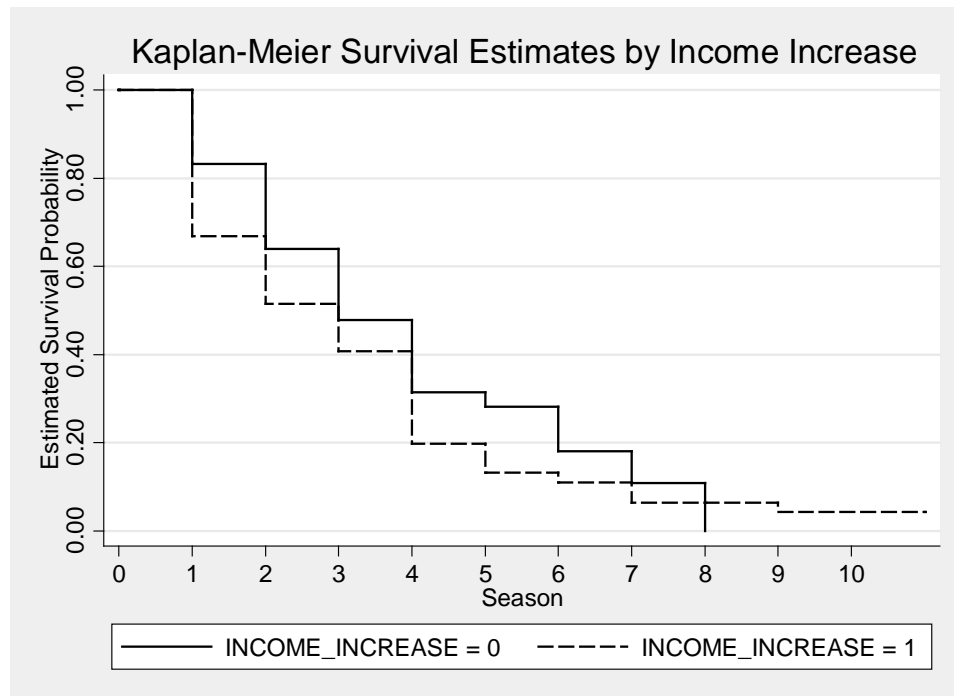
Figure 2.3: Kaplan-Meier Survival Estimates for Defensive Linemen by Mandatory Raise (Firm Tenure)
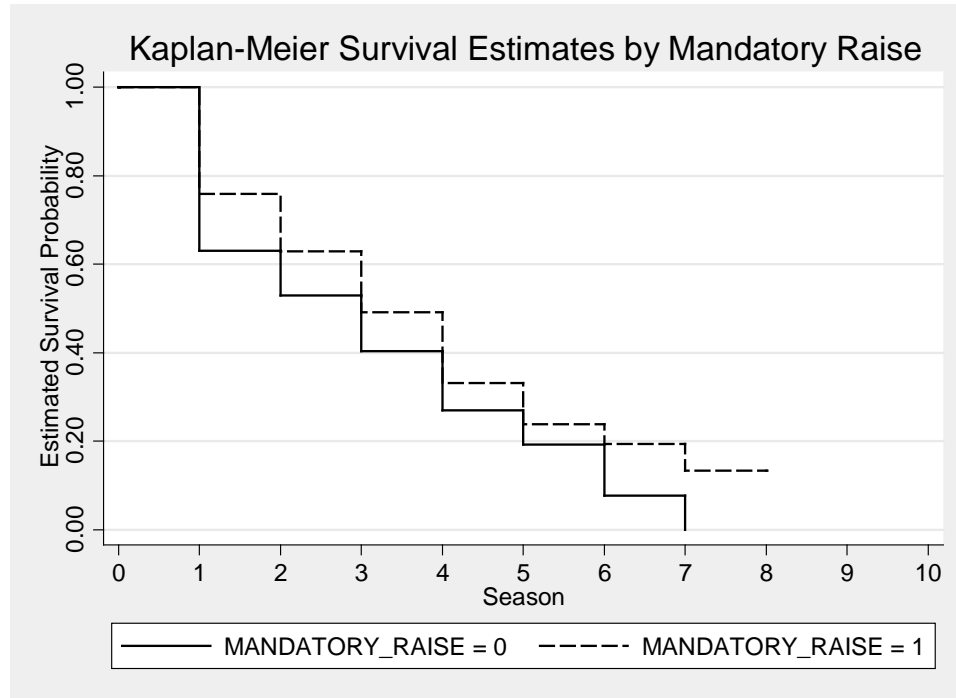
Figure 2.4: Kaplan-Meier Survival Estimates for Defensive Linemen by Income Increase (Firm Tenure)
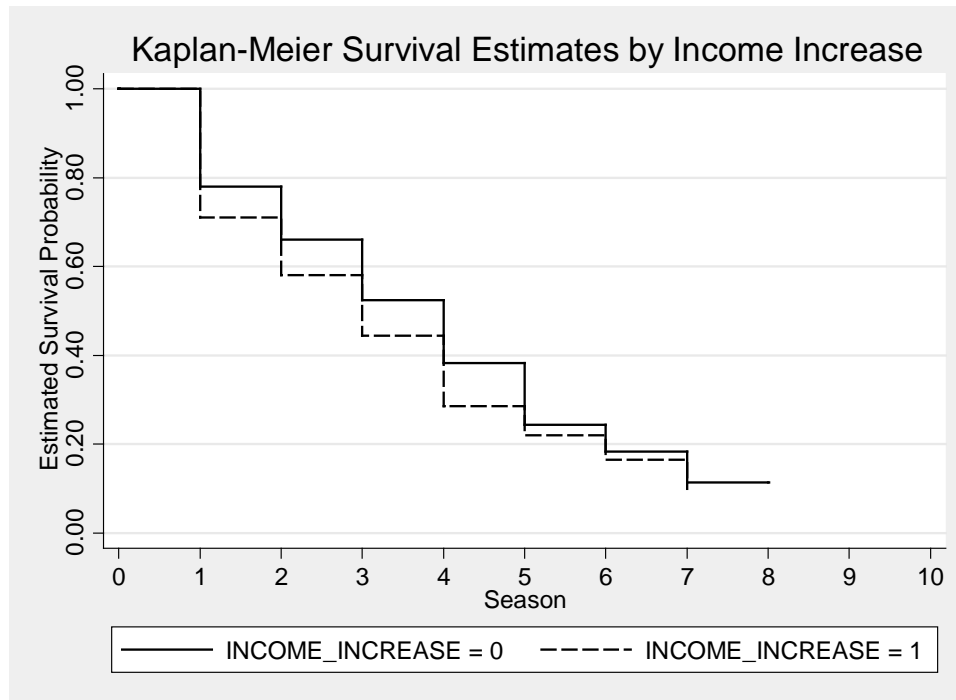
Figure 2.5: Kaplan-Meier Survival Estimates for Linebackers by Mandatory Raise (Firm Tenure)

Kaplan-Meier Survival Estimates by Mandatory Raise
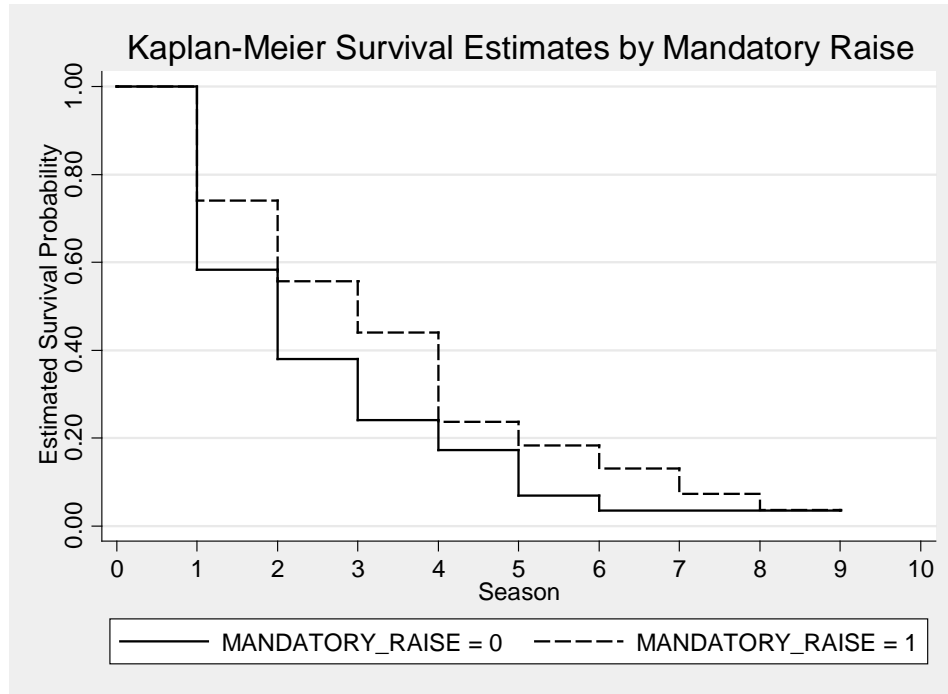
Figure 2.6: Kaplan-Meier Survival Estimates for Linebackers by Income Increase (Firm Tenure)

Kaplan-Meier Survival Estimates by Income Increase
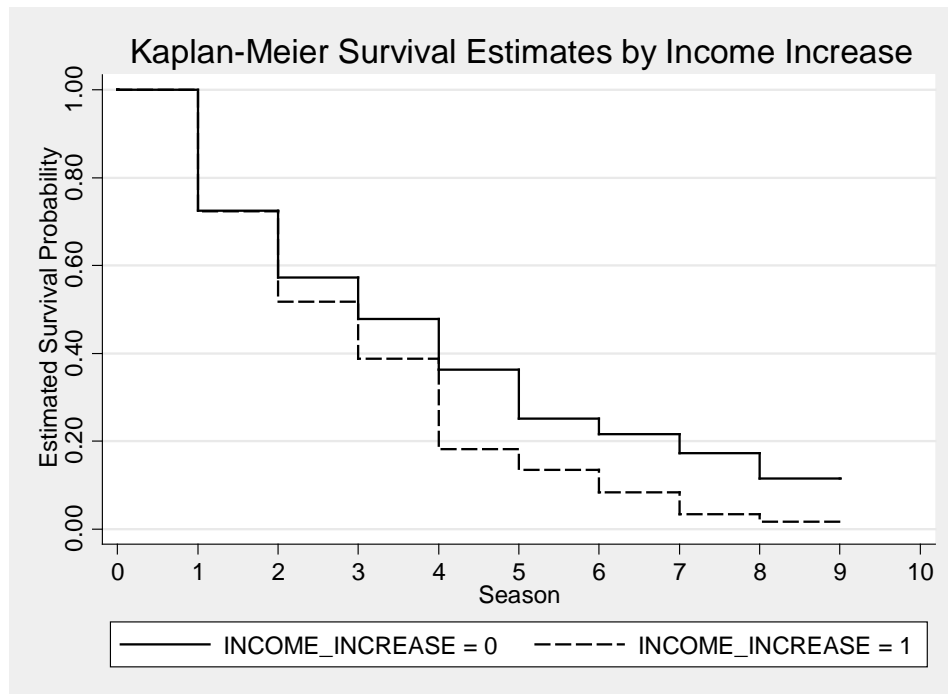
Figure 2.7: Kaplan-Meier Survival Estimates for Running Backs by Mandatory Raise (Firm Tenure)

Kaplan-Meier Survival Estimates by Mandatory Raise
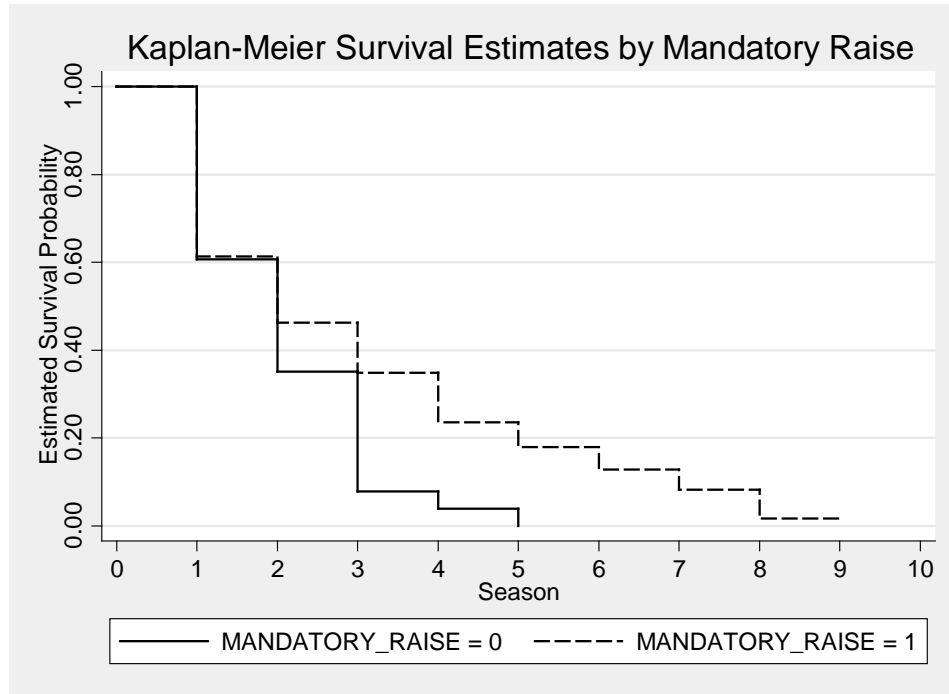
Figure 2.8: Kaplan-Meier Survival Estimates for Running Backs by Income Increase (Firm Tenure)

Kaplan-Meier Survival Estimates by Income Increase
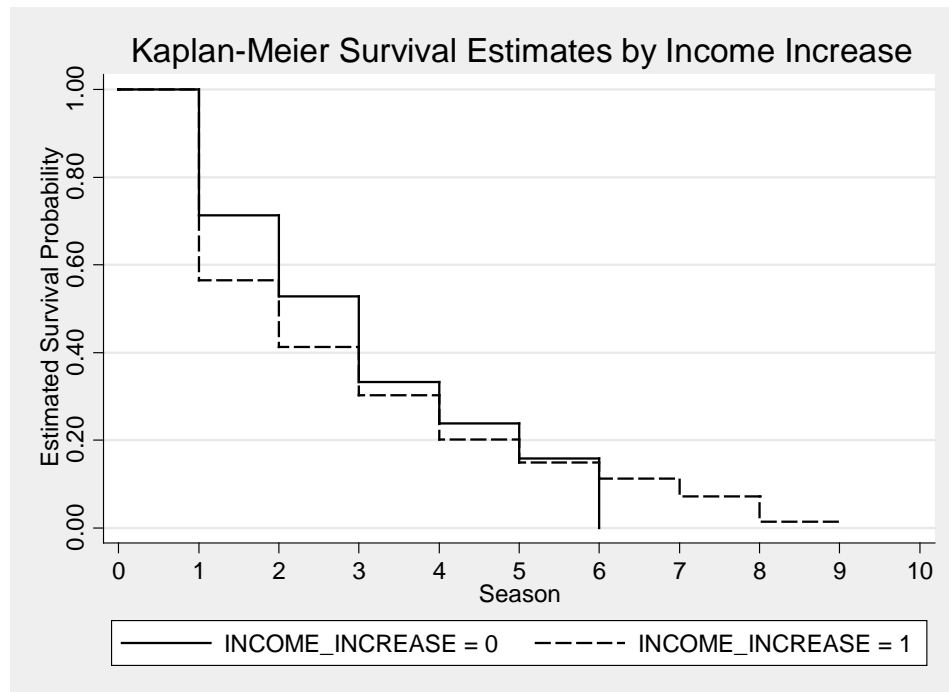
Figure 2.9: Kaplan-Meier Survival Estimates for Tight Ends by Mandatory Raise (Firm Tenure)
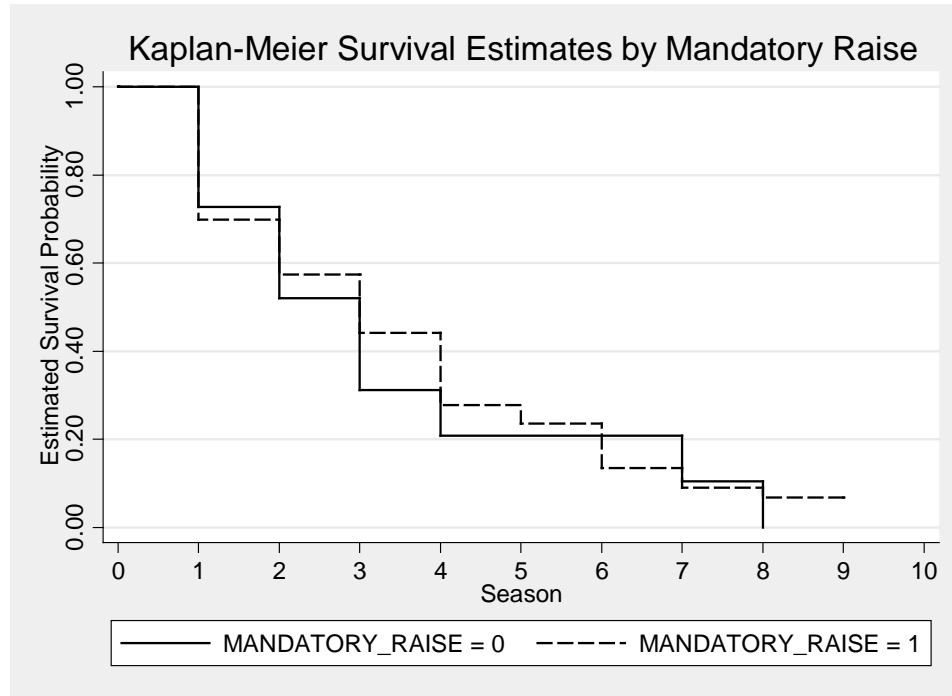
Figure 2.10: Kaplan-Meier Survival Estimates for Tight Ends by Income Increase (Firm Tenure)
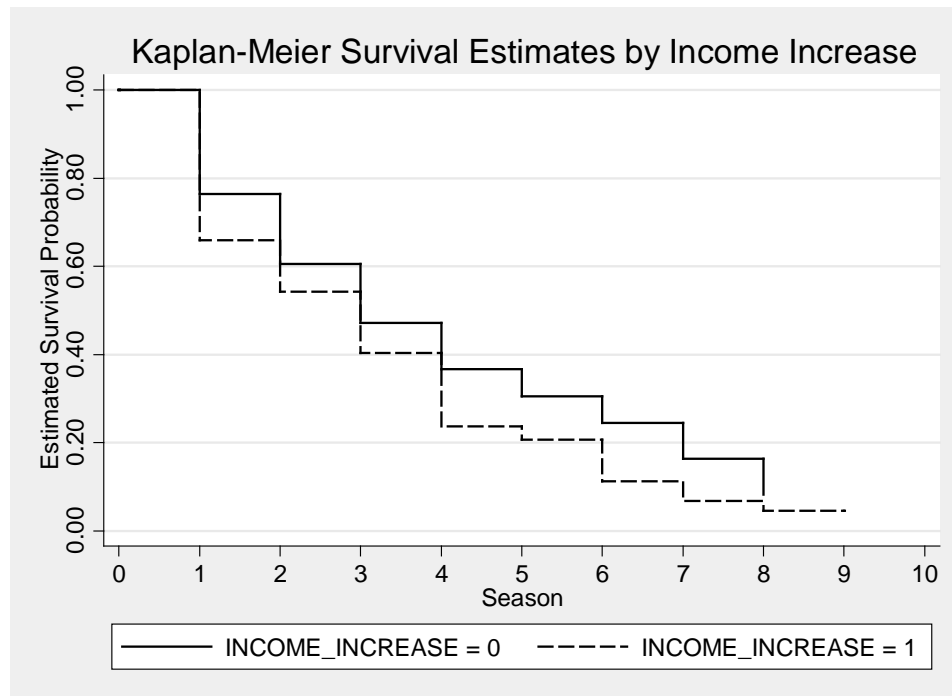
Figure 2.11: Kaplan-Meier Survival Estimates for Wide Receivers by Mandatory Raise (Firm Tenure)

Kaplan-Meier Survival Estimates by Mandatory Raise
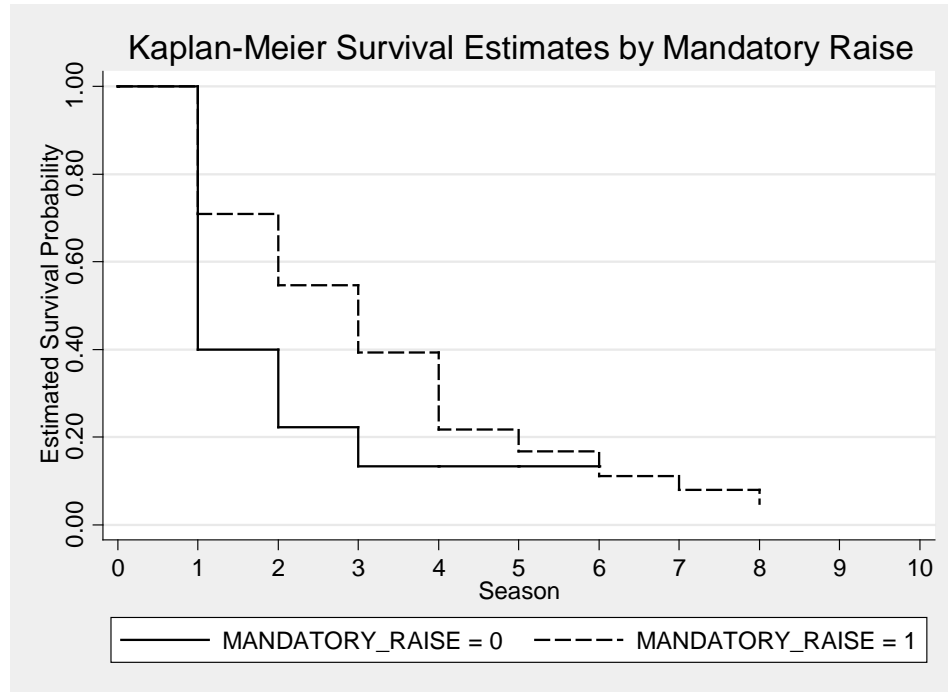
Figure 2.12: Kaplan-Meier Survival Estimates for Wide Receivers by Income Increase (Firm Tenure)

Kaplan-Meier Survival Estimates by Income Increase
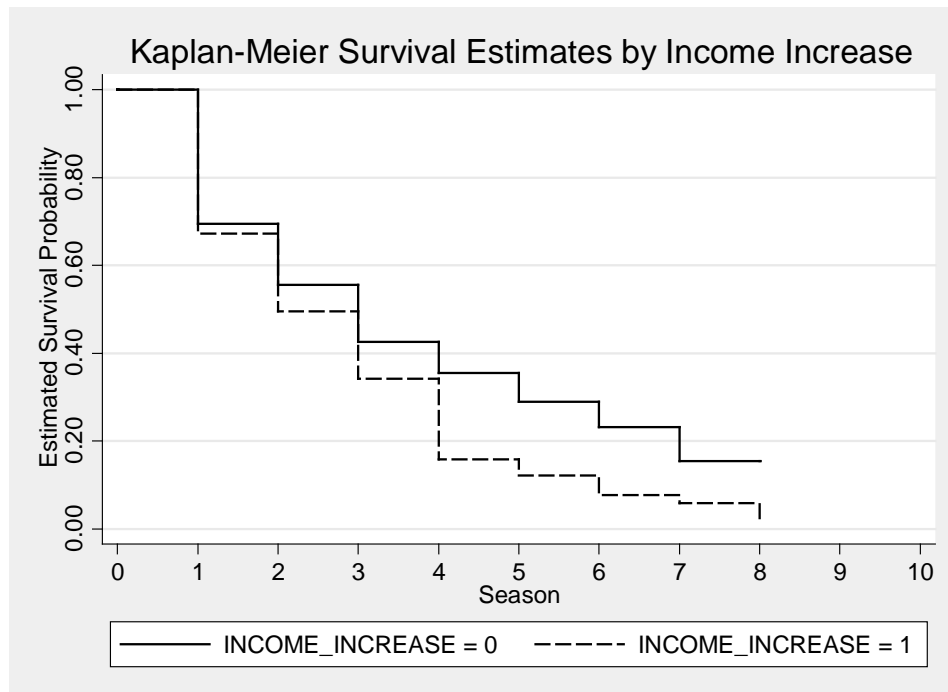
Figure 2.13: Kaplan-Meier Survival Estimates for Defensive Backs by Mandatory Raise (Career Length)

Kaplan-Meier Survival Estimates by Mandatory Raise
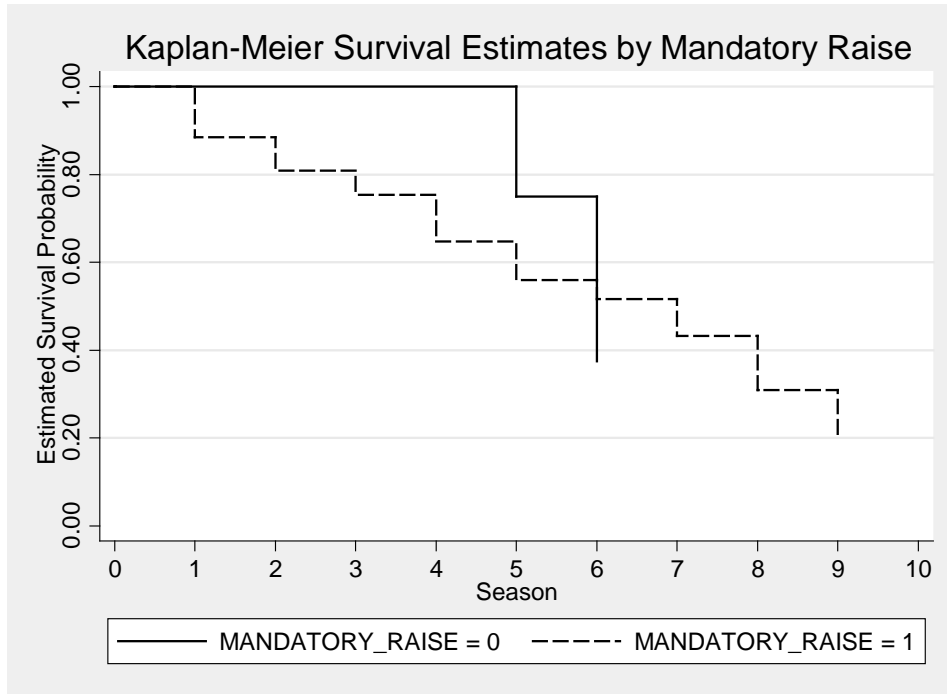
Figure 2.14: Kaplan-Meier Survival Estimates for Defensive Backs by Income Increase (Career Length)

Kaplan-Meier Survival Estimates by Income Increase
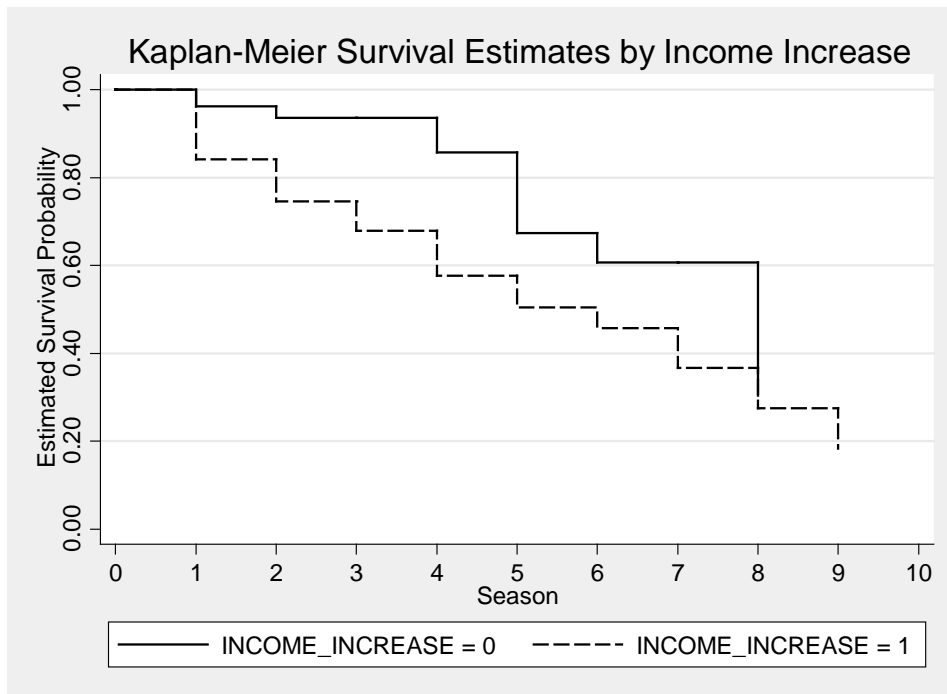
Figure 2.15: Kaplan-Meier Survival Estimates for Defensive Linemen by Mandatory Raise (Career Length)
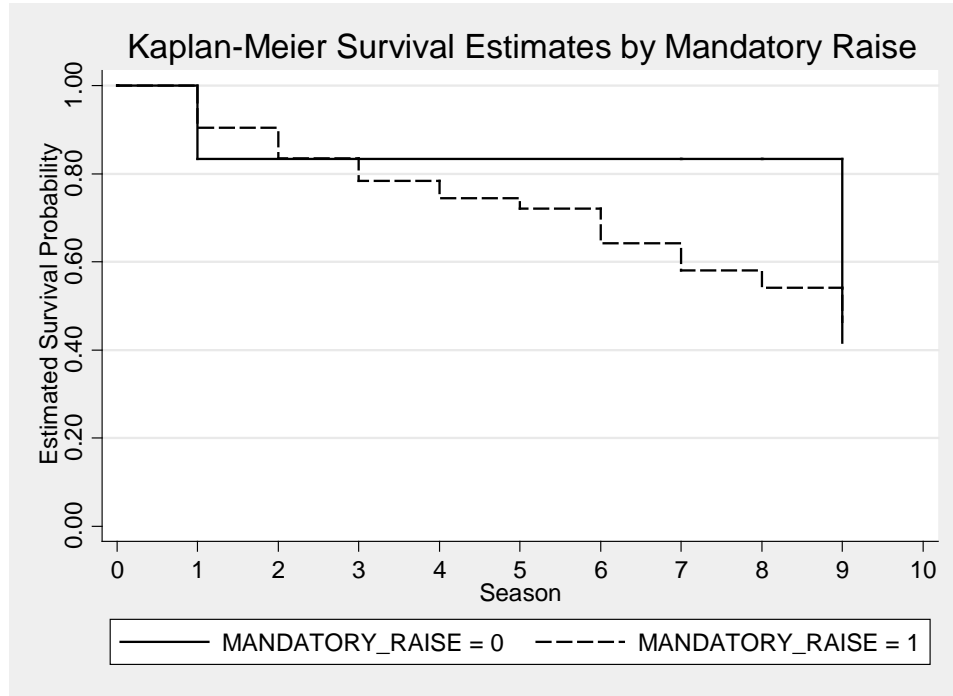
Figure 2.16: Kaplan-Meier Survival Estimates for Defensive Linemen by Income Increase (Career Length)
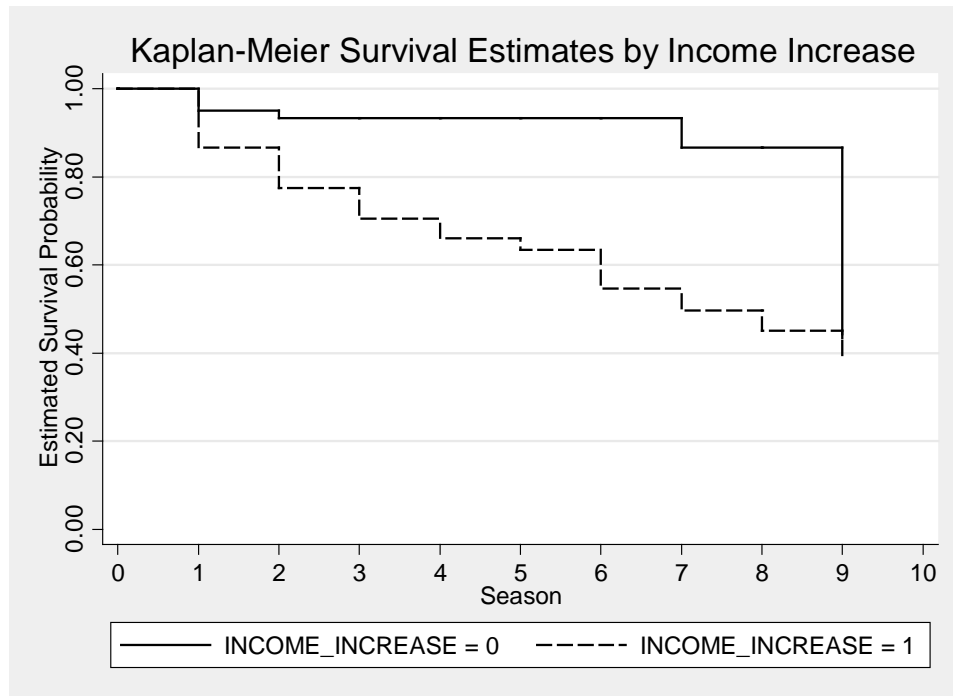
Figure 2.17: Kaplan-Meier Survival Estimates for Linebackers by Mandatory Raise (Career Length)

Kaplan-Meier Survival Estimates by Mandatory Raise
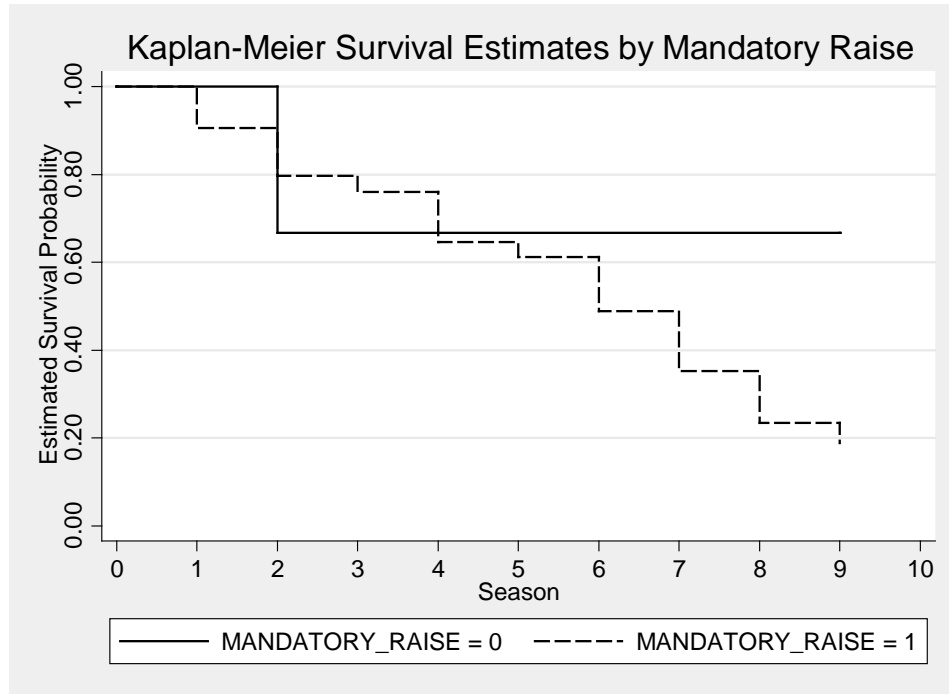
Figure 2.18: Kaplan-Meier Survival Estimates for Linebackers by Income Increase (Career Length)

Kaplan-Meier Survival Estimates by Income Increase
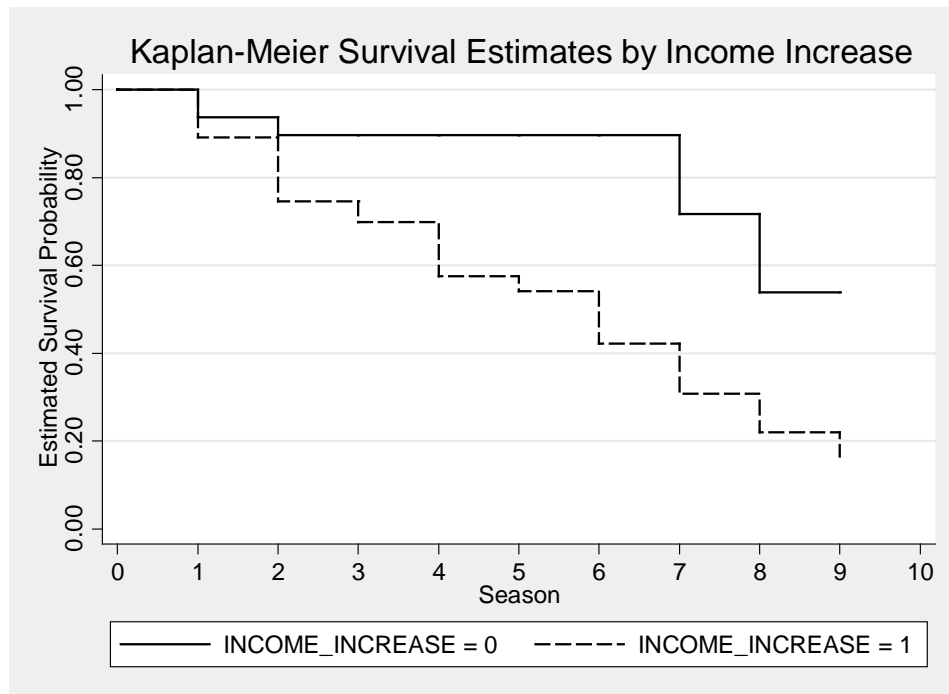
Figure 2.19: Kaplan-Meier Survival Estimates for Running Backs by Mandatory Raise (Career Length)
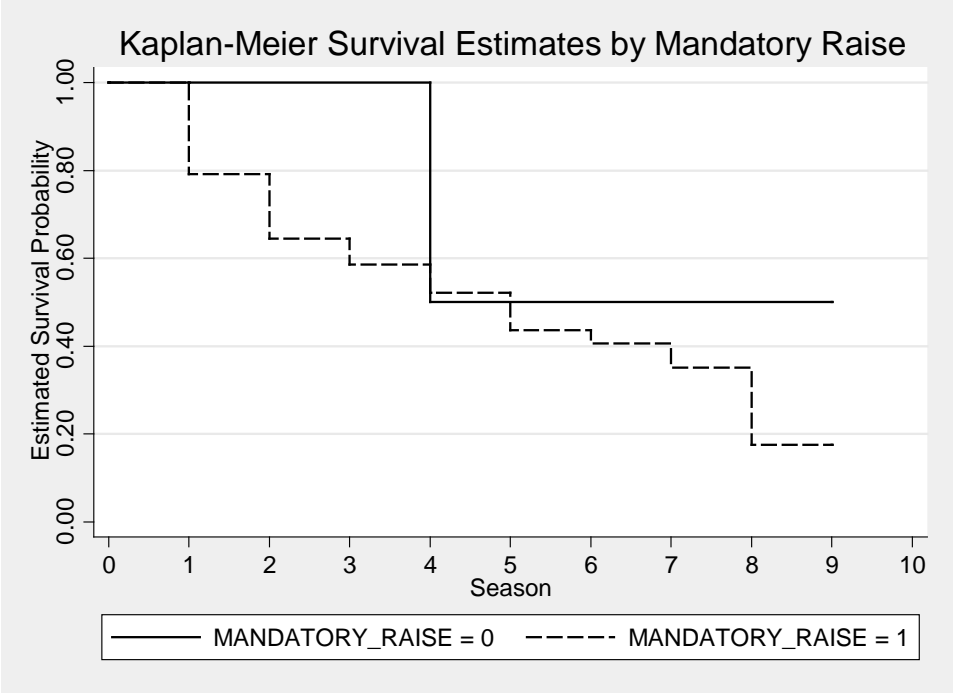
Figure 2.20: Kaplan-Meier Survival Estimates for Running Backs by Income Increase (Career Length)
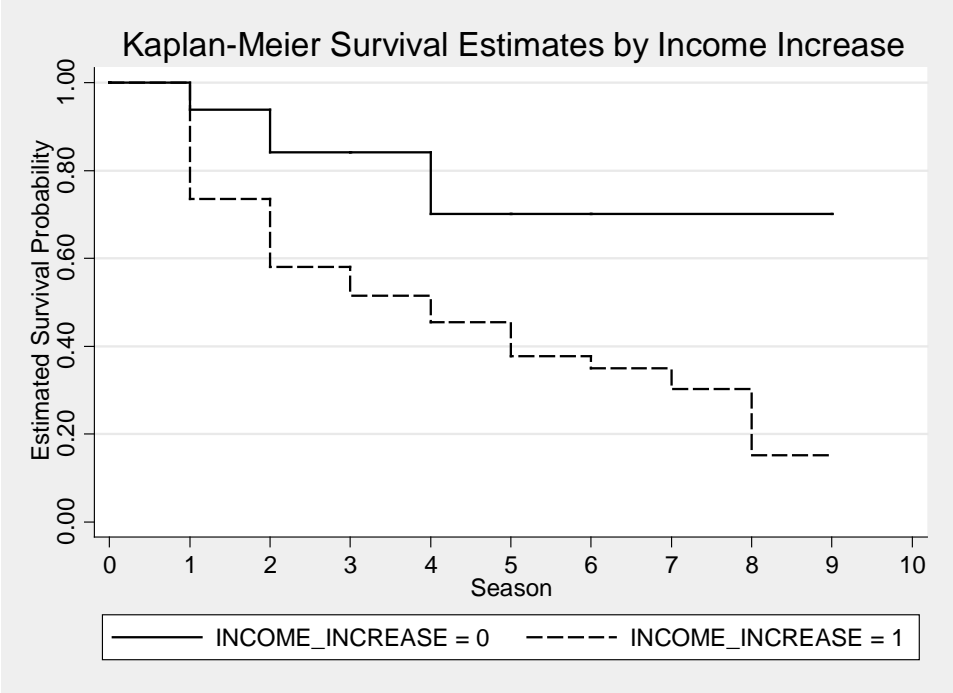
Figure 2.21: Kaplan-Meier Survival Estimates for Tight Ends by Mandatory Raise (Career Length)
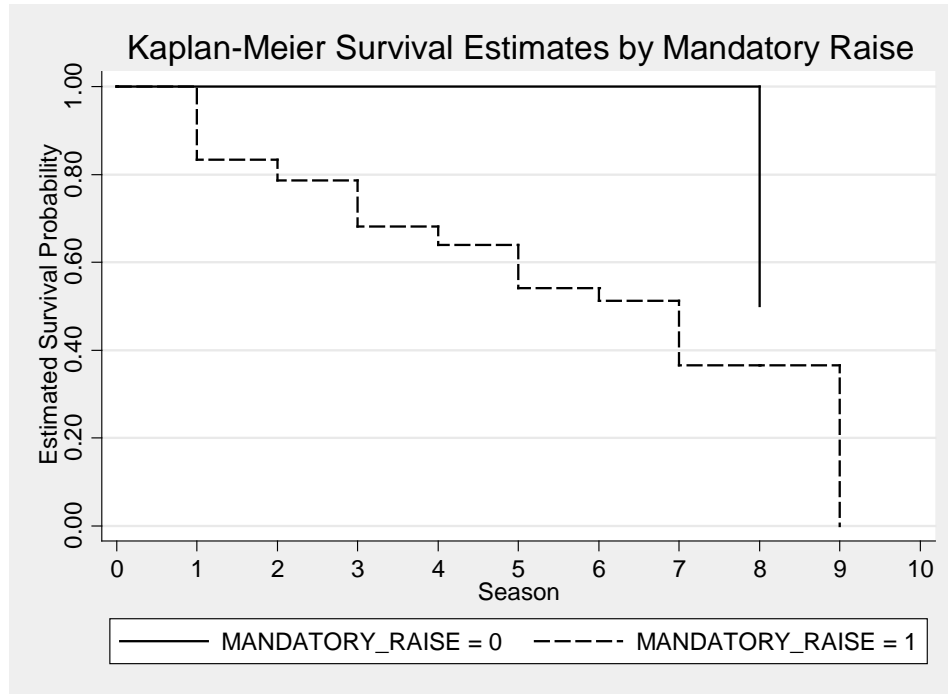
Figure 2.22: Kaplan-Meier Survival Estimates for Tight Ends by Income Increase (Career Length)
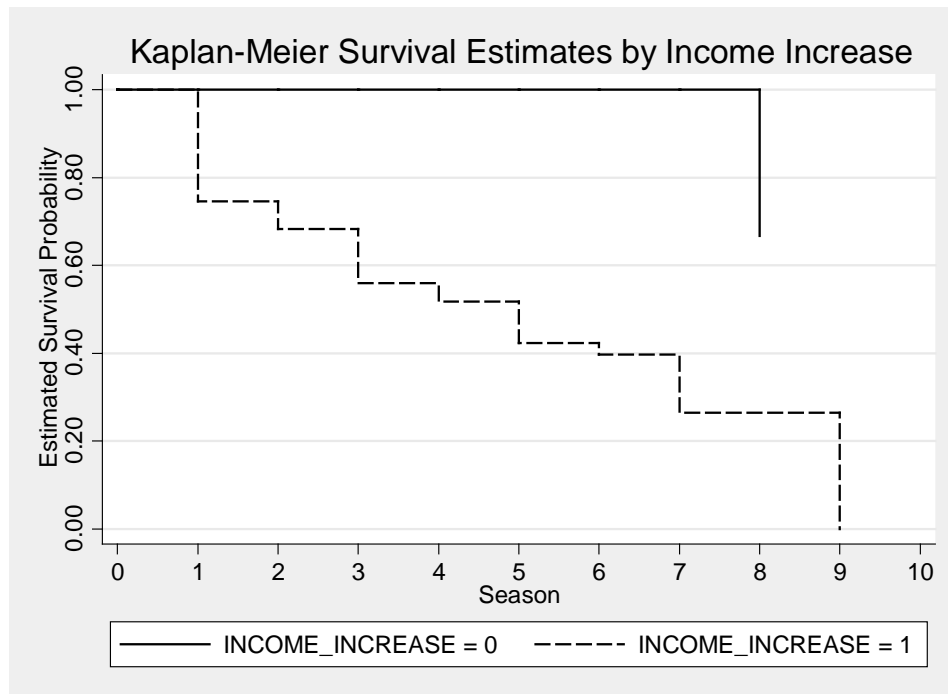
Figure 2.23: Kaplan-Meier Survival Estimates for Wide Receivers by Mandatory Raise (Career Length)

Kaplan-Meier Survival Estimates by Mandatory Raise

MANDATORY_RAISE = 0   MANDATORY_RAISE = 1
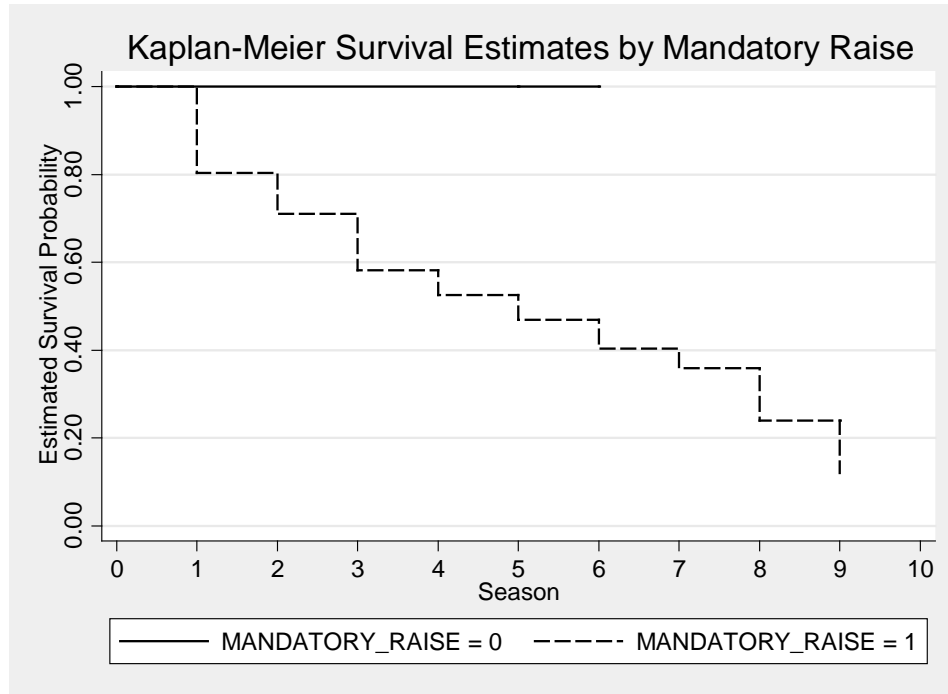
Figure 2.24: Kaplan-Meier Survival Estimates for Wide Receivers by Income Increase (Career Length)

Kaplan-Meier Survival Estimates by Income Increase

INCOME_INCREASE = 0   INCOME_INCREASE = 1
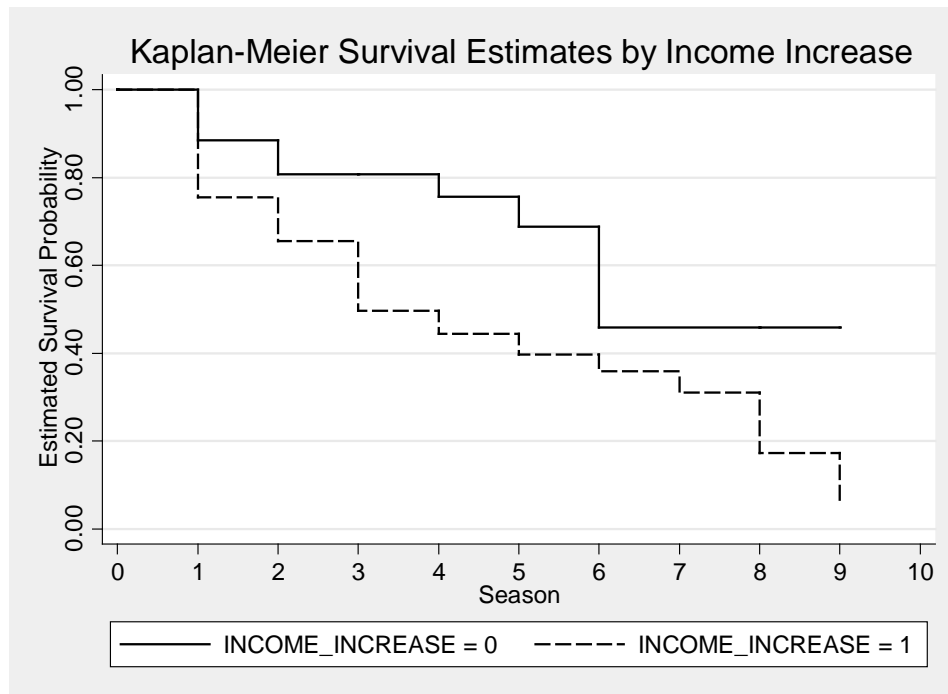
Figure 2.25: Weibull Regression Survival Estimates for Defensive Backs by Mandatory Raise (Firm Tenure)

Weibull Regression Survival Estimates by Mandatory Raise
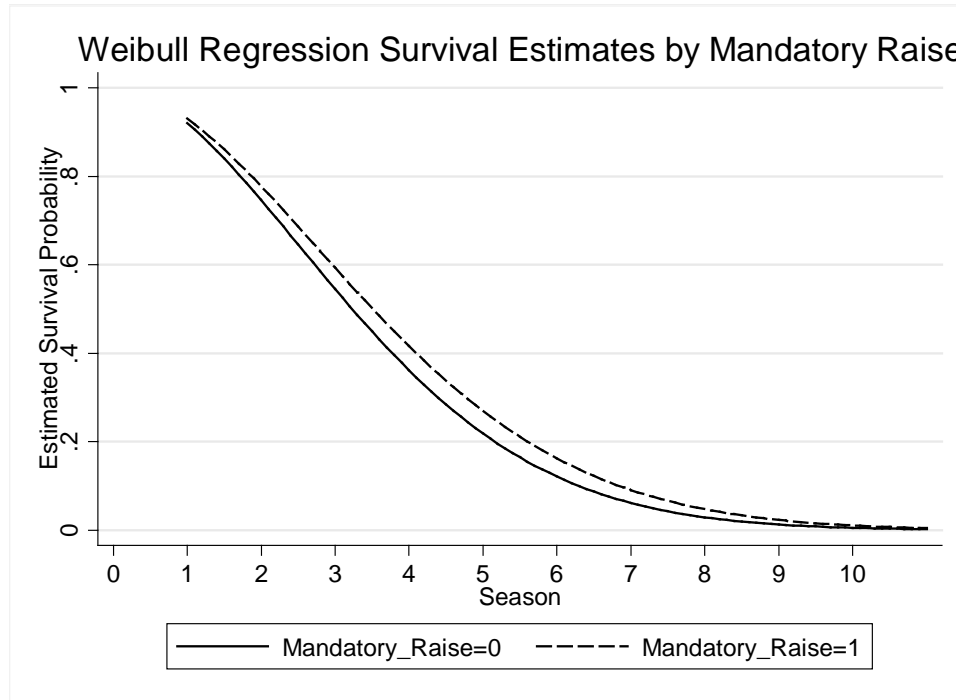
Figure 2.26: Weibull Regression Survival Estimates for Defensive Backs by Income Increase (Firm Tenure)

Weibull Regression Survival Estimates by Income Increase
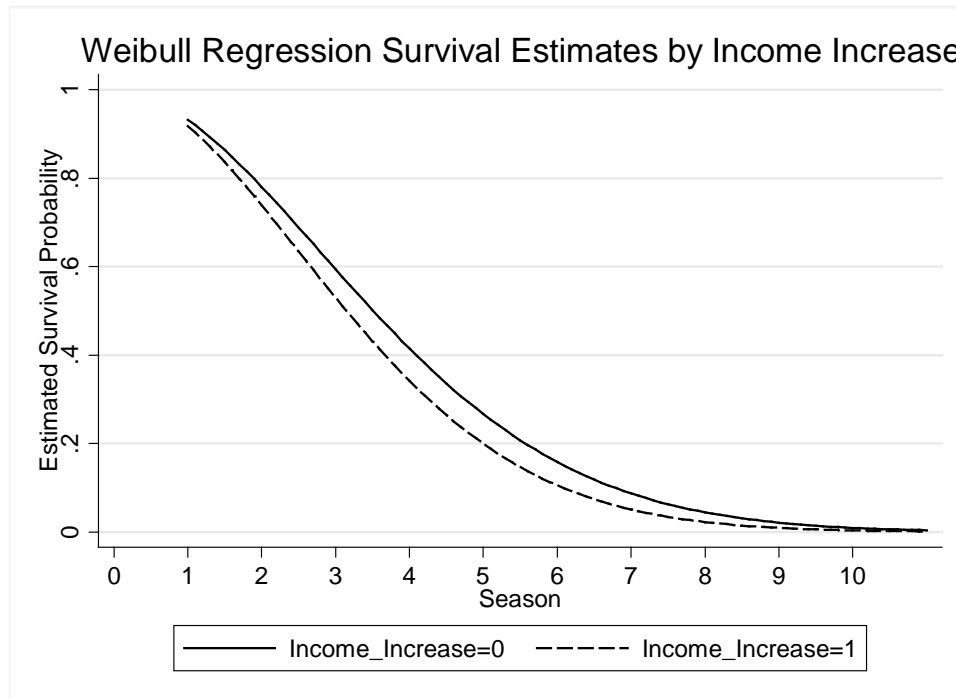
Figure 2.27: Weibull Regression Survival Estimates for Defensive Linemen by Mandatory Raise (Firm Tenure)

Weibull Regression Survival Estimates by Mandatory Raise
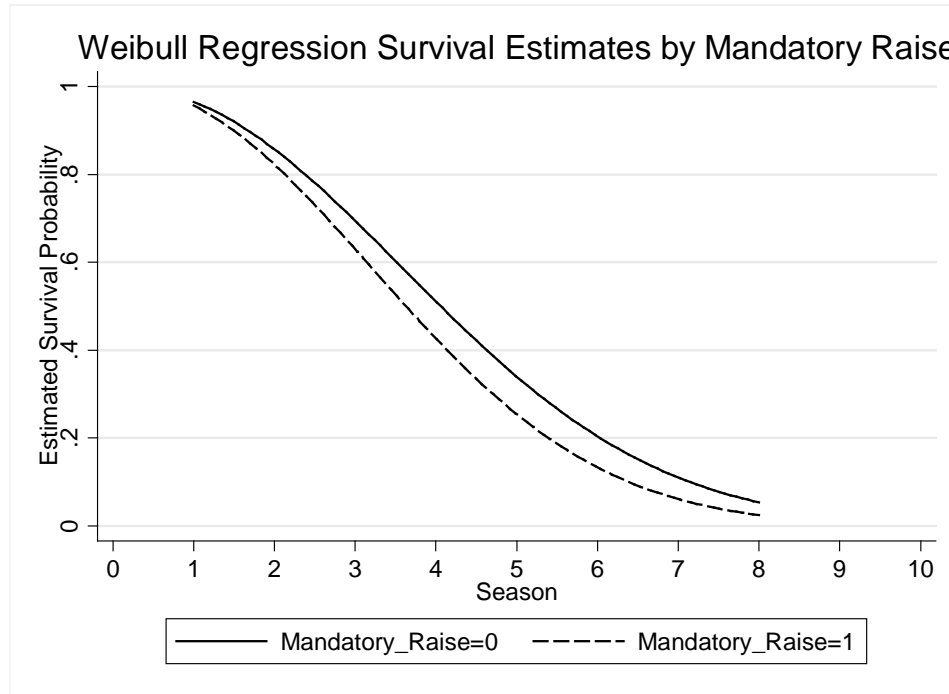
Figure 2.28: Weibull Regression Survival Estimates for Defensive Linemen by Income Increase (Firm Tenure)

Weibull Regression Survival Estimates by Income Increase
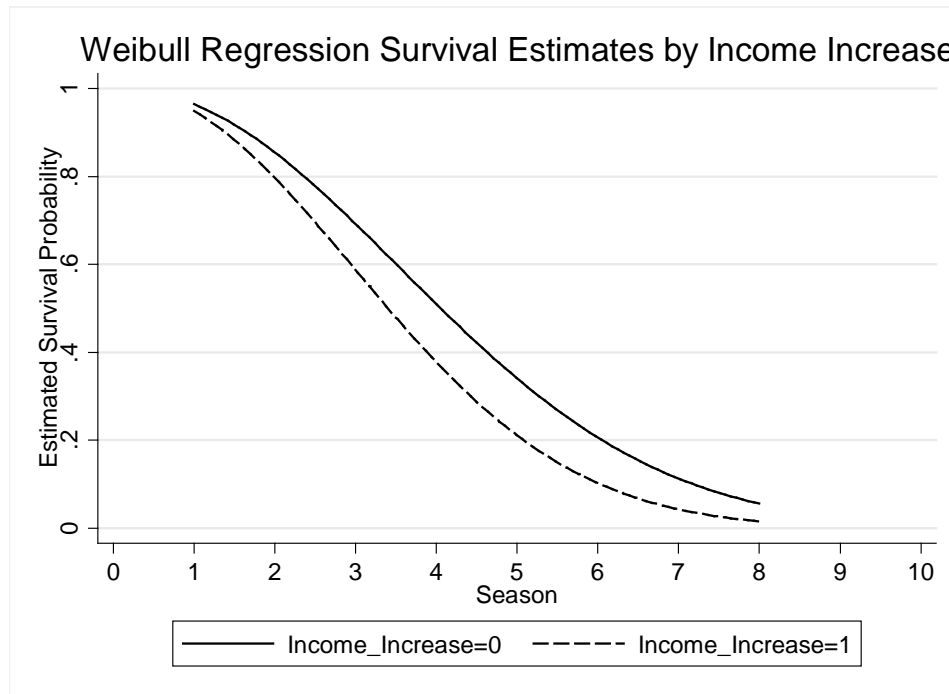
Figure 2.29: Weibull Regression Survival Estimates for Linebackers by Mandatory Raise (Firm Tenure)

Weibull Regression Survival Estimates by Mandatory Raise
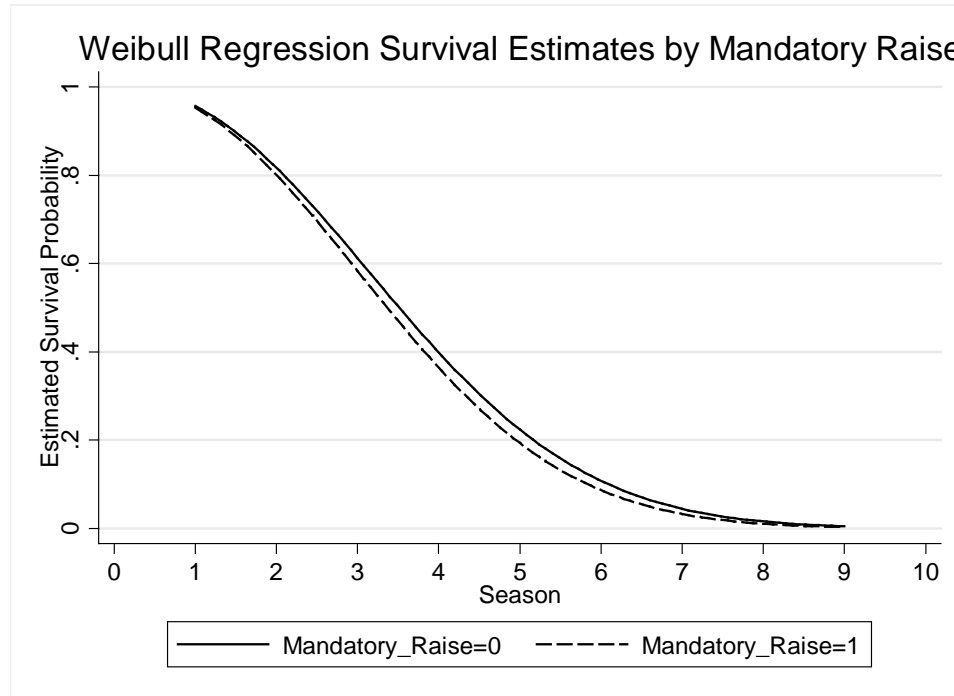
Figure 2.30: Weibull Regression Survival Estimates for Linebackers by Income Increase (Firm Tenure)

Weibull Regression Survival Estimates by Income Increase
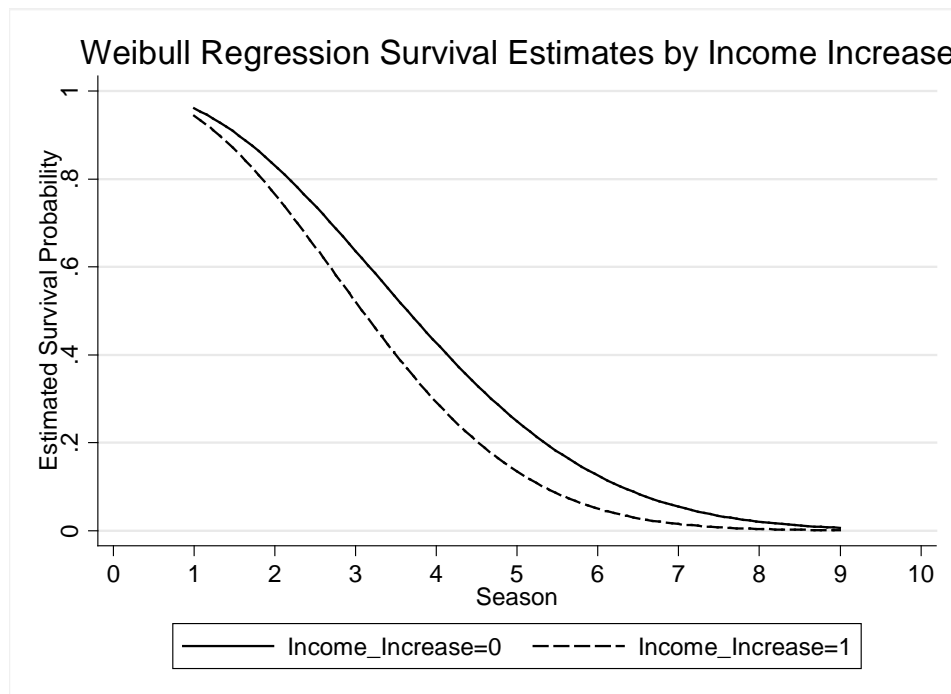
Figure 2.31: Weibull Regression Survival Estimates for Running Backs by Mandatory Raise (Firm Tenure)

Weibull Regression Survival Estimates by Mandatory Raise
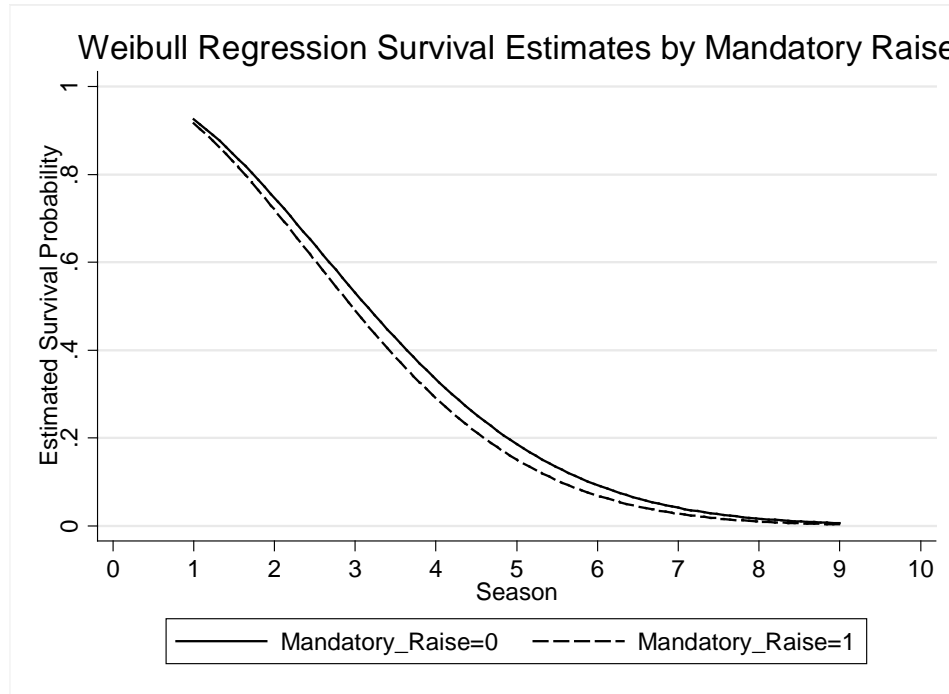
Figure 2.32: Weibull Regression Survival Estimates for Running Backs by Income Increase (Firm Tenure)

Weibull Regression Survival Estimates by Income Increase
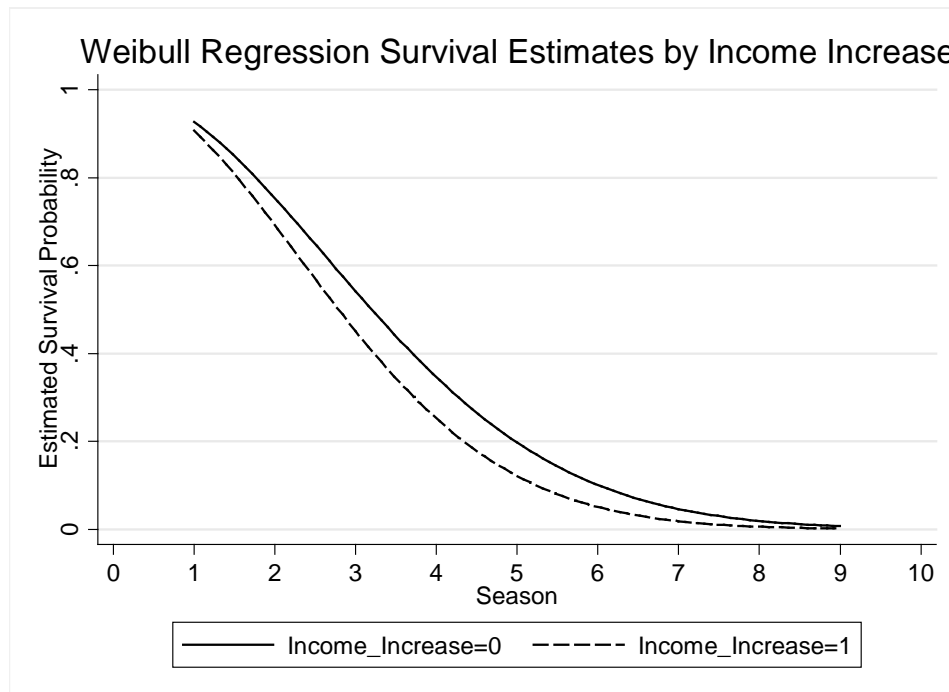
Figure 2.33: Weibull Regression Survival Estimates for Tight Ends by Mandatory Raise (Firm Tenure)

Weibull Regression Survival Estimates by Mandatory Raise
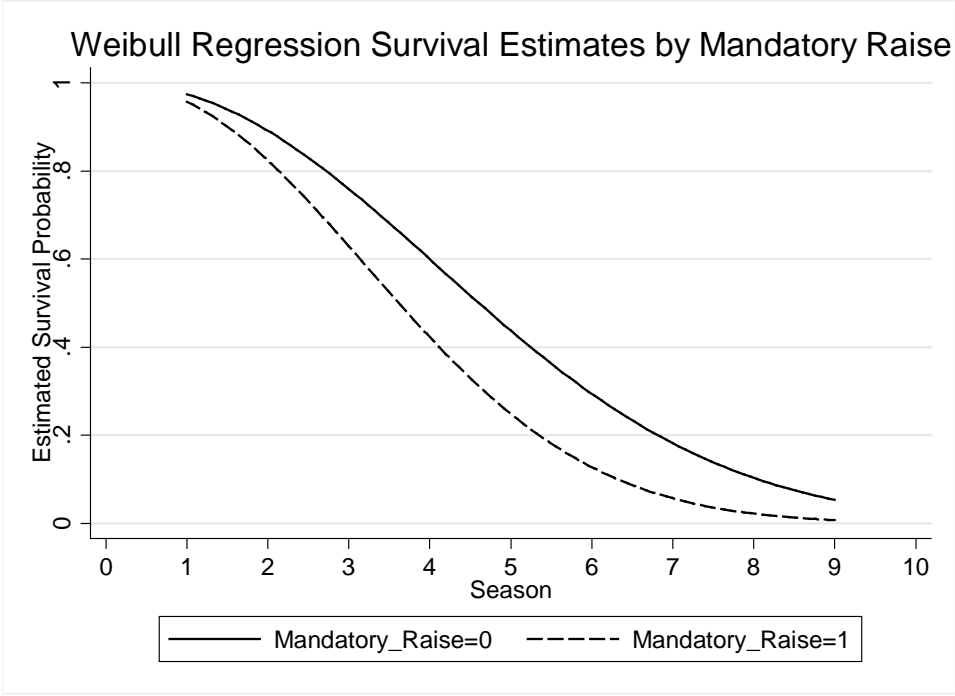
Figure 2.34: Weibull Regression Survival Estimates for Tight Ends by Income Increase (Firm Tenure)

Weibull Regression Survival Estimates by Income Increase
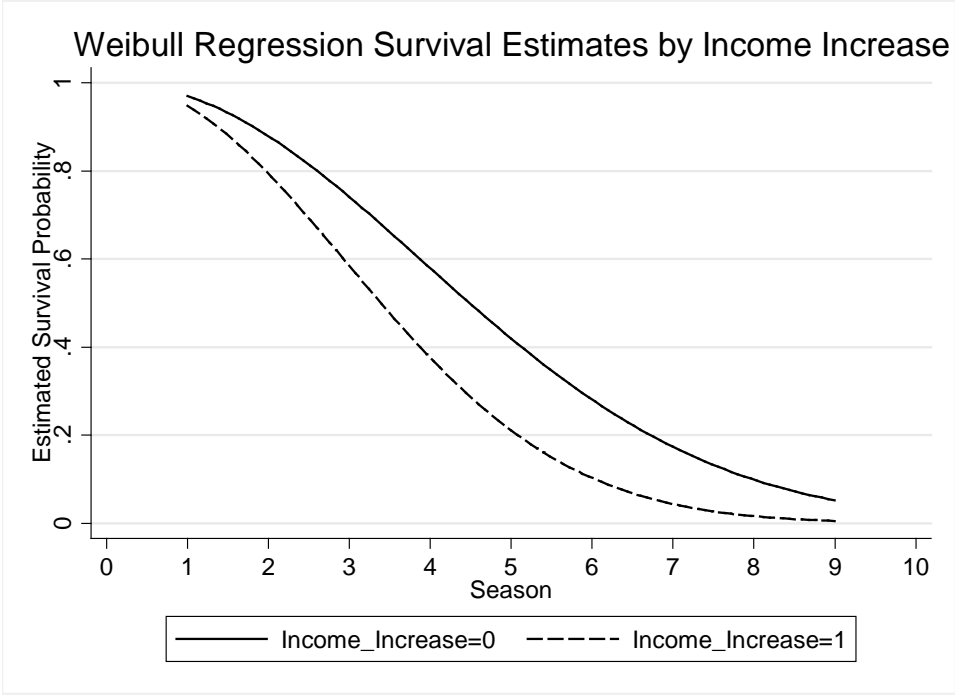
Figure 2.35: Weibull Regression Survival Estimates for Wide Receivers by Mandatory Raise (Firm Tenure)
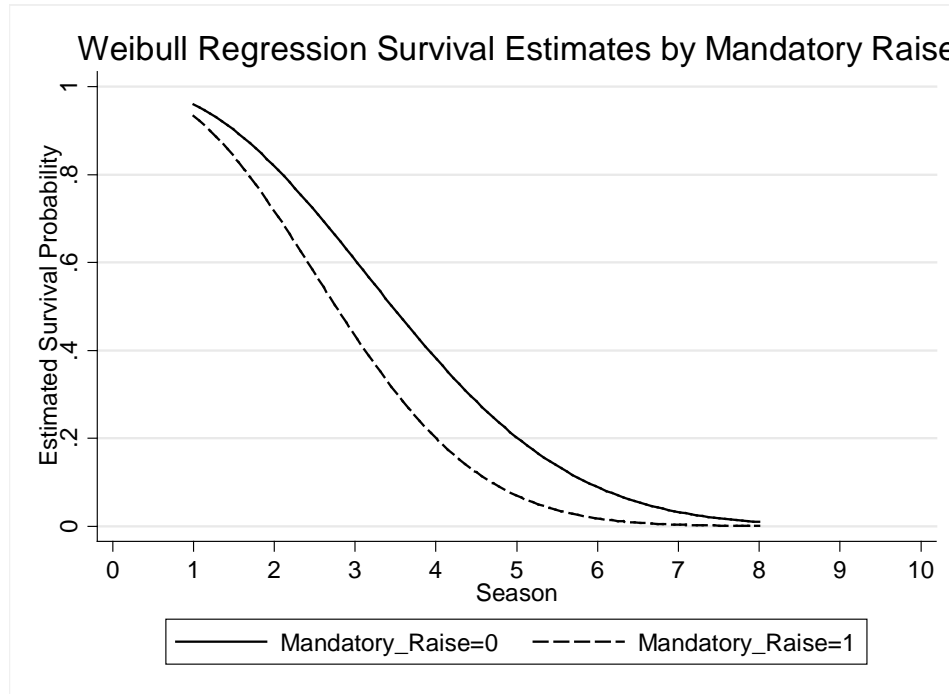
Figure 2.36: Weibull Regression Survival Estimates for Wide Receivers by Income Increase (Firm Tenure)
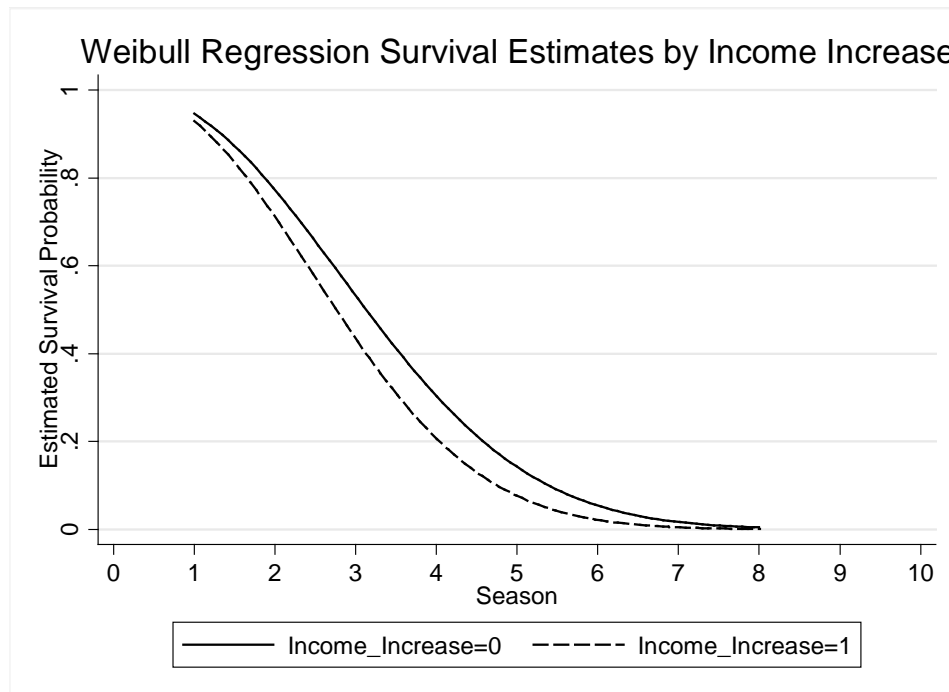
Figure 2.37: Weibull Regression Survival Estimates for Defensive Backs by Mandatory Raise (Career Length)
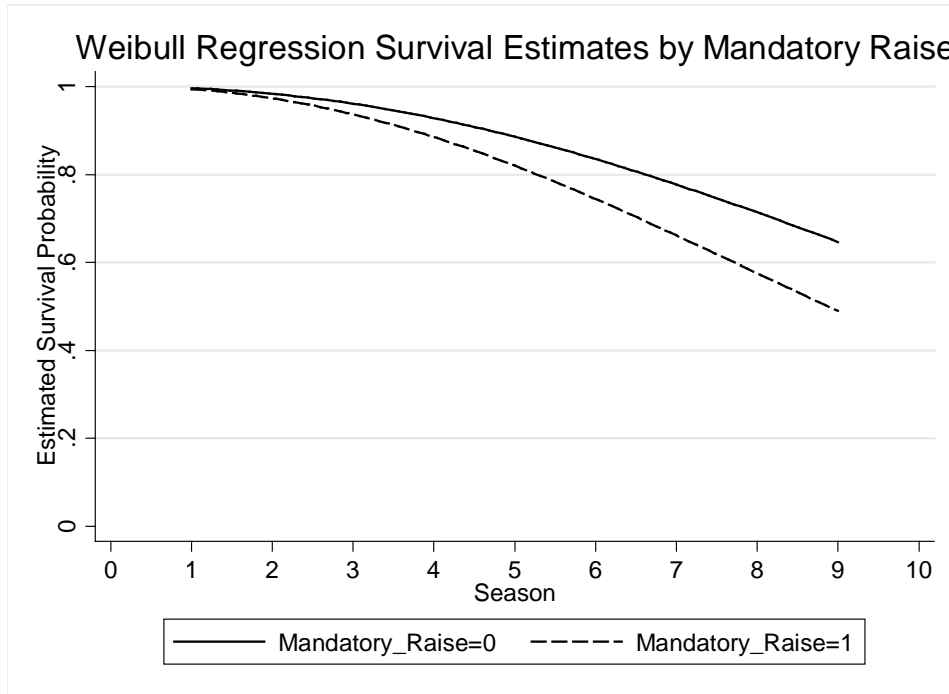
Figure 2.38: Weibull Regression Survival Estimates for Defensive Backs by Income Increase (Career Length)

Figure 2.39: Weibull Regression Survival Estimates for Defensive Linemen by Mandatory Raise (Career Length)

Weibull Regression Survival Estimates by Mandatory Raise

Figure 2.40: Weibull Regression Survival Estimates for Defensive Linemen by Income Increase (Career Length)

Weibull Regression Survival Estimates by Income Increase
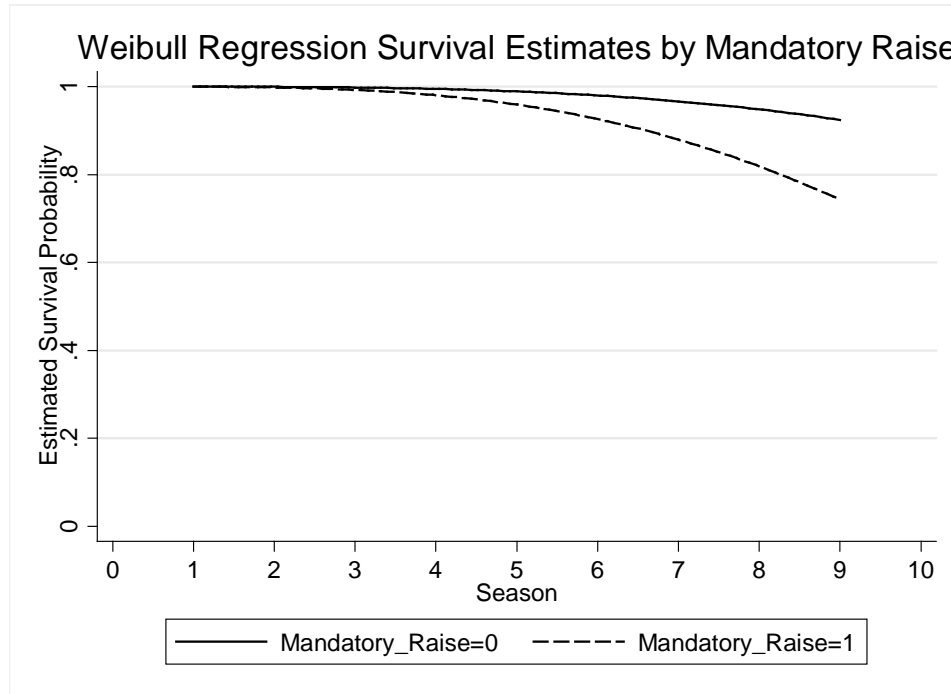
Figure 2.41: Weibull Regression Survival Estimates for Linebackers by Mandatory Raise (Career Length)
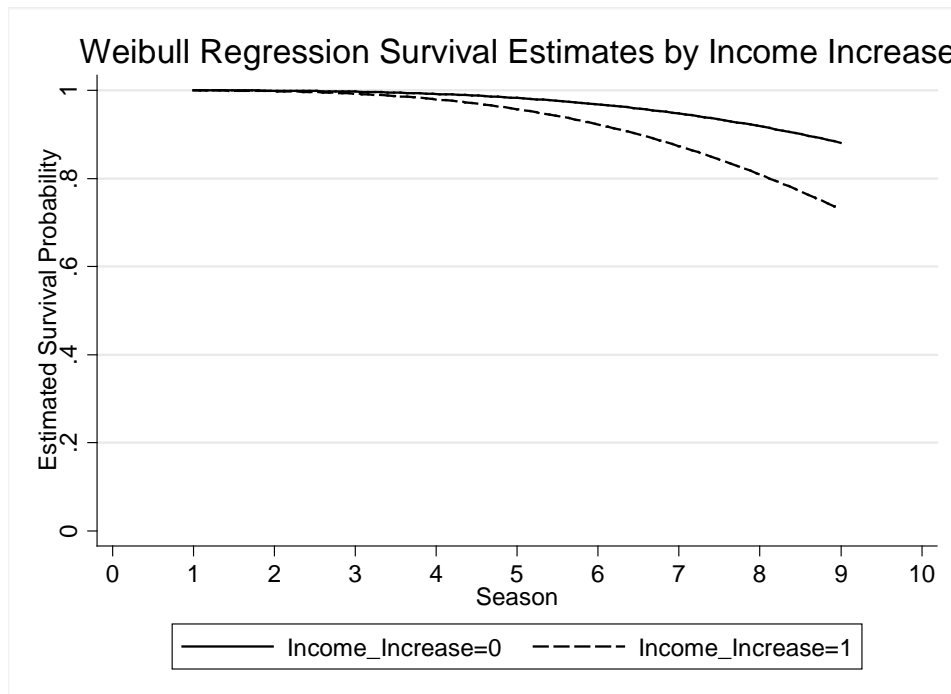
Weibull Regression Survival Estimates by Mandatory Raise

Figure 2.42: Weibull Regression Survival Estimates for Linebackers by Income Increase (Career Length)
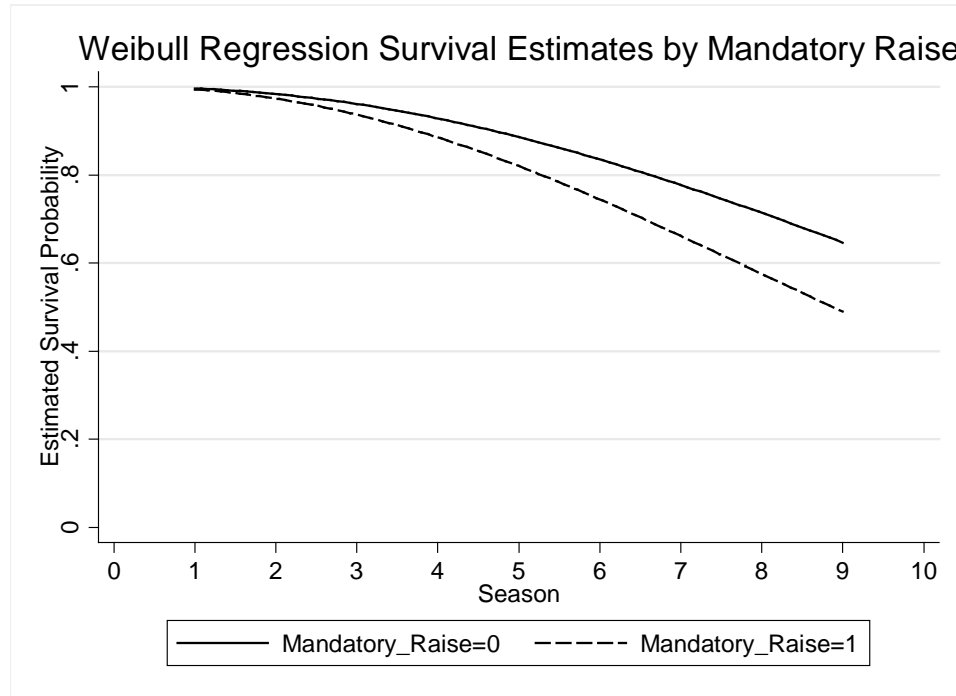
Weibull Regression Survival Estimates by Income Increase
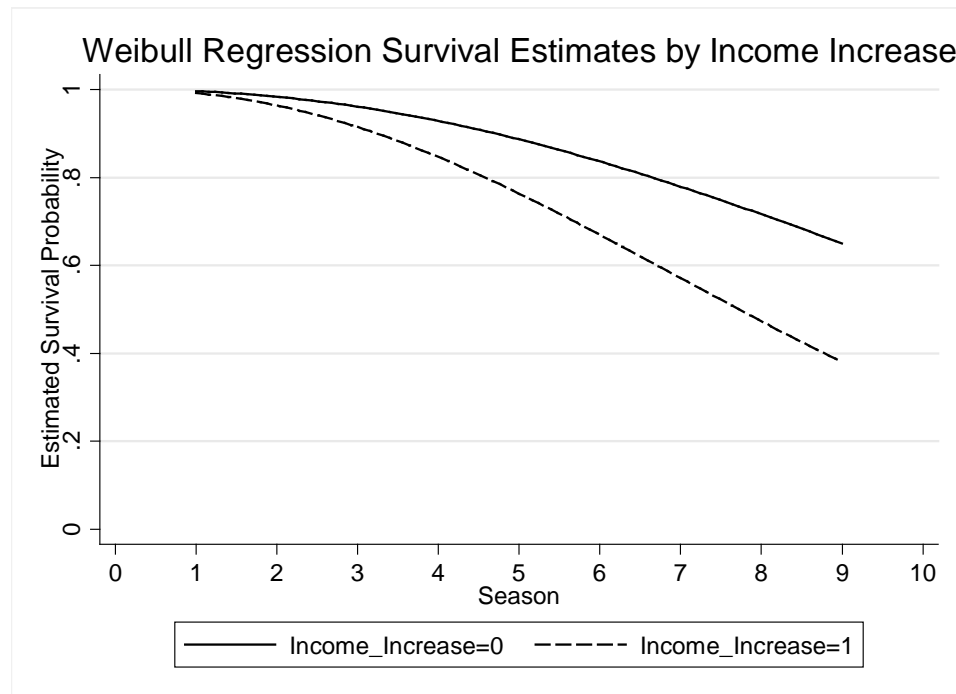
Figure 2.43: Weibull Regression Survival Estimates for Running Backs by Mandatory Raise (Career Length)
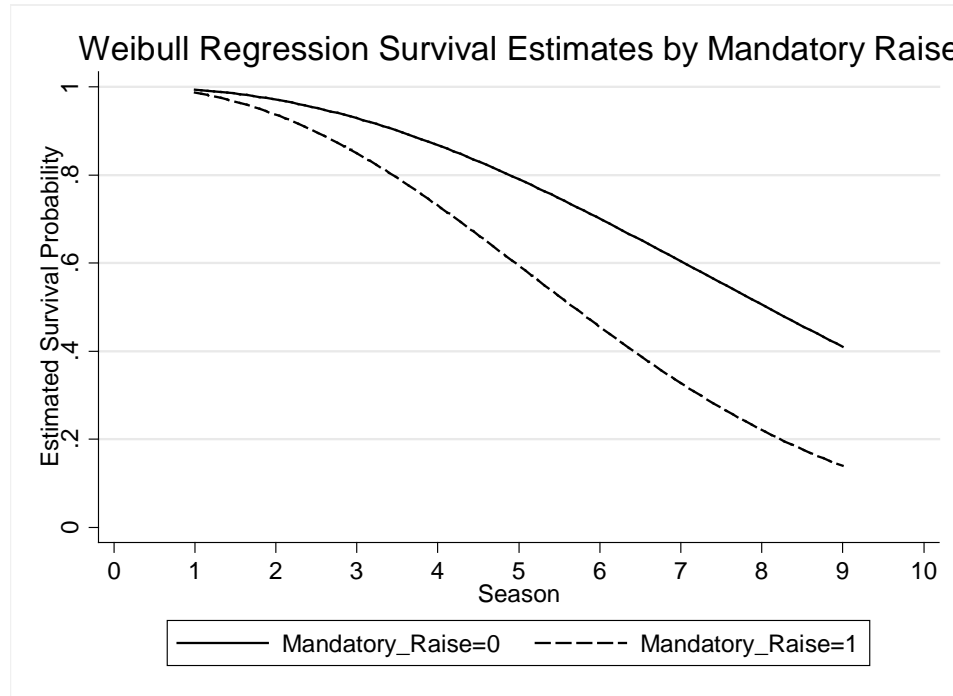
Figure 2.44: Weibull Regression Survival Estimates for Running Backs by Income Increase (Career Length)

Figure 2.45: Weibull Regression Survival Estimates for Tight Ends by Mandatory Raise (Career Length)

Weibull Regression Survival Estimates by Mandatory Raise
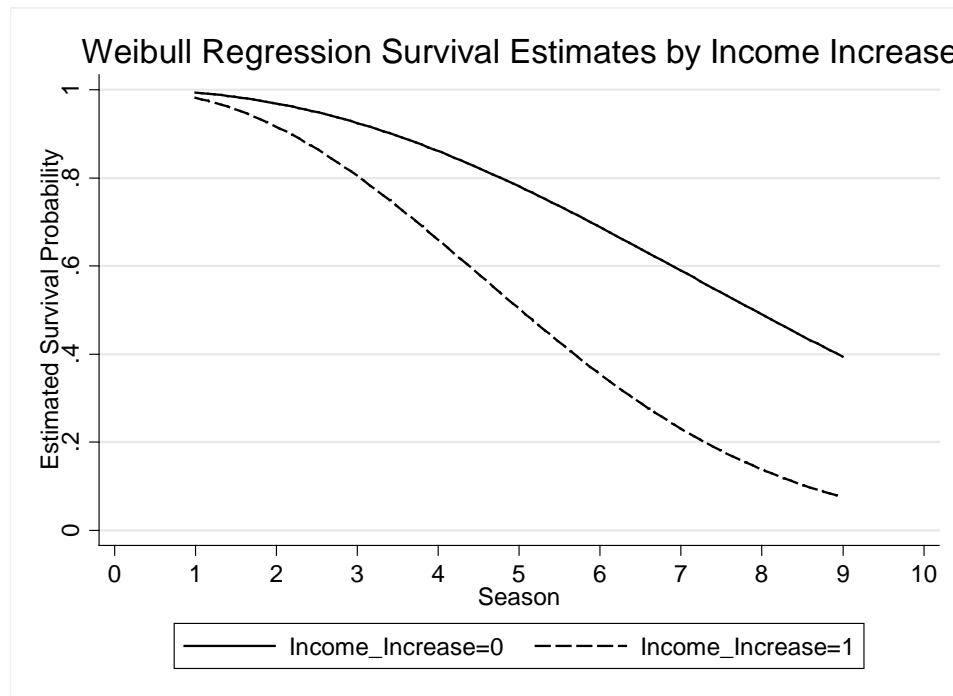
Figure 2.46: Weibull Regression Survival Estimates for Tight Ends by Income Increase (Career Length)
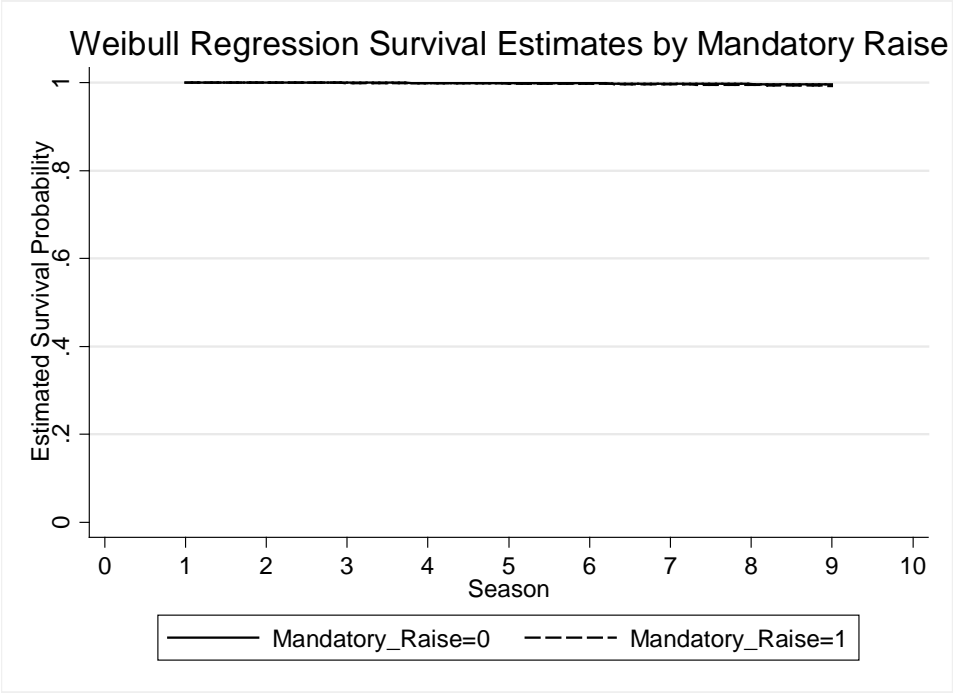
Weibull Regression Survival Estimates by Income Increase
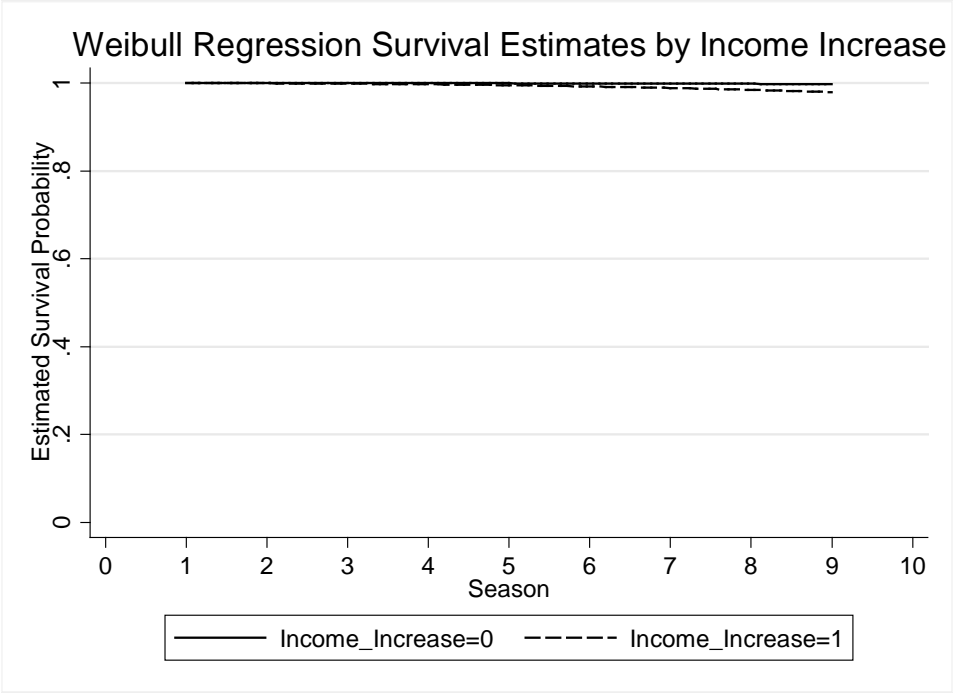
Figure 2.47: Weibull Regression Survival Estimates for Wide Receivers by Mandatory Raise (Career Length)
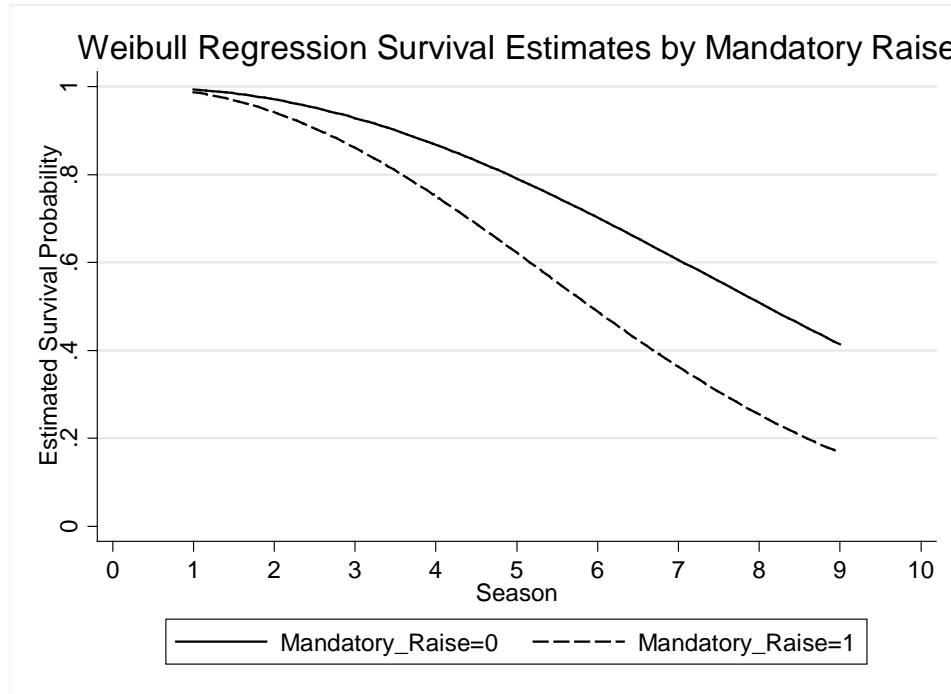
Figure 2.48: Weibull Regression Survival Estimates for Wide Receivers by Income Increase (Career Length)
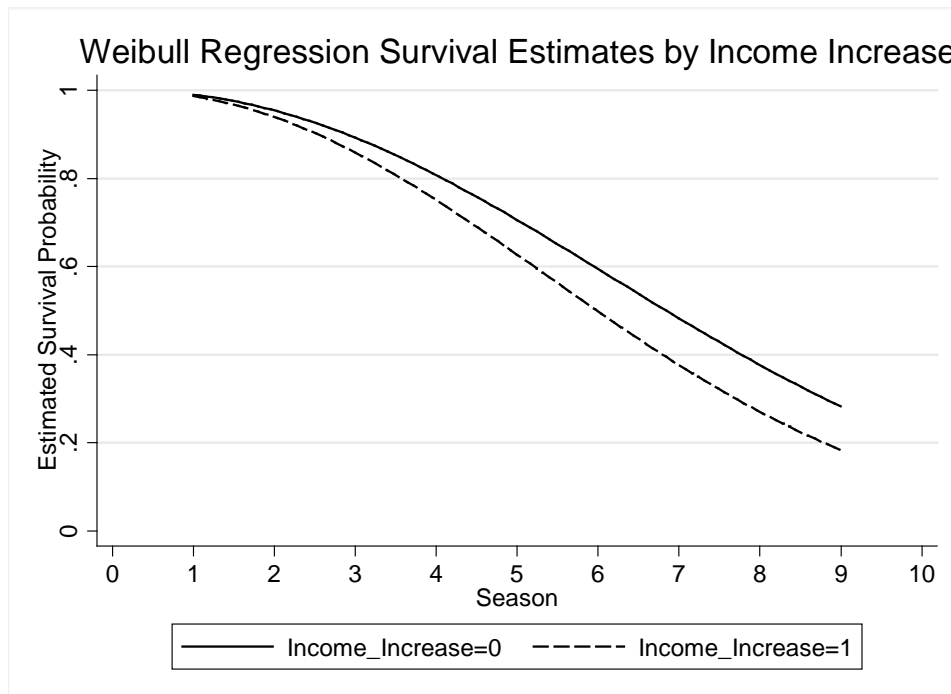
Table 2.1: Defensive Backs Summary Statistics (Firm Tenure)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	2.324	1.517	1.898	1.059	3.029	1.861	2.023	1.015	2.463	1.682
Mandatory Raise Indicator	0.623	0.485	1.000	0.000	0.000	0.000	1.000	0.000	0.450	0.498
Mandatory Raise (in 10000s)	5.131	4.806	8.233	3.391	0.000	0.000	8.603	3.439	3.536	4.494
Income Increase Indicator	0.315	0.465	0.505	0.500	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	2.301	3.845	3.693	4.311	0.000	0.000	7.311	3.213	0.000	0.000
Games Played	13.082	4.300	12.866	4.478	13.438	3.966	12.295	4.867	13.443	3.963
Games Started	7.480	6.554	6.110	6.380	9.745	6.206	4.940	6.103	8.646	6.425
Tackles	42.252	29.920	37.636	29.939	49.883	28.310	33.148	29.328	46.433	29.269
Sacks	0.334	0.726	0.300	0.681	0.390	0.791	0.261	0.686	0.367	0.741
Passes Defended	4.703	4.806	4.011	4.609	5.846	4.911	3.093	4.146	5.442	4.909
Interceptions	1.456	1.791	1.208	1.615	1.866	1.985	0.973	1.390	1.679	1.908
Forced Fumbles	0.534	0.891	0.477	0.859	0.628	0.935	0.423	0.772	0.586	0.937
Pension Eligibility	0.352	0.478	0.125	0.331	0.729	0.445	0.090	0.287	0.473	0.500
Second Team	0.227	0.419	0.112	0.316	0.418	0.494	0.108	0.310	0.282	0.450
Third Team	0.076	0.264	0.037	0.188	0.140	0.347	0.043	0.202	0.091	0.287
Fourth Team	0.025	0.157	0.014	0.117	0.044	0.205	0.018	0.131	0.029	0.167
Fifth Team	0.009	0.093	0.006	0.079	0.013	0.111	0.005	0.071	0.010	0.101
Sixth Team	0.003	0.056	0.003	0.050	0.004	0.065	0.000	0.000	0.005	0.068
Seventh Team	0.001	0.028	0.001	0.036	0.000	0.000	0.000	0.000	0.001	0.034
Win Percentage	0.506	0.192	0.508	0.193	0.502	0.190	0.514	0.185	0.502	0.195
Playoff Appearance	0.370	0.483	0.370	0.483	0.370	0.483	0.383	0.487	0.364	0.481
Signing Bonus (in 10000s)	92.474	200.796	55.355	137.888	153.848	263.824	0.806	2.084	134.572	230.688
Other Bonuses (in 10000s)	27.491	94.685	20.104	79.651	39.705	114.373	0.485	1.288	39.893	112.237
Millions Under Salary Cap	2.376	13.330	2.751	13.778	1.755	12.543	2.458	13.301	2.338	13.350
Age at Beginning of Career	22.489	0.974	22.543	0.965	22.399	0.982	22.663	1.042	22.409	0.930
Height (in inches)	71.648	1.661	71.615	1.694	71.701	1.606	71.575	1.699	71.681	1.643
Weight	200.351	11.354	200.057	11.418	200.837	11.244	200.093	11.871	200.470	11.114
Number of Observations	1270		791		479		400		870	

Table 2.2: Defensive Linemen Summary Statistics (Firm Tenure)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	2.418	1.542	1.893	1.002	3.084	1.826	1.977	0.899	2.581	1.692
Mandatory Raise Indicator	0.560	0.497	1.000	0.000	0.000	0.000	1.000	0.000	0.396	0.489
Mandatory Raise (in 10000s)	4.643	4.795	8.294	3.281	0.000	0.000	8.526	2.318	3.198	4.675
Income Increase Indicator	0.271	0.445	0.484	0.500	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	1.935	3.514	3.457	4.099	0.000	0.000	7.137	2.896	0.000	0.000
Games Played	12.933	4.547	12.293	4.977	13.747	3.785	11.460	5.339	13.481	4.085
Games Started	7.854	6.668	6.028	6.490	10.176	6.155	4.304	5.833	9.174	6.477
Tackles	28.368	19.032	24.267	18.001	33.583	19.051	20.183	16.907	31.413	18.890
Sacks	2.719	2.969	2.153	2.645	3.438	3.198	1.768	2.275	3.072	3.117
Passes Defended	1.385	1.715	1.203	1.667	1.616	1.749	1.030	1.627	1.516	1.729
Interceptions	0.087	0.306	0.072	0.279	0.105	0.337	0.053	0.225	0.099	0.330
Forced Fumbles	0.676	1.146	0.565	1.086	0.817	1.204	0.452	1.090	0.760	1.156
Pension Eligibility	0.414	0.493	0.136	0.343	0.768	0.423	0.057	0.232	0.547	0.498
Second Team	0.233	0.423	0.129	0.335	0.365	0.482	0.133	0.340	0.270	0.444
Third Team	0.081	0.274	0.037	0.189	0.138	0.345	0.011	0.106	0.107	0.310
Fourth Team	0.035	0.184	0.017	0.128	0.059	0.235	0.011	0.106	0.044	0.205
Fifth Team	0.006	0.078	0.004	0.061	0.009	0.096	0.004	0.062	0.007	0.084
Sixth Team	0.003	0.056	0.000	0.000	0.007	0.084	0.000	0.000	0.004	0.065
Seventh Team	0.004	0.064	0.002	0.043	0.007	0.084	0.004	0.062	0.004	0.065
Win Percentage	0.507	0.191	0.505	0.197	0.509	0.184	0.521	0.195	0.501	0.190
Playoff Appearance	0.369	0.483	0.381	0.486	0.354	0.479	0.403	0.491	0.356	0.479
Signing Bonus (in 10000s)	120.524	237.245	68.280	156.188	186.960	298.477	0.873	2.130	165.033	264.450
Other Bonuses (in 10000s)	34.173	103.670	21.825	85.443	49.875	121.312	0.515	1.006	46.693	119.045
Millions Under Salary Cap	2.667	13.478	2.757	13.355	2.552	13.649	3.735	12.895	2.269	13.677
Age at Beginning of Career	22.589	1.049	22.656	1.040	22.504	1.056	22.859	1.098	22.488	1.013
Height (in inches)	75.563	1.491	75.606	1.490	75.508	1.492	75.616	1.511	75.543	1.484
Weight	294.433	24.241	294.440	23.415	294.424	25.280	292.395	21.306	295.191	25.218
Number of Observations	970		543		427		263		707	

Table 2.3: Linebackers Summary Statistics (Firm Tenure)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	2.311	1.525	1.887	1.062	3.003	1.874	2.018	1.002	2.452	1.704
Mandatory Raise Indicator	0.620	0.486	1.000	0.000	0.000	0.000	1.000	0.000	0.437	0.496
Mandatory Raise (in 10000s)	5.222	4.844	8.422	3.298	0.000	0.000	8.516	3.067	3.636	4.745
Income Increase Indicator	0.325	0.469	0.524	0.500	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	2.379	3.852	3.838	4.283	0.000	0.000	7.323	3.073	0.000	0.000
Games Played	13.171	4.435	12.861	4.554	13.677	4.192	12.746	4.689	13.376	4.296
Games Started	7.476	6.702	5.765	6.398	10.269	6.240	4.686	6.057	8.820	6.586
Tackles	52.204	42.454	42.970	39.713	67.269	42.526	35.682	34.822	60.156	43.518
Sacks	1.190	2.125	0.869	1.680	1.715	2.617	0.638	1.275	1.456	2.386
Passes Defended	1.940	2.431	1.452	2.094	2.737	2.718	1.113	1.722	2.338	2.616
Interceptions	0.478	0.933	0.378	0.849	0.640	1.036	0.272	0.630	0.577	1.034
Forced Fumbles	0.651	1.003	0.519	0.929	0.867	1.082	0.382	0.707	0.781	1.096
Pension Eligibility	0.378	0.485	0.150	0.357	0.749	0.434	0.117	0.322	0.503	0.500
Second Team	0.233	0.423	0.126	0.332	0.408	0.492	0.117	0.322	0.289	0.454
Third Team	0.078	0.268	0.043	0.202	0.136	0.343	0.053	0.224	0.090	0.287
Fourth Team	0.025	0.157	0.013	0.113	0.045	0.208	0.018	0.132	0.029	0.168
Fifth Team	0.007	0.083	0.004	0.061	0.012	0.109	0.000	0.000	0.010	0.101
Win Percentage	0.501	0.187	0.509	0.188	0.488	0.186	0.493	0.186	0.505	0.188
Playoff Appearance	0.372	0.484	0.394	0.489	0.335	0.473	0.360	0.481	0.378	0.485
Signing Bonus (in 10000s)	88.563	201.185	45.108	107.954	159.457	282.032	0.759	2.122	130.823	233.412
Other Bonuses (in 10000s)	22.123	72.678	15.677	68.081	32.639	78.588	0.433	0.713	32.562	86.559
Millions Under Salary Cap	3.195	13.135	3.685	13.034	2.395	13.279	3.607	12.626	2.997	13.379
Age at Beginning of Career	22.582	0.881	22.622	0.886	22.517	0.872	22.746	0.891	22.503	0.867
Height (in inches)	73.794	1.402	73.698	1.369	73.952	1.443	73.774	1.388	73.804	1.410
Weight	240.663	8.495	239.852	8.171	241.985	8.854	239.838	8.002	241.060	8.701
Number of Observations	871		540		331		283		588	

Table 2.4: Running Backs Summary Statistics (Firm Tenure)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	2.287	1.599	1.883	1.243	2.977	1.881	1.848	1.002	2.549	1.817
Mandatory Raise Indicator	0.631	0.483	1.000	0.000	0.000	0.000	1.000	0.000	0.411	0.493
Mandatory Raise (in 10000s)	5.454	4.882	8.646	3.187	0.000	0.000	8.838	3.014	3.438	4.664
Income Increase Indicator	0.373	0.484	0.592	0.492	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	2.901	4.227	4.598	4.530	0.000	0.000	7.768	3.164	0.000	0.000
Games Played	11.922	4.902	11.632	5.070	12.418	4.569	10.773	5.417	12.607	4.435
Games Started	4.702	5.383	3.664	4.998	6.475	5.561	2.348	3.913	6.104	5.648
Touches	96.740	111.100	81.296	103.343	123.130	118.868	52.250	79.024	123.253	118.799
Yards	456.538	528.336	393.863	506.884	563.636	547.695	256.345	395.881	575.840	560.722
Touchdowns	2.868	4.059	2.590	4.026	3.345	4.078	1.667	3.058	3.585	4.402
Fumbles	1.202	1.590	1.034	1.474	1.490	1.736	0.761	1.233	1.465	1.716
Fumbles Lost	0.738	1.128	0.653	1.074	0.881	1.205	0.473	0.937	0.894	1.201
Pension Eligibility	0.383	0.487	0.157	0.364	0.770	0.422	0.136	0.344	0.530	0.500
Second Team	0.239	0.427	0.132	0.339	0.421	0.495	0.144	0.352	0.296	0.457
Third Team	0.065	0.247	0.034	0.180	0.119	0.324	0.038	0.191	0.081	0.274
Fourth Team	0.027	0.162	0.018	0.133	0.042	0.201	0.019	0.137	0.032	0.175
Fifth Team	0.008	0.092	0.011	0.105	0.004	0.062	0.015	0.122	0.005	0.067
Sixth Team	0.007	0.084	0.000	0.000	0.019	0.137	0.000	0.000	0.011	0.106
Seventh Team	0.001	0.038	0.002	0.047	0.000	0.000	0.004	0.062	0.000	0.000
Win Percentage	0.491	0.192	0.489	0.193	0.493	0.191	0.492	0.183	0.490	0.197
Playoff Appearance	0.349	0.477	0.345	0.476	0.356	0.480	0.348	0.477	0.350	0.477
Signing Bonus (in 10000s)	70.485	165.010	48.409	144.359	108.208	189.746	0.578	1.676	112.145	197.057
Other Bonuses (in 10000s)	26.754	94.062	17.219	85.760	43.045	104.948	0.492	1.492	42.404	116.075
Millions Under Salary Cap	2.479	13.565	2.705	14.175	2.092	12.471	2.473	14.275	2.482	13.140
Age at Beginning of Career	22.542	1.067	22.608	1.090	22.429	1.019	22.769	1.111	22.406	1.017
Height (in inches)	71.277	1.589	71.253	1.660	71.318	1.463	71.299	1.602	71.264	1.583
Weight	225.289	17.157	224.610	16.967	226.448	17.450	225.136	17.013	225.379	17.261
Number of Observations	707		446		261		264		443	

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Table 2.5: Tight Ends Summary Statistics (Firm Tenure)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	2.497	1.709	1.986	1.249	3.283	2.004	1.929	0.894	2.768	1.927
Mandatory Raise Indicator	0.606	0.489	1.000	0.000	0.000	0.000	1.000	0.000	0.418	0.494
Mandatory Raise (in 10000s)	5.057	4.818	8.348	3.283	0.000	0.000	8.853	2.943	3.247	4.474
Income Increase Indicator	0.323	0.468	0.533	0.500	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	2.474	3.860	4.085	4.246	0.000	0.000	7.664	2.510	0.000	0.000
Games Played	12.529	4.869	12.217	5.139	13.007	4.399	11.301	5.535	13.114	4.411
Games Started	7.109	5.749	5.953	5.533	8.884	5.640	4.389	5.100	8.405	5.596
Touches	22.017	21.247	18.594	19.873	27.275	22.267	13.947	17.693	25.865	21.749
Yards	231.394	235.887	197.670	221.721	283.963	248.228	144.504	193.118	273.175	243.441
Touchdowns	1.857	2.050	1.505	1.828	2.399	2.252	1.204	1.748	2.169	2.113
Fumbles	0.320	0.620	0.311	0.636	0.333	0.596	0.239	0.539	0.359	0.653
Fumbles Lost	0.203	0.462	0.203	0.458	0.203	0.470	0.142	0.350	0.232	0.505
Pension Eligibility	0.351	0.478	0.146	0.354	0.667	0.473	0.071	0.258	0.485	0.501
Second Team	0.186	0.389	0.104	0.306	0.312	0.465	0.080	0.272	0.236	0.426
Third Team	0.037	0.189	0.024	0.152	0.058	0.235	0.027	0.161	0.042	0.201
Fourth Team	0.017	0.130	0.014	0.118	0.022	0.146	0.009	0.094	0.021	0.144
Fifth Team	0.006	0.075	0.005	0.069	0.007	0.085	0.000	0.000	0.008	0.092
Win Percentage	0.520	0.190	0.514	0.192	0.528	0.186	0.516	0.184	0.522	0.193
Playoff Appearance	0.409	0.492	0.401	0.491	0.420	0.495	0.434	0.498	0.397	0.490
Signing Bonus (in 10000s)	73.931	153.720	54.683	140.648	103.501	168.151	0.724	1.899	108.836	176.502
Other Bonuses (in 10000s)	18.995	77.691	9.194	36.643	34.052	113.715	0.465	1.246	27.830	93.179
Millions Under Salary Cap	2.438	12.900	3.044	13.202	1.508	12.410	2.313	12.712	2.498	13.014
Age at Beginning of Career	22.766	1.025	22.745	0.934	22.797	1.154	22.920	1.045	22.692	1.010
Height (in inches)	76.186	1.308	76.179	1.249	76.196	1.398	76.115	1.245	76.219	1.338
Weight	255.169	9.526	254.840	9.631	255.674	9.376	254.283	10.293	255.591	9.131
Number of Observations	350		212		138		113		237	

Table 2.6: Wide Receivers Summary Statistics (Firm Tenure)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	2.230	1.467	1.858	0.975	2.869	1.892	1.963	0.899	2.354	1.652
Mandatory Raise Indicator	0.632	0.483	1.000	0.000	0.000	0.000	1.000	0.000	0.461	0.499
Mandatory Raise (in 10000s)	5.138	4.556	8.131	2.913	0.000	0.000	8.377	2.801	3.637	4.432
Income Increase Indicator	0.317	0.466	0.501	0.501	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	2.319	3.848	3.669	4.299	0.000	0.000	7.322	3.178	0.000	0.000
Games Played	12.173	4.932	11.457	5.282	13.402	3.983	10.944	5.399	12.742	4.595
Games Started	6.048	6.023	4.172	5.203	9.271	5.978	3.269	4.636	7.337	6.159
Touches	32.132	28.682	24.056	24.318	46.000	30.304	19.537	22.020	37.970	29.543
Yards	331.985	292.478	270.231	268.167	457.015	300.270	225.533	242.122	387.319	301.234
Touchdowns	2.441	3.013	1.768	2.447	3.598	3.509	1.389	2.108	2.929	3.239
Fumbles	0.752	1.208	0.752	1.325	0.753	0.977	0.588	1.079	0.828	1.257
Fumbles Lost	0.372	0.678	0.350	0.686	0.410	0.666	0.278	0.600	0.416	0.708
Pension Eligibility	0.331	0.471	0.093	0.290	0.741	0.439	0.046	0.211	0.464	0.499
Second Team	0.173	0.379	0.079	0.270	0.335	0.473	0.060	0.238	0.225	0.418
Third Team	0.070	0.256	0.030	0.171	0.139	0.347	0.019	0.135	0.094	0.293
Fourth Team	0.022	0.147	0.009	0.096	0.044	0.205	0.014	0.117	0.026	0.159
Fifth Team	0.013	0.114	0.005	0.068	0.028	0.165	0.000	0.000	0.019	0.138
Sixth Team	0.001	0.038	0.000	0.000	0.004	0.063	0.000	0.000	0.002	0.046
Win Percentage	0.497	0.198	0.495	0.199	0.500	0.198	0.483	0.207	0.503	0.194
Playoff Appearance	0.370	0.483	0.385	0.487	0.343	0.476	0.366	0.483	0.371	0.484
Signing Bonus (in 10000s)	113.273	229.896	57.060	129.378	209.798	316.824	0.625	1.718	165.488	262.250
Other Bonuses (in 10000s)	33.419	100.649	20.725	87.020	55.217	117.539	0.430	0.884	48.710	118.726
Millions Under Salary Cap	2.709	13.132	3.175	13.155	1.908	13.079	2.247	13.330	2.923	13.048
Age at Beginning of Career	22.459	0.957	22.538	1.015	22.323	0.832	22.796	1.106	22.303	0.835
Height (in inches)	72.922	2.215	72.963	2.239	72.853	2.176	73.005	2.281	72.884	2.185
Weight	201.348	14.001	201.193	14.132	201.614	13.798	200.727	14.169	201.635	13.929
Number of Observations	682		431		251		216		466	

Table 2.7: Defensive Backs Summary Statistics (Career Length)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	2.867	1.820	2.121	1.237	4.767	1.683	2.219	1.062	3.228	2.042
Mandatory Raise Indicator	0.718	0.450	1.000	0.000	0.000	0.000	1.000	0.000	0.561	0.497
Mandatory Raise (in 10000s)	5.854	4.166	8.154	2.324	0.000	0.000	8.337	2.090	4.473	4.388
Income Increase Indicator	0.357	0.479	0.498	0.500	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	2.556	3.769	3.561	4.026	0.000	0.000	7.153	2.616	0.000	0.000
Games Played	13.073	4.252	12.916	4.400	13.474	3.828	12.436	4.745	13.428	3.911
Games Started	7.115	6.493	6.140	6.395	9.596	6.077	5.184	6.231	8.189	6.391
Tackles	42.188	29.563	39.115	30.096	50.007	26.659	34.871	29.948	46.257	28.571
Sacks	0.307	0.680	0.298	0.679	0.330	0.682	0.284	0.719	0.320	0.657
Passes Defended	4.878	4.957	4.277	4.710	6.407	5.243	3.383	4.328	5.709	5.091
Interceptions	1.394	1.745	1.211	1.607	1.859	1.982	1.018	1.429	1.603	1.867
Forced Fumbles	0.548	0.906	0.511	0.889	0.641	0.945	0.459	0.809	0.597	0.953
Pension Eligibility	0.185	0.388	0.036	0.187	0.563	0.497	0.015	0.120	0.280	0.449
Win Percentage	0.511	0.194	0.508	0.193	0.518	0.196	0.517	0.185	0.507	0.199
Playoff Appearance	0.388	0.487	0.380	0.486	0.407	0.492	0.401	0.491	0.380	0.486
Signing Bonus (in 10000s)	93.034	206.207	54.172	131.489	191.916	305.539	0.730	1.893	144.364	242.526
Other Bonuses (in 10000s)	27.729	92.974	21.766	81.950	42.904	115.202	0.454	0.918	42.897	113.197
Millions Under Salary Cap	3.077	13.178	3.067	13.722	3.102	11.705	2.749	12.898	3.260	13.338
Age at Beginning of Career	22.574	0.980	22.560	0.970	22.607	1.006	22.687	1.058	22.511	0.929
Height (in inches)	71.665	1.655	71.656	1.691	71.685	1.564	71.596	1.735	71.702	1.609
Weight	200.356	11.174	200.090	11.257	201.033	10.952	200.097	11.768	200.501	10.837
Number of Observations	957		687		270		342		615	

Table 2.8: Defensive Linemen Summary Statistics (Career Length)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	3.181	2.059	2.159	1.280	5.070	1.884	2.129	0.935	3.672	2.248
Mandatory Raise Indicator	0.649	0.478	1.000	0.000	0.000	0.000	1.000	0.000	0.485	0.500
Mandatory Raise (in 10000s)	5.328	4.355	8.212	2.351	0.000	0.000	8.614	2.025	3.794	4.304
Income Increase Indicator	0.318	0.466	0.490	0.500	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	2.307	3.697	3.555	4.078	0.000	0.000	7.249	2.663	0.000	0.000
Games Played	12.875	4.591	12.207	5.011	14.109	3.367	11.155	5.466	13.678	3.871
Games Started	7.424	6.670	5.867	6.467	10.301	6.067	4.228	5.832	8.915	6.516
Tackles	29.066	19.512	24.510	18.153	37.484	19.165	19.914	16.979	33.338	19.159
Sacks	2.660	3.027	2.138	2.691	3.625	3.362	1.774	2.342	3.074	3.217
Passes Defended	1.432	1.782	1.247	1.735	1.773	1.820	1.052	1.656	1.610	1.812
Interceptions	0.092	0.316	0.076	0.281	0.121	0.372	0.056	0.230	0.109	0.348
Forced Fumbles	0.716	1.211	0.592	1.124	0.945	1.330	0.478	1.136	0.827	1.231
Pension Eligibility	0.250	0.433	0.047	0.211	0.625	0.485	0.009	0.093	0.362	0.481
Win Percentage	0.510	0.195	0.504	0.198	0.520	0.190	0.522	0.197	0.504	0.194
Playoff Appearance	0.380	0.486	0.383	0.487	0.375	0.485	0.414	0.494	0.364	0.482
Signing Bonus (in 10000s)	118.263	237.496	59.738	142.022	226.397	324.964	0.857	2.052	173.068	270.791
Other Bonuses (in 10000s)	35.272	100.736	23.763	89.259	56.537	116.293	0.508	0.992	51.500	118.594
Millions Under Salary Cap	3.230	13.195	2.995	13.252	3.663	13.103	3.865	12.816	2.933	13.370
Age at Beginning of Career	22.647	1.046	22.683	1.028	22.582	1.078	22.897	1.056	22.531	1.022
Height (in inches)	75.584	1.526	75.617	1.512	75.523	1.552	75.638	1.517	75.559	1.531
Weight	295.368	24.872	294.700	23.831	296.602	26.693	291.970	21.806	296.954	26.050
Number of Observations	729		473		256		232		497	

Table 2.9: Linebackers Summary Statistics (Career Length)

Variable	Full Sample		Mandatory Raise		Mandatory Raise		Income Increase		Income Increase	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	3.052	1.959	2.236	1.371	4.985	1.779	2.367	1.213	3.435	2.180
Mandatory Raise Indicator	0.703	0.457	1.000	0.000	0.000	0.000	1.000	0.000	0.537	0.499
Mandatory Raise (in 10000s)	5.693	4.181	8.098	2.316	0.000	0.000	8.221	2.063	4.282	4.396
Income Increase Indicator	0.358	0.480	0.510	0.500	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	2.550	3.737	3.627	3.996	0.000	0.000	7.118	2.539	0.000	0.000
Games Played	13.176	4.397	12.915	4.497	13.794	4.094	12.817	4.610	13.377	4.265
Games Started	7.396	6.702	6.068	6.487	10.538	6.145	5.071	6.239	8.693	6.607
Tackles	52.851	41.448	45.947	39.887	69.191	40.576	39.254	35.555	60.440	42.587
Sacks	1.213	2.144	0.950	1.774	1.834	2.740	0.698	1.359	1.500	2.431
Passes Defended	1.958	2.394	1.561	2.154	2.899	2.661	1.238	1.799	2.360	2.584
Interceptions	0.469	0.882	0.382	0.808	0.673	1.009	0.308	0.663	0.558	0.973
Forced Fumbles	0.681	1.049	0.558	0.968	0.970	1.172	0.421	0.739	0.826	1.163
Pension Eligibility	0.224	0.417	0.064	0.244	0.603	0.491	0.042	0.200	0.326	0.469
Win Percentage	0.504	0.190	0.511	0.189	0.487	0.192	0.493	0.185	0.510	0.192
Playoff Appearance	0.384	0.487	0.391	0.488	0.367	0.483	0.350	0.478	0.402	0.491
Signing Bonus (in 10000s)	87.663	196.000	46.521	110.266	185.042	295.604	0.650	1.891	136.229	230.880
Other Bonuses (in 10000s)	25.687	80.766	17.527	72.524	45.001	94.985	0.453	0.725	39.771	98.067
Millions Under Salary Cap	3.526	13.253	3.690	13.139	3.138	13.546	3.265	12.883	3.673	13.468
Age at Beginning of Career	22.603	0.877	22.616	0.887	22.573	0.855	22.754	0.893	22.519	0.857
Height (in inches)	73.827	1.333	73.718	1.336	74.085	1.290	73.800	1.339	73.842	1.330
Weight	240.124	8.259	239.692	8.058	241.146	8.654	239.296	7.845	240.586	8.456
Number of Observations	670		471		199		240		430	

Table 2.10: Running Backs Summary Statistics (Career Length)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	2.962	2.023	2.182	1.517	4.993	1.748	2.147	1.250	3.534	2.256
Mandatory Raise Indicator	0.722	0.448	1.000	0.000	0.000	0.000	1.000	0.000	0.528	0.500
Mandatory Raise (in 10000s)	6.105	4.247	8.450	2.262	0.000	0.000	8.681	2.011	4.295	4.466
Income Increase Indicator	0.413	0.493	0.571	0.496	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	3.231	4.143	4.473	4.268	0.000	0.000	7.832	2.350	0.000	0.000
Games Played	12.099	4.830	11.916	4.945	12.575	4.496	11.217	5.350	12.718	4.331
Games Started	4.437	5.265	3.618	4.942	6.568	5.495	2.382	3.959	5.880	5.585
Touches	95.943	108.412	84.179	102.679	126.562	117.008	55.023	79.261	124.680	116.705
Yards	454.698	515.469	406.776	498.564	579.425	539.134	271.742	399.530	583.181	548.473
Touchdowns	2.897	3.901	2.666	3.897	3.500	3.860	1.774	3.006	3.686	4.253
Fumbles	1.162	1.557	1.042	1.470	1.473	1.731	0.765	1.192	1.440	1.717
Fumbles Lost	0.716	1.079	0.651	1.040	0.884	1.160	0.465	0.863	0.890	1.176
Pension Eligibility	0.219	0.414	0.066	0.248	0.616	0.488	0.028	0.164	0.353	0.479
Win Percentage	0.488	0.194	0.488	0.196	0.488	0.191	0.493	0.187	0.484	0.199
Playoff Appearance	0.342	0.475	0.337	0.473	0.356	0.481	0.346	0.477	0.340	0.474
Signing Bonus (in 10000s)	75.874	180.139	51.783	151.228	138.576	228.548	0.515	1.543	128.796	220.226
Other Bonuses (in 10000s)	28.140	101.095	18.764	91.245	52.541	120.051	0.334	0.546	47.666	128.426
Millions Under Salary Cap	2.487	13.689	2.661	14.064	2.035	12.695	2.124	13.881	2.742	13.569
Age at Beginning of Career	22.567	1.105	22.618	1.118	22.432	1.063	22.825	1.149	22.385	1.037
Height (in inches)	71.200	1.608	71.224	1.697	71.137	1.353	71.230	1.628	71.178	1.597
Weight	225.483	16.389	225.040	16.827	226.637	15.187	225.465	16.803	225.495	16.120
Number of Observations	526		380		146		217		309	

Table 2.11: Tight Ends Summary Statistics (Career Length)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	3.105	1.963	2.301	1.566	4.549	1.772	2.182	1.146	3.597	2.127
Mandatory Raise Indicator	0.642	0.480	1.000	0.000	0.000	0.000	1.000	0.000	0.452	0.499
Mandatory Raise (in 10000s)	5.284	4.359	8.229	2.297	0.000	0.000	8.717	2.127	3.457	4.136
Income Increase Indicator	0.347	0.477	0.541	0.500	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	2.619	3.832	4.079	4.114	0.000	0.000	7.540	2.252	0.000	0.000
Games Played	12.653	4.838	12.257	5.199	13.363	4.041	11.283	5.711	13.382	4.138
Games Started	7.084	5.739	5.951	5.532	9.118	5.564	4.525	5.138	8.446	5.587
Touches	23.095	21.811	19.426	20.343	29.676	22.887	14.566	18.373	27.634	22.178
Yards	244.138	242.737	208.443	228.100	309.460	255.971	151.323	201.939	294.076	248.578
Touchdowns	1.947	2.107	1.563	1.885	2.637	2.307	1.222	1.805	2.333	2.158
Fumbles	0.354	0.659	0.333	0.666	0.392	0.647	0.253	0.560	0.409	0.701
Fumbles Lost	0.235	0.494	0.219	0.476	0.265	0.525	0.141	0.350	0.285	0.550
Pension Eligibility	0.246	0.431	0.071	0.258	0.559	0.499	0.020	0.141	0.366	0.483
Win Percentage	0.524	0.190	0.520	0.190	0.533	0.189	0.515	0.185	0.529	0.193
Playoff Appearance	0.414	0.493	0.393	0.490	0.451	0.500	0.424	0.497	0.409	0.493
Signing Bonus (in 10000s)	80.582	165.234	57.271	148.608	122.406	184.997	0.790	2.002	123.052	191.546
Other Bonuses (in 10000s)	22.773	85.628	10.420	39.278	44.936	130.632	0.387	0.602	34.688	104.139
Millions Under Salary Cap	2.721	12.954	3.286	13.369	1.709	12.172	2.192	13.042	3.003	12.933
Age at Beginning of Career	22.740	1.079	22.749	0.962	22.725	1.268	22.960	1.068	22.624	1.070
Height (in inches)	76.161	1.298	76.148	1.260	76.186	1.370	76.111	1.285	76.188	1.308
Weight	255.663	9.238	255.180	9.408	256.529	8.904	254.899	10.357	256.070	8.585
Number of Observations	285		183		102		99		186	

Table 2.12: Wide Receivers Summary Statistics (Career Length)

Variable	Full Sample		Mandatory Raise Required		Mandatory Raise Not Required		Income Increase Required		Income Increase Not Required	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Seasons Played	2.931	1.942	2.145	1.313	4.831	1.903	2.165	1.088	3.349	2.166
Mandatory Raise Indicator	0.707	0.455	1.000	0.000	0.000	0.000	1.000	0.000	0.548	0.498
Mandatory Raise (in 10000s)	5.850	4.254	8.271	2.351	0.000	0.000	8.541	2.065	4.383	4.422
Income Increase Indicator	0.353	0.478	0.499	0.501	0.000	0.000	1.000	0.000	0.000	0.000
Income Increase (in 10000s)	2.612	3.868	3.693	4.143	0.000	0.000	7.405	2.621	0.000	0.000
Games Played	12.026	5.010	11.369	5.304	13.614	3.783	10.925	5.416	12.627	4.673
Games Started	5.589	5.934	3.998	5.142	9.434	5.973	3.165	4.592	6.910	6.167
Touches	30.594	29.036	23.267	24.318	48.295	31.823	18.945	21.522	36.943	30.617
Yards	313.580	293.378	262.141	270.087	463.970	307.750	222.241	244.252	369.414	306.938
Touchdowns	2.309	2.887	1.753	2.519	3.651	3.264	1.385	2.159	2.812	3.105
Fumbles	0.780	1.249	0.751	1.341	0.849	0.995	0.585	1.090	0.886	1.317
Fumbles Lost	0.369	0.670	0.344	0.672	0.428	0.663	0.275	0.584	0.420	0.708
Pension Eligibility	0.212	0.409	0.047	0.213	0.608	0.490	0.020	0.140	0.316	0.466
Win Percentage	0.491	0.196	0.497	0.196	0.478	0.197	0.486	0.205	0.494	0.192
Playoff Appearance	0.360	0.480	0.374	0.484	0.325	0.470	0.360	0.481	0.360	0.481
Signing Bonus (in 10000s)	106.307	221.734	52.306	109.262	236.755	339.863	0.696	1.892	163.861	258.098
Other Bonuses (in 10000s)	32.154	100.186	21.989	90.005	56.710	118.043	0.439	0.909	49.438	121.130
Millions Under Salary Cap	2.866	12.995	3.142	13.058	2.199	12.857	2.002	13.255	3.337	12.846
Age at Beginning of Career	22.429	0.954	22.496	1.000	22.265	0.810	22.730	1.088	22.264	0.829
Height (in inches)	72.974	2.272	72.990	2.256	72.934	2.318	72.990	2.321	72.965	2.249
Weight	201.575	14.499	201.459	14.340	201.855	14.917	200.665	14.540	202.071	14.472
Number of Observations	567		401		166		200		367	

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Table 2.13: Percentage of Defensive Backs Requiring a Mandatory Raise (Firm Tenure)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	500	73.2%	64.4%	52.4%	19.8%
2	315	70.8%	64.8%	47.0%	7.0%
3	209	67.9%	63.2%	34.4%	8.6%
4	134	38.1%	30.6%	29.9%	9.0%
5	56	7.1%	3.6%	3.6%	1.8%
6	32	9.4%	3.1%	3.1%	0.0%
7	17	11.8%	11.8%	11.8%	11.8%
8	4	0.0%	0.0%	0.0%	0.0%
9	3	33.3%	33.3%	33.3%	33.3%
Total	1270	62.4%	55.5%	41.6%	12.2%

Table 2.14: Percentage of Defensive Backs Requiring an Income Increase (Firm Tenure)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	500	29.2%	23.0%	16.8%	5.2%
2	315	43.2%	38.7%	21.3%	5.1%
3	209	42.6%	36.8%	9.1%	5.7%
4	134	18.7%	13.4%	9.0%	3.0%
5	56	5.4%	3.6%	3.6%	1.8%
6	32	0.0%	0.0%	0.0%	0.0%
7	17	0.0%	0.0%	0.0%	0.0%
8	4	0.0%	0.0%	0.0%	0.0%
9	3	33.3%	33.3%	0.0%	0.0%
Total	1270	31.5%	26.4%	14.5%	4.6%

Table 2.15: Percentage of Defensive Linemen Requiring a Mandatory Raise (Firm Tenure)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	362	67.7%	59.9%	48.1%	17.7%
2	233	68.2%	62.2%	45.9%	10.7%
3	165	60.0%	55.2%	33.9%	9.7%
4	102	33.3%	24.5%	23.5%	9.8%
5	56	8.9%	1.8%	1.8%	1.8%
6	32	0.0%	0.0%	0.0%	0.0%
7	18	5.6%	5.6%	5.6%	5.6%
8	2	0.0%	0.0%	0.0%	0.0%
9	0	0.0%	0.0%	0.0%	0.0%
Total	970	56.0%	49.5%	37.4%	12.1%

Table 2.16: Percentage of Defensive Linemen Requiring an Income Increase (Firm Tenure)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	362	26.0%	18.2%	13.3%	4.4%
2	233	40.3%	35.2%	21.9%	6.4%
3	165	38.8%	32.7%	8.5%	6.7%
4	102	8.8%	7.8%	7.8%	3.9%
5	56	3.6%	0.0%	0.0%	0.0%
6	32	0.0%	0.0%	0.0%	0.0%
7	18	0.0%	0.0%	0.0%	0.0%
8	2	0.0%	0.0%	0.0%	0.0%
9	0	0.0%	0.0%	0.0%	0.0%
Total	970	27.1%	21.6%	12.5%	4.7%

Table 2.17: Percentage of Linebackers Requiring a Mandatory Raise (Firm Tenure)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	347	72.3%	64.3%	51.9%	21.0%
2	217	72.4%	68.7%	47.0%	9.2%
3	143	64.3%	60.1%	35.7%	11.2%
4	87	35.6%	29.9%	28.7%	6.9%
5	36	5.6%	0.0%	0.0%	0.0%
6	23	21.7%	0.0%	0.0%	0.0%
7	10	20.0%	10.0%	10.0%	10.0%
8	5	0.0%	0.0%	0.0%	0.0%
9	3	0.0%	0.0%	0.0%	0.0%
Total	871	62.0%	55.7%	41.2%	13.3%

Table 2.18: Percentage of Linebackers Requiring an Income Increase (Firm Tenure)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	347	28.8%	23.1%	17.0%	6.3%
2	217	47.9%	44.7%	25.8%	6.5%
3	143	42.7%	38.5%	11.2%	6.3%
4	87	16.1%	10.3%	6.9%	1.1%
5	36	2.8%	0.0%	0.0%	0.0%
6	23	8.7%	0.0%	0.0%	0.0%
7	10	10.0%	10.0%	10.0%	0.0%
8	5	0.0%	0.0%	0.0%	0.0%
9	3	0.0%	0.0%	0.0%	0.0%
Total	871	32.5%	27.8%	15.8%	5.3%

Table 2.19: Percentage of Running Backs Requiring a Mandatory Raise (Firm Tenure)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	308	74.4%	69.8%	59.7%	22.1%
2	164	68.9%	64.6%	48.8%	6.7%
3	102	65.7%	63.7%	36.3%	12.7%
4	58	37.9%	32.8%	31.0%	15.5%
5	34	11.8%	2.9%	2.9%	2.9%
6	21	19.0%	4.8%	4.8%	0.0%
7	14	35.7%	35.7%	28.6%	28.6%
8	5	20.0%	0.0%	0.0%	0.0%
9	1	100.0%	0.0%	0.0%	0.0%
Total	707	63.1%	58.3%	46.0%	15.0%

Table 2.20: Percentage of Running Backs Requiring an Income Increase (Firm Tenure)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	308	40.3%	33.8%	27.6%	9.1%
2	164	47.0%	45.1%	26.2%	3.7%
3	102	47.1%	42.2%	15.7%	9.8%
4	58	20.7%	15.5%	15.5%	10.3%
5	34	2.9%	0.0%	0.0%	0.0%
6	21	4.8%	4.8%	4.8%	0.0%
7	14	7.1%	7.1%	7.1%	7.1%
8	5	0.0%	0.0%	0.0%	0.0%
9	1	0.0%	0.0%	0.0%	0.0%
Total	707	37.3%	32.8%	21.9%	7.2%

Table 2.21: Percentage of Tight Ends Requiring a Mandatory Raise (Firm Tenure)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	135	71.9%	65.2%	55.6%	20.0%
2	78	74.4%	73.1%	55.1%	11.5%
3	55	67.3%	65.5%	38.2%	7.3%
4	36	36.1%	19.4%	16.7%	2.8%
5	20	5.0%	0.0%	0.0%	0.0%
6	14	21.4%	0.0%	0.0%	0.0%
7	7	28.6%	28.6%	14.3%	14.3%
8	4	25.0%	0.0%	0.0%	0.0%
9	1	0.0%	0.0%	0.0%	0.0%
Total	350	60.6%	54.3%	41.7%	12.0%

Table 2.22: Percentage of Tight Ends Requiring an Income Increase (Firm Tenure)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	135	32.6%	27.4%	18.5%	7.4%
2	78	48.7%	48.7%	33.3%	6.4%
3	55	47.3%	41.8%	10.9%	7.3%
4	36	13.9%	8.3%	8.3%	2.8%
5	20	0.0%	0.0%	0.0%	0.0%
6	14	0.0%	0.0%	0.0%	0.0%
7	7	0.0%	0.0%	0.0%	0.0%
8	4	0.0%	0.0%	0.0%	0.0%
9	1	0.0%	0.0%	0.0%	0.0%
Total	350	32.3%	28.9%	17.1%	5.7%

Table 2.23: Percentage of Wide Receivers Requiring a Mandatory Raise (Firm Tenure)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	286	70.3%	61.9%	51.0%	17.8%
2	171	71.9%	65.5%	48.0%	8.2%
3	108	72.2%	62.0%	42.6%	13.9%
4	61	42.6%	37.7%	31.1%	11.5%
5	28	7.1%	0.0%	0.0%	0.0%
6	16	6.3%	0.0%	0.0%	0.0%
7	7	0.0%	0.0%	0.0%	0.0%
8	5	0.0%	0.0%	0.0%	0.0%
9	0	0.0%	0.0%	0.0%	0.0%
Total	682	63.2%	55.6%	43.0%	12.8%

Table 2.24: Percentage of Wide Receivers Requiring an Income Increase (Firm Tenure)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	286	28.3%	21.7%	17.1%	5.2%
2	171	42.1%	38.0%	22.2%	4.7%
3	108	49.1%	39.8%	17.6%	11.1%
4	61	16.4%	11.5%	8.2%	3.3%
5	28	0.0%	0.0%	0.0%	0.0%
6	16	0.0%	0.0%	0.0%	0.0%
7	7	0.0%	0.0%	0.0%	0.0%
8	5	0.0%	0.0%	0.0%	0.0%
9	0	0.0%	0.0%	0.0%	0.0%
Total	682	31.7%	26.0%	16.3%	5.4%

Table 2.25: Percentage of Defensive Backs Requiring a Mandatory Raise (Career Length)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	280	95.0%	91.4%	73.6%	23.9%
2	212	94.8%	90.1%	63.7%	9.0%
3	165	87.3%	82.4%	46.7%	10.3%
4	123	41.5%	36.6%	36.6%	11.4%
5	77	10.4%	0.0%	0.0%	0.0%
6	52	13.5%	0.0%	0.0%	0.0%
7	31	29.0%	25.8%	25.8%	25.8%
8	14	7.1%	0.0%	0.0%	0.0%
9	3	0.0%	0.0%	0.0%	0.0%
Total	957	71.8%	66.5%	49.2%	13.1%

Table 2.26: Percentage of Defensive Backs Requiring an Income Increase (Career Length)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	280	32.9%	25.7%	20.0%	5.7%
2	212	60.4%	55.2%	29.2%	7.5%
3	165	54.5%	47.3%	13.3%	7.9%
4	123	22.0%	16.3%	12.2%	3.3%
5	77	1.3%	0.0%	0.0%	0.0%
6	52	1.9%	0.0%	0.0%	0.0%
7	31	6.5%	6.5%	3.2%	0.0%
8	14	7.1%	0.0%	0.0%	0.0%
9	3	0.0%	0.0%	0.0%	0.0%
Total	957	35.7%	30.2%	16.3%	5.1%

Table 2.27: Percentage of Defensive Linemen Requiring a Mandatory Raise (Career Length)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	193	92.7%	89.6%	70.5%	22.8%
2	149	94.6%	90.6%	65.1%	11.4%
3	118	81.4%	77.1%	47.5%	10.2%
4	87	40.2%	33.3%	32.2%	13.8%
5	67	11.9%	0.0%	0.0%	0.0%
6	51	13.7%	0.0%	0.0%	0.0%
7	36	16.7%	16.7%	16.7%	16.7%
8	19	5.3%	0.0%	0.0%	0.0%
9	9	0.0%	0.0%	0.0%	0.0%
Total	729	64.9%	59.5%	44.3%	12.5%

Table 2.28: Percentage of Defensive Linemen Requiring an Income Increase (Career Length)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	193	34.7%	24.9%	16.6%	5.7%
2	149	57.0%	51.7%	33.6%	8.7%
3	118	55.9%	49.2%	14.4%	10.2%
4	87	13.8%	11.5%	11.5%	4.6%
5	67	1.5%	0.0%	0.0%	0.0%
6	51	2.0%	0.0%	0.0%	0.0%
7	36	0.0%	0.0%	0.0%	0.0%
8	19	0.0%	0.0%	0.0%	0.0%
9	9	0.0%	0.0%	0.0%	0.0%
Total	729	31.8%	26.5%	15.0%	5.5%

Table 2.29: Percentage of Linebackers Requiring a Mandatory Raise (Career Length)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	182	95.6%	94.0%	76.4%	23.6%
2	145	94.5%	92.4%	60.7%	7.6%
3	111	85.6%	80.2%	45.0%	11.7%
4	82	42.7%	36.6%	34.1%	11.0%
5	58	17.2%	0.0%	0.0%	0.0%
6	47	21.3%	0.0%	0.0%	0.0%
7	27	37.0%	33.3%	29.6%	25.9%
8	11	0.0%	0.0%	0.0%	0.0%
9	7	0.0%	0.0%	0.0%	0.0%
Total	670	70.3%	64.6%	46.7%	12.4%

Table 2.30: Percentage of Linebackers Requiring an Income Increase (Career Length)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	182	30.8%	24.7%	17.6%	5.5%
2	145	62.8%	59.3%	33.1%	6.9%
3	111	58.6%	54.1%	17.1%	9.0%
4	82	22.0%	14.6%	13.4%	2.4%
5	58	3.4%	0.0%	0.0%	0.0%
6	47	6.4%	0.0%	0.0%	0.0%
7	27	18.5%	18.5%	18.5%	3.7%
8	11	0.0%	0.0%	0.0%	0.0%
9	7	0.0%	0.0%	0.0%	0.0%
Total	670	35.8%	31.0%	17.2%	4.9%

Table 2.31: Percentage of Running Backs Requiring a Mandatory Raise (Career Length)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	166	96.4%	96.4%	80.1%	25.9%
2	110	96.4%	94.5%	69.1%	6.4%
3	78	82.1%	80.8%	46.2%	14.1%
4	57	43.9%	42.1%	40.4%	19.3%
5	44	11.4%	0.0%	0.0%	0.0%
6	30	20.0%	0.0%	0.0%	0.0%
7	23	43.5%	43.5%	39.1%	39.1%
8	13	15.4%	0.0%	0.0%	0.0%
9	5	40.0%	0.0%	0.0%	0.0%
Total	526	72.2%	68.6%	52.7%	15.4%

Table 2.32: Percentage of Running Backs Requiring an Income Increase (Career Length)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	166	45.2%	40.4%	31.9%	9.0%
2	110	68.2%	68.2%	40.9%	6.4%
3	78	57.7%	55.1%	20.5%	12.8%
4	57	28.1%	22.8%	22.8%	14.0%
5	44	2.3%	0.0%	0.0%	0.0%
6	30	0.0%	0.0%	0.0%	0.0%
7	23	17.4%	17.4%	17.4%	8.7%
8	13	0.0%	0.0%	0.0%	0.0%
9	5	20.0%	0.0%	0.0%	0.0%
Total	526	41.3%	38.4%	24.9%	8.0%

Table 2.33: Percentage of Tight Ends Requiring a Mandatory Raise (Career Length)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	79	88.6%	88.6%	73.4%	22.8%
2	55	90.9%	90.9%	67.3%	9.1%
3	47	76.6%	74.5%	40.4%	8.5%
4	34	41.2%	26.5%	23.5%	5.9%
5	28	7.1%	0.0%	0.0%	0.0%
6	21	14.3%	0.0%	0.0%	0.0%
7	16	37.5%	31.3%	25.0%	25.0%
8	4	25.0%	0.0%	0.0%	0.0%
9	1	100.0%	0.0%	0.0%	0.0%
Total	285	64.2%	59.3%	44.2%	11.6%

Table 2.34: Percentage of Tight Ends Requiring an Income Increase (Career Length)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	79	39.2%	32.9%	20.3%	7.6%
2	55	60.0%	60.0%	40.0%	7.3%
3	47	57.4%	51.1%	14.9%	8.5%
4	34	17.6%	11.8%	11.8%	2.9%
5	28	0.0%	0.0%	0.0%	0.0%
6	21	0.0%	0.0%	0.0%	0.0%
7	16	12.5%	12.5%	12.5%	6.3%
8	4	0.0%	0.0%	0.0%	0.0%
9	1	0.0%	0.0%	0.0%	0.0%
Total	285	34.7%	31.2%	17.9%	5.6%

Table 2.35: Percentage of Wide Receivers Requiring a Mandatory Raise (Career Length)

Season	Number of Players	Mandatory Raise Required	Mandatory Raise > $50,000 Required	Mandatory Raise > $75,000 Required	Mandatory Raise > $100,000 Required
1	173	91.9%	89.6%	72.8%	24.3%
2	121	94.2%	90.1%	63.6%	12.4%
3	90	87.8%	80.0%	57.8%	15.6%
4	63	47.6%	46.0%	39.7%	11.1%
5	49	14.3%	2.0%	2.0%	0.0%
6	37	13.5%	0.0%	0.0%	0.0%
7	18	27.8%	16.7%	16.7%	16.7%
8	12	16.7%	0.0%	0.0%	0.0%
9	4	0.0%	0.0%	0.0%	0.0%
Total	567	70.7%	65.1%	50.1%	14.3%

Table 2.36: Percentage of Wide Receivers Requiring an Income Increase (Career Length)

Season	Number of Players	Income Increase Required	Income Increase > $50,000 Required	Income Increase > $75,000 Required	Income Increase > $100,000 Required
1	173	36.4%	28.3%	22.5%	5.8%
2	121	54.5%	51.2%	29.8%	7.4%
3	90	61.1%	51.1%	23.3%	14.4%
4	63	19.0%	15.9%	12.7%	3.2%
5	49	2.0%	0.0%	0.0%	0.0%
6	37	2.7%	0.0%	0.0%	0.0%
7	18	11.1%	11.1%	11.1%	11.1%
8	12	0.0%	0.0%	0.0%	0.0%
9	4	0.0%	0.0%	0.0%	0.0%
Total	567	35.3%	29.8%	18.7%	6.3%

Table 2.37: Weibull Regression Results for Defensive Backs (Firm Tenure)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	0.280			
	(0.287)			
Mandatory Raise (in 10000s)		0.021		
		(0.408)		
Income Increase Indicator			-0.362	
			(0.137)	
Income Increase (in 10000s)				-0.025
				(0.340)
Games Played	0.035	0.036	0.035	0.035
	(0.168)	(0.155)	(0.158)	(0.165)
Games Started	-0.067**	-0.064*	-0.071**	-0.071**
	(0.047)	(0.060)	(0.033)	(0.033)
Tackles	0.012	0.011	0.012	0.012
	(0.115)	(0.142)	(0.106)	(0.106)
Sacks	0.459**	0.458**	0.437**	0.443**
	(0.032)	(0.031)	(0.037)	(0.035)
Passes Defended	0.129***	0.126***	0.122***	0.126***
	(0.002)	(0.003)	(0.003)	(0.002)
Interceptions	0.235**	0.235**	0.241**	0.239**
	(0.024)	(0.023)	(0.019)	(0.020)
Forced Fumbles	-0.038	-0.032	-0.024	-0.032
	(0.807)	(0.836)	(0.878)	(0.837)
Pension Eligibility	0.425	0.376	0.075	0.143
	(0.244)	(0.291)	(0.825)	(0.673)
Second Team	-1.275***	-1.278***	-1.226***	-1.218***
	(0.000)	(0.000)	(0.000)	(0.000)
Third Team	-1.559***	-1.561***	-1.513***	-1.510***
	(0.000)	(0.000)	(0.000)	(0.000)
Fourth Team	-2.113***	-2.121***	-2.065***	-2.057***
	(0.000)	(0.000)	(0.000)	(0.000)
Fifth Team	-2.415***	-2.406***	-2.354***	-2.351***
	(0.000)	(0.000)	(0.000)	(0.000)
Sixth Team	-1.962***	-1.947***	-1.921***	-1.906***
	(0.001)	(0.001)	(0.001)	(0.002)
Seventh Team	-2.706***	-2.653***	-2.657***	-2.648***
	(0.000)	(0.000)	(0.000)	(0.000)
Win Percentage	-0.583	-0.584	-0.559	-0.535
	(0.454)	(0.451)	(0.468)	(0.487)
Playoff Appearance	0.390	0.385	0.346	0.341
	(0.236)	(0.239)	(0.281)	(0.290)
Signing Bonus (in 10000s)	0.002***	0.002**	0.002**	0.002**
	(0.010)	(0.011)	(0.016)	(0.013)
Other Bonuses (in 10000s)	0.004*	0.004*	0.004*	0.004*
	(0.064)	(0.067)	(0.090)	(0.077)
Millions Under Salary Cap	0.008	0.008	0.008	0.007
	(0.344)	(0.333)	(0.337)	(0.373)
Age at Beginning of Career	-0.262**	-0.259**	-0.243**	-0.247**
	(0.016)	(0.017)	(0.024)	(0.022)
Height (in inches)	0.003	0.001	0.002	0.002
	(0.966)	(0.992)	(0.976)	(0.977)
Weight	0.015	0.015	0.015	0.015
	(0.239)	(0.242)	(0.243)	(0.231)
Number of Observations	1270	1270	1270	1270

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.38: Weibull Regression Results for Defensive Linemen (Firm Tenure)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-0.429			
	(0.193)			
Mandatory Raise (in 10000s)		-0.020		
		(0.527)		
Income Increase Indicator			-0.651*	
			(0.053)	
Income Increase (in 10000s)				-0.104**
				(0.015)
Games Played	0.031	0.030	0.033	0.031
	(0.331)	(0.354)	(0.307)	(0.324)
Games Started	0.024	0.026	0.022	0.021
	(0.475)	(0.430)	(0.516)	(0.522)
Tackles	0.047***	0.048***	0.048***	0.048***
	(0.002)	(0.002)	(0.003)	(0.002)
Sacks	0.092	0.096	0.097	0.104
	(0.263)	(0.250)	(0.248)	(0.215)
Passes Defended	0.088	0.085	0.095	0.087
	(0.454)	(0.474)	(0.429)	(0.467)
Interceptions	0.241	0.239	0.246	0.239
	(0.695)	(0.702)	(0.697)	(0.702)
Forced Fumbles	0.208	0.210	0.191	0.182
	(0.301)	(0.302)	(0.351)	(0.367)
Pension Eligibility	-0.248	-0.111	-0.350	-0.340
	(0.572)	(0.798)	(0.435)	(0.431)
Second Team	-1.125***	-1.133***	-1.120***	-1.185***
	(0.000)	(0.000)	(0.000)	(0.000)
Third Team	-1.729***	-1.728***	-1.766***	-1.800***
	(0.000)	(0.000)	(0.000)	(0.000)
Fourth Team	-2.128***	-2.152***	-2.153***	-2.178***
	(0.000)	(0.000)	(0.000)	(0.000)
Fifth Team	-2.761***	-2.786***	-2.791***	-2.755***
	(0.000)	(0.000)	(0.000)	(0.000)
Sixth Team	-2.123***	-2.102***	-2.145***	-2.155***
	(0.000)	(0.001)	(0.001)	(0.000)
Seventh Team	-0.396	-0.447	-0.319	-0.533
	(0.813)	(0.788)	(0.856)	(0.744)
Win Percentage	0.597	0.671	0.798	0.787
	(0.554)	(0.510)	(0.440)	(0.442)
Playoff Appearance	0.418	0.392	0.369	0.307
	(0.303)	(0.338)	(0.373)	(0.453)
Signing Bonus (in 10000s)	0.002**	0.002**	0.002**	0.002**
	(0.024)	(0.025)	(0.037)	(0.037)
Other Bonuses (in 10000s)	0.008**	0.008**	0.008**	0.008**
	(0.012)	(0.011)	(0.013)	(0.013)
Millions Under Salary Cap	-0.006	-0.007	-0.005	-0.007
	(0.468)	(0.468)	(0.548)	(0.457)
Age at Beginning of Career	0.051	0.053	0.058	0.076
	(0.672)	(0.661)	(0.641)	(0.537)
Height (in inches)	0.038	0.040	0.050	0.030
	(0.657)	(0.644)	(0.569)	(0.732)
Weight	0.011*	0.011*	0.010*	0.010*
	(0.068)	(0.072)	(0.093)	(0.091)
Number of Observations	970	970	970	970

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.39: Weibull Regression Results for Linebackers (Firm Tenure)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-0.148			
	(0.559)			
Mandatory Raise (in 10000s)		-0.030		
		(0.147)		
Income Increase Indicator			-0.559**	
			(0.023)	
Income Increase Indicator				-0.070***
				(0.007)
Games Played	0.027	0.027	0.035	0.030
	(0.230)	(0.233)	(0.129)	(0.188)
Games Started	-0.106***	-0.107***	-0.106***	-0.108***
	(0.003)	(0.002)	(0.003)	(0.002)
Tackles	0.034***	0.034***	0.033***	0.034***
	(0.000)	(0.000)	(0.000)	(0.000)
Sacks	0.111	0.103	0.111	0.110
	(0.282)	(0.311)	(0.282)	(0.283)
Passes Defended	-0.117	-0.115	-0.112	-0.111
	(0.120)	(0.123)	(0.139)	(0.142)
Interceptions	0.617***	0.602***	0.597***	0.582***
	(0.006)	(0.007)	(0.008)	(0.009)
Forced Fumbles	0.295*	0.301*	0.293*	0.317*
	(0.080)	(0.073)	(0.085)	(0.063)
Pension Eligibility	0.375	0.342	0.269	0.282
	(0.246)	(0.267)	(0.392)	(0.358)
Second Team	-1.865***	-1.858***	-1.943***	-1.916***
	(0.000)	(0.000)	(0.000)	(0.000)
Third Team	-1.874***	-1.841***	-1.878***	-1.864***
	(0.000)	(0.000)	(0.000)	(0.000)
Fourth Team	-2.281***	-2.260***	-2.296***	-2.261***
	(0.000)	(0.000)	(0.000)	(0.000)
Fifth Team	-2.326***	-2.345***	-2.402***	-2.392***
	(0.000)	(0.000)	(0.000)	(0.000)
Win Percentage	1.696*	1.709**	1.593*	1.643*
	(0.054)	(0.050)	(0.068)	(0.060)
Playoff Appearance	-0.210	-0.232	-0.168	-0.215
	(0.530)	(0.484)	(0.617)	(0.518)
Signing Bonus (in 10000s)	0.002**	0.002**	0.002*	0.002*
	(0.040)	(0.042)	(0.072)	(0.070)
Other Bonuses (in 10000s)	0.003	0.003	0.003	0.003
	(0.176)	(0.189)	(0.235)	(0.233)
Millions Under Salary Cap	0.007	0.006	0.007	0.008
	(0.412)	(0.433)	(0.412)	(0.325)
Age at Beginning of Career	-0.317***	-0.316***	-0.304***	-0.313***
	(0.004)	(0.004)	(0.006)	(0.005)
Height (in inches)	0.023	0.025	0.011	0.007
	(0.775)	(0.763)	(0.893)	(0.933)
Weight	0.022*	0.023*	0.023*	0.022*
	(0.096)	(0.085)	(0.091)	(0.095)
Number of Observations	871	871	871	871

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.40: Weibull Regression Results for Running Backs (Firm Tenure)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-0.189			
	(0.465)			
Mandatory Raise (in 10000s)		-0.007		
		(0.760)		
Income Increase Indicator			-0.410*	
			(0.098)	
Income Increase (in 10000s)				-0.029
				(0.282)
Games Played	0.043**	0.043*	0.043*	0.043*
	(0.048)	(0.052)	(0.052)	(0.053)
Games Started	0.070*	0.072*	0.066	0.070*
	(0.088)	(0.082)	(0.114)	(0.091)
Touches	-0.031***	-0.031***	-0.031***	-0.031***
	(0.000)	(0.000)	(0.000)	(0.000)
Yards	0.008***	0.008***	0.008***	0.008***
	(0.000)	(0.000)	(0.000)	(0.000)
Touchdowns	0.002	0.000	-0.002	-0.003
	(0.978)	(0.995)	(0.974)	(0.965)
Fumbles	0.011	0.018	0.004	0.020
	(0.951)	(0.924)	(0.982)	(0.916)
Fumbles Lost	-0.115	-0.124	-0.099	-0.122
	(0.630)	(0.605)	(0.681)	(0.614)
Pension Eligibility	0.933***	0.987***	0.825**	0.898***
	(0.005)	(0.003)	(0.014)	(0.007)
Second Team	-1.684***	-1.683***	-1.667***	-1.670***
	(0.000)	(0.000)	(0.000)	(0.000)
Third Team	-2.057***	-2.055***	-2.043***	-2.034***
	(0.000)	(0.000)	(0.000)	(0.000)
Fourth Team	-2.039***	-2.043***	-2.026***	-2.033***
	(0.000)	(0.000)	(0.000)	(0.000)
Fifth Team	-1.878***	-1.879***	-1.850***	-1.835***
	(0.000)	(0.000)	(0.000)	(0.000)
Sixth Team	-0.874	-0.855	-0.851	-0.836
	(0.461)	(0.477)	(0.481)	(0.492)
Seventh Team	-2.459***	-2.487***	-2.430***	-2.483***
	(0.000)	(0.000)	(0.000)	(0.000)
Win Percentage	0.695	0.679	0.752	0.686
	(0.436)	(0.450)	(0.407)	(0.449)
Playoff Appearance	0.280	0.282	0.277	0.288
	(0.454)	(0.455)	(0.464)	(0.448)
Signing Bonus (in 10000s)	0.002*	0.002*	0.002	0.002
	(0.085)	(0.082)	(0.134)	(0.106)
Other Bonuses (in 10000s)	0.001	0.001	0.001	0.001
	(0.523)	(0.495)	(0.620)	(0.551)
Millions Under Salary Cap	-0.006	-0.007	-0.007	-0.007
	(0.423)	(0.400)	(0.417)	(0.395)
Age at Beginning of Career	-0.152	-0.148	-0.161	-0.153
	(0.159)	(0.171)	(0.138)	(0.159)
Height (in inches)	-0.103	-0.110	-0.099	-0.101
	(0.218)	(0.191)	(0.235)	(0.228)
Weight	0.009	0.010	0.009	0.009
	(0.241)	(0.222)	(0.236)	(0.249)
Number of Observations	707	707	707	707

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.41: Weibull Regression Results for Tight Ends (Firm Tenure)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-0.990*			
	(0.067)			
Mandatory Raise (in 10000s)		-0.061		
		(0.153)		
Income Increase Indicator			-1.094*	
			(0.051)	
Income Increase (in 10000s)				-0.093
				(0.143)
Games Played	0.130***	0.131***	0.139***	0.136***
	(0.008)	(0.010)	(0.008)	(0.010)
Games Started	0.117	0.120	0.101	0.112
	(0.120)	(0.130)	(0.207)	(0.170)
Touches	-0.159**	-0.166**	-0.171**	-0.174**
	(0.029)	(0.030)	(0.031)	(0.030)
Yards	0.015**	0.015**	0.016**	0.016**
	(0.032)	(0.030)	(0.031)	(0.030)
Touchdowns	0.203	0.202	0.228	0.235
	(0.362)	(0.387)	(0.344)	(0.336)
Fumbles	1.648	1.724	1.718	1.739
	(0.237)	(0.235)	(0.246)	(0.247)
Fumbles Lost	-1.971	-2.031	-2.165	-2.099
	(0.192)	(0.195)	(0.177)	(0.194)
Pension Eligibility	0.605	0.889	0.506	0.758
	(0.406)	(0.219)	(0.525)	(0.330)
Second Team	-2.369***	-2.439***	-2.425***	-2.461***
	(0.000)	(0.000)	(0.000)	(0.000)
Third Team	-2.500***	-2.483***	-2.616***	-2.584***
	(0.000)	(0.000)	(0.000)	(0.000)
Fourth Team	-3.095***	-3.054***	-3.233***	-3.156***
	(0.000)	(0.000)	(0.000)	(0.000)
Fifth Team	-2.652***	-2.753***	-2.825***	-2.791***
	(0.000)	(0.000)	(0.000)	(0.000)
Win Percentage	1.433	1.557	1.409	1.537
	(0.387)	(0.363)	(0.429)	(0.390)
Playoff Appearance	-0.629	-0.632	-0.653	-0.648
	(0.324)	(0.338)	(0.336)	(0.343)
Signing Bonus (in 10000s)	0.008***	0.009***	0.008**	0.008**
	(0.009)	(0.009)	(0.018)	(0.013)
Other Bonuses (in 10000s)	0.000	0.001	0.000	0.000
	(0.911)	(0.896)	(0.972)	(0.936)
Millions Under Salary Cap	0.014	0.016	0.016	0.016
	(0.414)	(0.373)	(0.399)	(0.382)
Age at Beginning of Career	-0.109	-0.111	-0.102	-0.112
	(0.604)	(0.608)	(0.645)	(0.618)
Height (in inches)	-0.044	-0.056	-0.027	-0.031
	(0.801)	(0.757)	(0.885)	(0.868)
Weight	0.009	0.010	0.006	0.011
	(0.728)	(0.715)	(0.809)	(0.696)
Number of Observations	350	350	350	350

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.42: Weibull Regression Results for Wide Receivers (Firm Tenure)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-0.696**			
	(0.024)			
Mandatory Raise (in 10000s)		-0.065***		
		(0.008)		
Income Increase Indicator			-0.370	
			(0.188)	
Income Increase (in 10000s)				-0.051*
				(0.067)
Games Played	0.051**	0.047**	0.049**	0.047**
	(0.025)	(0.038)	(0.037)	(0.041)
Games Started	-0.091**	-0.086**	-0.087**	-0.088**
	(0.022)	(0.029)	(0.036)	(0.032)
Touches	-0.006	-0.003	-0.007	-0.005
	(0.781)	(0.882)	(0.747)	(0.795)
Yards	0.003*	0.003*	0.003*	0.003*
	(0.089)	(0.098)	(0.079)	(0.080)
Touchdowns	0.203**	0.187**	0.197**	0.186**
	(0.028)	(0.042)	(0.039)	(0.049)
Fumbles	0.175	0.204	0.178	0.188
	(0.380)	(0.311)	(0.390)	(0.363)
Fumbles Lost	-0.315	-0.351	-0.317	-0.338
	(0.280)	(0.234)	(0.291)	(0.260)
Pension Eligibility	-0.038	0.065	0.187	0.225
	(0.919)	(0.855)	(0.626)	(0.528)
Second Team	-1.764***	-1.812***	-1.802***	-1.832***
	(0.000)	(0.000)	(0.000)	(0.000)
Third Team	-1.940***	-1.926***	-1.955***	-1.945***
	(0.000)	(0.000)	(0.000)	(0.000)
Fourth Team	-1.859***	-1.851***	-1.867***	-1.867***
	(0.000)	(0.000)	(0.000)	(0.000)
Fifth Team	-1.754***	-1.779***	-1.782***	-1.793***
	(0.000)	(0.000)	(0.000)	(0.000)
Sixth Team	-2.072***	-2.069***	-2.055***	-2.069***
	(0.000)	(0.000)	(0.000)	(0.000)
Win Percentage	1.504**	1.467*	1.452*	1.411*
	(0.049)	(0.057)	(0.075)	(0.081)
Playoff Appearance	0.019	0.010	0.003	0.004
	(0.956)	(0.977)	(0.994)	(0.990)
Signing Bonus (in 10000s)	0.002***	0.002***	0.002**	0.002**
	(0.008)	(0.008)	(0.014)	(0.015)
Other Bonuses (in 10000s)	0.005**	0.005**	0.005**	0.005**
	(0.021)	(0.020)	(0.019)	(0.019)
Millions Under Salary Cap	0.005	0.004	0.003	0.003
	(0.494)	(0.550)	(0.662)	(0.696)
Age at Beginning of Career	-0.296***	-0.294***	-0.283***	-0.283***
	(0.004)	(0.004)	(0.009)	(0.008)
Height (in inches)	-0.031	-0.023	-0.031	-0.024
	(0.642)	(0.730)	(0.648)	(0.731)
Weight	0.004	0.004	0.004	0.004
	(0.678)	(0.715)	(0.696)	(0.714)
Number of Observations	682	682	682	682

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.43: Weibull Regression Results for Defensive Backs (Career Length)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-2.258*			
	(0.088)			
Mandatory Raise (in 10000s)		-0.293**		
		(0.030)		
Income Increase Indicator			-3.487***	
			(0.003)	
Income Increase (in 10000s)				-0.438***
				(0.003)
Games Played	0.307**	0.283**	0.316**	0.291**
	(0.011)	(0.015)	(0.012)	(0.017)
Games Started	-0.277	-0.289	-0.333	-0.321
	(0.263)	(0.232)	(0.209)	(0.217)
Tackles	0.124**	0.125**	0.140**	0.135**
	(0.044)	(0.037)	(0.034)	(0.035)
Sacks	1.402	1.487	1.281	1.484
	(0.429)	(0.393)	(0.480)	(0.415)
Passes Defended	1.118**	1.105**	1.083**	1.098**
	(0.020)	(0.019)	(0.026)	(0.024)
Interceptions	0.574	0.548	0.676	0.693
	(0.496)	(0.506)	(0.441)	(0.427)
Forced Fumbles	0.076	0.057	0.149	0.080
	(0.947)	(0.959)	(0.901)	(0.946)
Pension Eligibility	0.233	-0.237	-0.121	-0.279
	(0.869)	(0.871)	(0.935)	(0.851)
Win Percentage	4.609	4.759	5.261	5.247
	(0.195)	(0.173)	(0.163)	(0.159)
Playoff Appearance	-0.802	-0.902	-0.998	-0.843
	(0.548)	(0.493)	(0.473)	(0.540)
Signing Bonus (in 10000s)	0.006	0.006	0.005	0.005
	(0.174)	(0.168)	(0.251)	(0.225)
Other Bonuses (in 10000s)	0.014	0.014	0.011	0.012
	(0.318)	(0.300)	(0.431)	(0.381)
Millions Under Salary Cap	0.023	0.025	0.018	0.015
	(0.514)	(0.470)	(0.640)	(0.688)
Age at Beginning of Career	-1.033**	-1.010**	-0.930*	-0.876*
	(0.028)	(0.028)	(0.051)	(0.061)
Height (in inches)	-0.222	-0.200	-0.262	-0.195
	(0.467)	(0.504)	(0.414)	(0.535)
Weight	0.072	0.071	0.081	0.083
	(0.158)	(0.160)	(0.129)	(0.123)
Number of Observations	957	957	957	957

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.44: Weibull Regression Results for Defensive Linemen (Career Length)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-5.661**			
	(0.046)			
Mandatory Raise (in 10000s)		-0.668**		
		(0.023)		
Income Increase Indicator			-3.542**	
			(0.041)	
Income Increase (in 10000s)				-0.568**
				(0.011)
Games Played	0.291	0.314*	0.318*	0.299*
	(0.104)	(0.072)	(0.076)	(0.078)
Games Started	-0.305	-0.184	-0.229	-0.182
	(0.302)	(0.521)	(0.447)	(0.523)
Tackles	0.433**	0.395**	0.400**	0.383**
	(0.014)	(0.013)	(0.019)	(0.016)
Sacks	2.655**	2.617**	2.797**	2.714**
	(0.028)	(0.024)	(0.027)	(0.024)
Passes Defended	0.813	0.944	0.911	0.755
	(0.444)	(0.368)	(0.386)	(0.446)
Interceptions	-6.281	-6.887*	-6.492	-5.880
	(0.116)	(0.082)	(0.112)	(0.142)
Forced Fumbles	-2.169	-2.418	-2.382	-2.348
	(0.169)	(0.117)	(0.138)	(0.126)
Pension Eligibility	0.332	-0.323	2.511	2.145
	(0.894)	(0.903)	(0.257)	(0.302)
Win Percentage	20.366***	20.879***	23.707***	22.765***
	(0.005)	(0.003)	(0.002)	(0.002)
Playoff Appearance	-3.667*	-4.041**	-4.158**	-4.492**
	(0.069)	(0.042)	(0.043)	(0.024)
Signing Bonus (in 10000s)	0.006	0.006	0.003	0.003
	(0.359)	(0.328)	(0.532)	(0.568)
Other Bonuses (in 10000s)	0.071*	0.069*	0.082*	0.077*
	(0.089)	(0.093)	(0.071)	(0.069)
Millions Under Salary Cap	0.051	0.043	0.045	0.040
	(0.192)	(0.267)	(0.252)	(0.289)
Age at Beginning of Career	-1.524***	-1.553***	-1.512***	-1.471***
	(0.001)	(0.001)	(0.001)	(0.001)
Height (in inches)	1.247**	1.261**	1.298**	1.164**
	(0.023)	(0.015)	(0.022)	(0.026)
Weight	0.205***	0.193***	0.193***	0.185***
	(0.000)	(0.000)	(0.000)	(0.000)
Number of Players	193	193	193	193
Number of Observations	729	729	729	729

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.45: Weibull Regression Results for Linebackers (Career Length)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-1.896			
	(0.157)			
Mandatory Raise (in 10000s)		-0.199		
		(0.108)		
Income Increase Indicator			-2.835**	
			(0.033)	
Income Increase (in 10000s)				-0.319**
				(0.047)
Games Played	0.067	0.065	0.071	0.070
	(0.495)	(0.505)	(0.502)	(0.503)
Games Started	-0.523*	-0.511*	-0.578*	-0.562*
	(0.083)	(0.082)	(0.087)	(0.091)
Tackles	0.235***	0.230***	0.256**	0.246**
	(0.009)	(0.008)	(0.011)	(0.011)
Sacks	0.973	1.008	1.013	1.141
	(0.336)	(0.317)	(0.347)	(0.300)
Passes Defended	-0.338	-0.324	-0.338	-0.327
	(0.574)	(0.586)	(0.606)	(0.613)
Interceptions	0.954	0.978	0.812	0.783
	(0.527)	(0.516)	(0.612)	(0.626)
Forced Fumbles	1.078	1.061	1.235	1.170
	(0.335)	(0.338)	(0.307)	(0.326)
Pension Eligibility	1.526	1.645	1.097	1.256
	(0.322)	(0.262)	(0.500)	(0.434)
Win Percentage	8.150*	7.767*	8.310*	8.304*
	(0.056)	(0.064)	(0.066)	(0.065)
Playoff Appearance	-0.743	-0.752	-0.856	-0.946
	(0.617)	(0.610)	(0.589)	(0.548)
Signing Bonus (in 10000s)	0.005	0.004	0.003	0.003
	(0.361)	(0.446)	(0.587)	(0.512)
Other Bonuses (in 10000s)	0.000	0.000	0.000	0.001
	(0.948)	(0.978)	(0.994)	(0.946)
Millions Under Salary Cap	0.028	0.029	0.033	0.041
	(0.434)	(0.416)	(0.389)	(0.295)
Age at Beginning of Career	-0.746	-0.797	-0.734	-0.776
	(0.154)	(0.129)	(0.194)	(0.170)
Height (in inches)	0.899**	0.905**	0.877*	0.877*
	(0.039)	(0.036)	(0.055)	(0.054)
Weight	0.051	0.055	0.048	0.047
	(0.423)	(0.390)	(0.488)	(0.490)
Number of Observations	670	670	670	670

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.46: Weibull Regression Results for Running Backs (Career Length)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-2.381**			
	(0.024)			
Mandatory Raise (in 10000s)		-0.274***		
		(0.005)		
Income Increase Indicator			-2.877***	
			(0.003)	
Income Increase (in 10000s)				-0.290***
				(0.007)
Games Played	0.312***	0.328***	0.329***	0.331***
	(0.000)	(0.000)	(0.000)	(0.000)
Games Started	0.194	0.168	0.188	0.195
	(0.229)	(0.300)	(0.277)	(0.268)
Touches	-0.079**	-0.081**	-0.082**	-0.084**
	(0.038)	(0.037)	(0.047)	(0.049)
Yards	0.021**	0.022**	0.023**	0.023**
	(0.020)	(0.018)	(0.023)	(0.024)
Touchdowns	-0.050	-0.053	-0.068	-0.082
	(0.852)	(0.843)	(0.812)	(0.784)
Fumbles	-0.388	-0.376	-0.537	-0.383
	(0.573)	(0.582)	(0.464)	(0.607)
Fumbles Lost	0.669	0.695	0.869	0.726
	(0.465)	(0.448)	(0.378)	(0.466)
Pension Eligibility	3.103***	2.582**	2.414**	2.604**
	(0.007)	(0.024)	(0.047)	(0.038)
Win Percentage	2.768	2.465	2.835	2.665
	(0.251)	(0.315)	(0.286)	(0.331)
Playoff Appearance	-0.688	-0.652	-0.642	-0.574
	(0.498)	(0.530)	(0.563)	(0.618)
Signing Bonus (in 10000s)	0.008	0.008	0.004	0.006
	(0.220)	(0.197)	(0.438)	(0.352)
Other Bonuses (in 10000s)	-0.001	-0.002	-0.003	-0.002
	(0.834)	(0.733)	(0.595)	(0.705)
Millions Under Salary Cap	-0.021	-0.020	-0.030	-0.031
	(0.375)	(0.381)	(0.215)	(0.214)
Age at Beginning of Career	-0.815***	-0.832***	-0.728***	-0.775***
	(0.003)	(0.003)	(0.010)	(0.008)
Height (in inches)	-0.360	-0.402	-0.422*	-0.413
	(0.149)	(0.101)	(0.100)	(0.118)
Weight	0.065**	0.067**	0.071**	0.071**
	(0.024)	(0.019)	(0.017)	(0.020)
Number of Observations	526	526	526	526

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.47: Weibull Regression Results for Tight Ends (Career Length)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-18.598			
	(0.997)			
Mandatory Raise (in 10000s)		-2.796		
		(0.997)		
Income Increase Indicator			-55.657	
			(0.995)	
Income Increase (in 10000s)				-5.821
				(0.997)
Games Played	3.929	3.287	3.640	3.131
	(0.997)	(0.997)	(0.995)	(0.997)
Games Started	8.026	6.713	5.347	5.956
	(0.997)	(0.997)	(0.995)	(0.997)
Touches	-6.492	-5.605	-5.874	-6.706
	(0.997)	(0.997)	(0.995)	(0.997)
Yards	0.584	0.500	0.608	0.628
	(0.997)	(0.997)	(0.995)	(0.997)
Touchdowns	19.517	15.497	14.730	16.507
	(0.997)	(0.997)	(0.995)	(0.997)
Fumbles	-17.084	-14.968	-13.136	-15.655
	(0.997)	(0.997)	(0.995)	(0.997)
Fumbles Lost	555.187	469.768	432.289	427.197
	(0.998)	(0.998)	(0.997)	(0.998)
Pension Eligibility	36.182	26.383	-8.508	5.099
	(0.997)	(0.997)	(0.995)	(0.997)
Win Percentage	76.668	72.959	65.448	64.585
	(0.997)	(0.997)	(0.995)	(0.997)
Playoff Appearance	-7.859	-7.730	-6.282	-8.605
	(0.997)	(0.997)	(0.995)	(0.997)
Signing Bonus (in 10000s)	0.173	0.142	0.085	0.088
	(0.997)	(0.997)	(0.995)	(0.997)
Other Bonuses (in 10000s)	-0.200	-0.124	-0.212	-0.180
	(0.997)	(0.997)	(0.995)	(0.997)
Millions Under Salary Cap	0.058	0.137	-0.075	-0.054
	(0.997)	(0.997)	(0.995)	(0.997)
Age at Beginning of Career	-15.400	-13.349	-14.961	-13.414
	(0.997)	(0.997)	(0.995)	(0.997)
Height (in inches)	-1.389	-1.495	0.309	-0.339
	(0.997)	(0.997)	(0.995)	(0.997)
Weight	0.003	-0.015	0.019	0.201
	(0.998)	(0.997)	(0.995)	(0.997)
Number of Observations	285	285	285	285

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.48: Weibull Regression Results for Wide Receivers (Career Length)

Variables	(1)	(2)	(3)	(4)
Mandatory Raise Indicator	-2.173			
	(0.117)			
Mandatory Raise (in 10000s)		-0.209*		
		(0.068)		
Income Increase Indicator			-0.855	
			(0.327)	
Income Increase (in 10000s)				-0.093
				(0.334)
Games Played	0.195***	0.190***	0.202***	0.200***
	(0.007)	(0.007)	(0.007)	(0.007)
Games Started	-0.364	-0.300	-0.364	-0.358
	(0.127)	(0.194)	(0.140)	(0.145)
Touches	0.106	0.107	0.121	0.123
	(0.422)	(0.407)	(0.379)	(0.370)
Yards	0.008	0.007	0.007	0.007
	(0.445)	(0.533)	(0.510)	(0.521)
Touchdowns	0.471	0.555	0.562	0.552
	(0.388)	(0.312)	(0.329)	(0.336)
Fumbles	0.736	0.770	0.773	0.771
	(0.412)	(0.385)	(0.406)	(0.405)
Fumbles Lost	-0.953	-0.993	-1.084	-1.051
	(0.464)	(0.437)	(0.416)	(0.428)
Pension Eligibility	1.239	1.167	2.065	2.142*
	(0.329)	(0.354)	(0.109)	(0.089)
Win Percentage	4.047	3.172	3.734	3.732
	(0.135)	(0.229)	(0.196)	(0.193)
Playoff Appearance	-1.342	-1.091	-1.317	-1.290
	(0.215)	(0.311)	(0.251)	(0.260)
Signing Bonus (in 10000s)	0.007*	0.006*	0.006*	0.006*
	(0.074)	(0.083)	(0.098)	(0.093)
Other Bonuses (in 10000s)	0.007	0.007	0.008	0.009
	(0.432)	(0.398)	(0.342)	(0.327)
Millions Under Salary Cap	0.017	0.013	0.015	0.013
	(0.437)	(0.560)	(0.522)	(0.584)
Age at Beginning of Career	-1.076***	-1.076***	-1.056***	-1.080***
	(0.001)	(0.001)	(0.002)	(0.002)
Height (in inches)	-0.000	0.057	0.029	0.035
	(0.999)	(0.778)	(0.893)	(0.869)
Weight	0.024	0.014	0.017	0.016
	(0.486)	(0.692)	(0.642)	(0.661)
Number of Observations	567	567	567	567

Marginal Effects are reported. P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.49: Joint Test of Statistical Significance for Performance and Team Statistics (Firm Tenure Samples)

	(1)	(2)	(3)	(4)
Defensive Backs	74.88***	74.39***	72.28***	72.97***
	(0.000)	(0.000)	(0.000)	(0.000)
Defensive Linemen	109.39***	111.13***	106.24***	108.73***
	(0.000)	(0.000)	(0.000)	(0.000)
Linebackers	104.53***	104.55***	101.89***	103.06***
	(0.000)	(0.000)	(0.000)	(0.000)
Running Backs	78.15***	79.01***	74.92***	76.4***
	(0.000)	(0.000)	(0.000)	(0.000)
Tight Ends	50.93***	50.91***	48.1***	48.88***
	(0.000)	(0.000)	(0.000)	(0.000)
Wide Receivers	67.32***	67.47***	64.81***	64.44***
	(0.000)	(0.000)	(0.000)	(0.000)

P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 2.50: Joint Test of Statistical Significance for Performance and Team Statistics (Career Length Samples)

	(1)	(2)	(3)	(4)
Defensive Backs	159.21***	153.85***	159.82***	150.04***
	(0.000)	(0.000)	(0.000)	(0.000)
Defensive Linemen	92.33***	90.40***	76.97***	72.77***
	(0.000)	(0.000)	(0.000)	(0.000)
Linebackers	90.92***	99.03***	89.27***	88.02***
	(0.000)	(0.000)	(0.000)	(0.000)
Running Backs	88.93***	91.15***	87.67***	86.99***
	(0.000)	(0.000)	(0.000)	(0.000)
Tight Ends	70.02***	73.03***	70.48***	69.69***
	(0.000)	(0.000)	(0.000)	(0.000)
Wide Receivers	101.62***	101.99***	100.69***	101.83***
	(0.000)	(0.000)	(0.000)	(0.000)

P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

3   Do Minimum Salaries Change the Experience Distribution through Changing the Relative Minimum Prices between Employees of Different Experience Levels?

In general, firms choose the profit maximizing mix of labor inputs. Firms have the option to choose between experienced and inexperienced labor. In the presence of minimum salary schedules, the minimum salary for inexperienced labor is typically lower than the minimum salary for experienced labor. In absolute terms, a firm can hire an inexperienced worker at a lower salary than they can hire an experienced worker. When the minimum salary for inexperienced workers relative to the minimum salary for experienced workers changes, firms may be provided with the incentive to change their distribution of inexperienced and experienced workers.

When the relative minimum salary between inexperienced and experienced labor changes, one of these two types of labor is more expensive in terms of the other type compared to the relative prices before the change. The incentive to change the experience distribution exist when changing the relative minimum prices between inexperienced and experienced labor makes it more profitable for the firm to substitute away from the experience level that becomes relatively more expensive. Studying the impact of changing relative prices on the experience distribution is important for two reasons. The first reason is that changing the relative prices could be used as policy instrument to move the experience distribution closer to some desired experience distribution. The second reason is that the level of profitability firms can achieve may be reduced when the relative minimum prices change. This paper will focus on the first reason.

In general, in the situation that minimum salary schedules are put in place to protect older workers from receiving the lowest wages, it may be desirable to change the relative prices in a way that makes it more profitable for firms to hire experienced workers. Evidence in Chapter 2 reveals that minimum salary schedules shorten career length when they force firm's to increase a worker's compensation. Under minimum salary schedules, when the worker's experience level increases, the minimum salary paid to the worker increases. This increases the opportunity that a worker would be forced to receive an increase in compensation, therefore increasing the probability that a worker's career length is shortened. Even though minimum salary schedules can protect experienced workers by insuring that they do not receive the lowest salaries, they can harm experienced workers by shortening their careers. In order to counteract the impact of shortened careers due to minimum salary schedules, relative prices could be changed in a way that makes it more profitable to hire experienced workers. Furthermore, if the minimum salary schedule is put in place to protect older workers and the relative minimum prices are changing in a way that provide firms with an incentive to dismiss experienced workers in favor of inexperienced workers, relative prices can be changed to provide firms with the incentive to dismiss inexperienced workers in favor of experienced workers, aligning the relative price structure with the goal of minimum salary schedules.

The National Football League (NFL) has a minimum salary schedule in place in which the minimum salary of a worker with x years of experience relative to the minimum salary of a worker with y years of experience has changed over time. This is important because when the minimum salary of a player with x years of experience becomes more expensive relative to the minimum salary of a player with y years of

experience, the team has an incentive to hire more players with y years of experience and fewer players with x years of experience. This is because a team can now hire more players at the minimum salary for y years of experience at the price it cost to hire a player at x years of experience. In the absence of a change in the relative prices between the minimum salaries of players with different experience levels, the optimal number of players of each experience level is chosen. When the relative prices between minimum salaries change, teams are likely to re-optimize, therefore changing the experience distribution of players.

This chapter makes a contribution by using data from the NFL to focus on the impact of changing relative minimum salaries on an employer's choice between inexperienced and experienced workers. If the minimum salary of inexperienced workers increases relative to the minimum salary of experienced workers, employers have an incentive to hire fewer inexperienced workers on the margin because they are becoming relatively more expensive. If the minimum salary of inexperienced workers decreases relative to the minimum salary of experienced workers, employers have an incentive to hire more inexperienced workers on the margin because they are becoming relatively more inexpensive.

Table 3.1 shows the relative price for minimum salaries of all experience levels to the minimum salary of zero years of experience. For example, in the year 2000, 1.425 players with 0 years of experience can be employed at the minimum salary in place of a player with 1 year of experience at the minimum salary. This translates to a team being able to employ almost 3 players at the minimum salary for 0 years of experience in place of 2 players at the minimum salary for 1 year of experience. In 2002, the relative price of

the minimum salary of player with 1 year of experience to the minimum salary of a player with 0 years of experience falls to 1.333. When this relative price changes from 1.425 to 1.333, players with 1 year of experience are becoming cheaper relative to players with 0 years of experience. In 2002, a team can employ roughly 4 players at the minimum salary for 0 years of experience in place of 3 players at the minimum salary for 1 year of experience. In 2008, players with 1 year of experience are becoming even cheaper relative to players with 0 years of experience. In 2008, a team can employ roughly 5 players at the minimum salary for 0 years of experience in place of 4 players at the minimum salary for 1 year of experience.

In any industry that employs a minimum salary schedule in which the relative price of the minimum salaries between workers of different experience levels changes, the firm has an incentive to substitute towards the experience level that becomes relatively cheaper. In this paper, I measure the impact of changing relative prices on the experience distribution by exploiting the fact that the minimum salaries in the NFL have changed over time in a way that has changed the relative price of the minimum salaries between different experience levels.

3.1   Theoretical Model

Previous studies of professional sports leagues have made the assumption that professional teams maximize profits (Hamlen Jr., 2007; Fort and Quirk, 1995; Scully, 1974; Vrooman, 1995). In this analysis, I also make the assumption that professional teams maximize profits. Let each team choose the profit maximizing labor input mix by choosing the distribution of player salaries' that maximize profits subject to the fact that the sum of all player salaries is less than or equal to the league salary cap. Therefore, a

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team's profit maximization problem is to choose x_1, x_2, ..., x_n to maximize profits, (1), subject to the salary cap constraint, (2).

(1) *profits = f(x_1, x_2, ..., x_n)*

(2) $a_1x_1 + a_2x_2 + ... + a_n x_n \leq cap$

Each x_i represent the number of players earning salary a_i and cap is the NFL's salary cap.

The team's constrained profit maximization problem becomes (3).

(3) *max L = f(x_1, x_2, ..., x_n) - λ[a_1x_1 + a_2x_2 + ... + $a_n x_n$ – cap].*

The first order conditions of L with respect to x_i and x_j are shown in (4) and (5).

(4) $\dfrac{\partial L}{\partial x_i} = \dfrac{\partial f}{\partial x_i} - \lambda a_i = 0$ or $\dfrac{\partial f}{\partial x_i} = \lambda a_i$; $MPx_i = \lambda a_i$

(5) $\dfrac{\partial L}{\partial x_j} = \dfrac{\partial f}{\partial x_j} - \lambda a_j = 0$ or $\dfrac{\partial f}{\partial x_j} = \lambda a_j$; $MPx_j = \lambda a_j$

Dividing (4) by (5) yields (6).

(6) $\dfrac{MPx_i}{MPx_j} = \dfrac{\lambda a_i}{\lambda a_j} = \dfrac{a_i}{a_j}$

Equation (6) tells us that at a maximum, the ratio of the marginal productivity of a player earning salary a_i to the marginal productivity of a player earning salary a_j is equal to the ratio of the salary a_i to the salary a_j.

For example, let x_i represent the number of players on the team earning the minimum salary for one year of experience. Let x_j represent the number of players on the team earning the minimum salary for zero years of experience. Let a_i represent the minimum salary for players with one year of experience. Let a_j represent the minimum salary for players with zero years of experience. The NFL's minimum salary structure currently causes the relative price of a player with one year of experience to a player with

zero years of experience to change over time. Profit maximization requires that an increase in the relative price of a player with one year of experience to a player with zero years of experience lead to an increase in the ratio of the marginal product of a player with one year of experience to the marginal product of a player with zero years of experience. When the relative price of a player with one year of experience to a player with zero years of experience increase, players with zero years of experience become less expensive relative to players with one year of experience. This provides the team with an incentive to increase the number of players on the team with zero years of experience and decrease the number of players on the team with one year of experience. Increasing the number of players on the team earning the minimum salary with zero years of experience will reduce the marginal product of players with zero years of experience. Decreasing the number of players on the team earning the minimum salary with one year of experience will enlarge the marginal product of players with one year of experience. Both of these actions increase the ratio of the marginal product of players with one year of experience to the marginal product of players with zero years of experience. These actions will be taken until the ratio of the marginal product of players earning the minimum salary for one year of experience to the marginal product of players earning the minimum salary for zero years of experience is equated to the ratio of minimum salaries. When a team increases the number of players earning the minimum salary for zero years of experience and decreases the number of players earning the minimum salary for one year of experience, the experience distribution changes.

3.2   Empirical Model

In order to test whether the NFL's salary structure has an impact on a firm's labor input mix, I estimate Ordinary Least Squares Models represented by equation (7).

(7) *percent_x_years_experience = β_0 +$\beta_1$relative_min_price_1to2_0 +*
$\beta_2$relative_min_price_3to6_0 + $\beta_3$relative_min_price_7ormore_0 +
*$\beta_4$under_the_salary_cap_in_ten_millions + **δteam** + ε*

The dependent variable, *percent_x_years_experience*, represents the percentage of players at 1 of 4 groups of experience levels, 0 years of experience, 1 to 2 years of experience, 3 to 6 years of experience, and 7 or more years of experience. I estimate four different models where I allow the dependent variable to represent one of the four groups of experience levels in each model.   The explanatory variables of interest are *relative_min_price_1to2_0*,   *relative_min_price_3to6_0*,   and *relative_min_price_7ormore_0*. These variables represent the relative prices for the minimum salary of a player with 1 to 2 years of experience to the minimum salary of a player with 0 years of experience, the relative price of the minimum salary of a player with 3 to 6 years of experience to the minimum salary of a player with 0 years of experience, and the relative price of the minimum salary of a player with 7 or more years of experience to the minimum salary of a player with 0 years of experience. These variables are simply the ratios of the minimum salary for a player in each of the three experience level groups to the minimum salary of a player with 0 years of experience. I also restrict the sample to players who earn less than $200 thousand dollars above the minimum salary estimate four different models where I allow the dependent variable to represent one of the four groups of experience levels in each model. I restrict the sample to estimate the impact of changing relative prices for players who are close to earning the

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The dependent variable, *percent_x_years_experience*, represents the percentage of players at 1 of 4 groups of experience levels, 0 years of experience, 1 to 2 years of experience, 3 to 6 years of experience, and 7 or more years of experience. I estimate four different models where I allow the dependent variable to represent one of the four groups of experience levels in each model.   The explanatory variables of interest are *relative_min_price_1to2_0*,   *relative_min_price_3to6_0*,   and *relative_min_price_7ormore_0*. These variables represent the relative prices for the minimum salary of a player with 1 to 2 years of experience to the minimum salary of a player with 0 years of experience, the relative price of the minimum salary of a player with 3 to 6 years of experience to the minimum salary of a player with 0 years of experience, and the relative price of the minimum salary of a player with 7 or more years of experience to the minimum salary of a player with 0 years of experience. These variables are simply the ratios of the minimum salary for a player in each of the three experience level groups to the minimum salary of a player with 0 years of experience. I also restrict the sample to players who earn less than $200 thousand dollars above the minimum salary estimate four different models where I allow the dependent variable to represent one of the four groups of experience levels in each model. I restrict the sample to estimate the impact of changing relative prices for players who are close to earning the

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minimum salary. Table 3.2 provides descriptions of the variables used in the models. I choose to use the relative prices for the minimum salaries of all other experience levels to minimum salary for 0 years of experience because the minimum salary for a player with zero years of experience is the lowest salary a team can pay a player and only players with zero years of experience can earn that salary.

Equations (1) – (6) show that when a team maximizes profits the ratio of the salaries to the ratio of marginal products are equated. When the ratios of the salaries change, the ratio of marginal products must change to equate these ratios. The ratio of salaries changes when the relative price for the minimum salaries of two experience levels changes. In order to equate the ratio of salaries to the ratio of marginal products the quantity of players at a given salary must adjust. The empirical model is a test of the theoretical model because when the relative price for the minimum salaries of two experience levels changes, the quantity of players at those experience levels should change in order for the ratio of marginal products to adjust.

The experience level group with 1 to 2 years of experience can be thought of as low experienced players. The experience level group with 3 to 6 years of experience can be thought of as medium experienced players. The experience level group with 7 or more years of experience can be thought of as high experienced players. The experience levels are grouped the way they are because the relative price of the minimum salaries of the experience levels in a particular group to the minimum salary of a player with 0 years of experience are almost perfectly correlated.

Table 3.3 shows the correlation coefficients between the relative prices for the minimum salary of all experience levels in terms of the minimum salary of 0 years of

experience. The correlation coefficient between the relative price for the minimum salary of a player with 1 year of experience to the minimum salary of a player with 0 years of experience and the relative price for the minimum salary of a player with 2 years of experience to the minimum salary of a player with 0 years of experience is 0.9999. This correlation coefficient indicates that these two variables almost always move together. Given the strength of the linear relationship between these two variables, I only use the relative price for the minimum salary of a player with 1 year of experience to the minimum salary of a player with 0 years of experience to estimate the impact of both of these relative prices. The correlation coefficient between the relative price for the minimum salary of a player with 3 years of experience to the minimum salary of a player with 0 years of experience and the relative price for the minimum salary of a player with 5 to 6 years of experience to the minimum salary of a player with 0 years of experience is 0.9782. I only use the relative price for the minimum salary of a player with 5 to 6 years of experience to the minimum salary of a player with 0 years of experience to estimate the impact these relative prices. I also use the relative price for the minimum salary of a player with 5 to 6 years of experience to the minimum salary of a player with 0 years of experience to measure the impact of the relative price for the minimum salary of a player with 4 years of experience to the minimum salary of a player with 0 years of experience because these two variables are exactly the same for the last eight of the ten years in the sample. The correlation coefficient between the relative price for the minimum salary of a player with 7 to 9 years of experience to the minimum salary of a player with 0 years of experience and the relative price for the minimum salary of a player with 10 or more years of experience to the minimum salary of a player with 0 years of experience is

0.9754. I only use the relative price for the minimum salary of a player with 10 or more years of experience to the minimum salary of a player with 0 years of experience to estimate the impact these relative prices.

In the model where *percent_0_years_experience* is the dependent variable, the expected sign of the coefficient on *relative_min_price_1to2_0* is positive. When *relative_min_price_1to2_0* increases, the minimum price of a player with 1 to 2 years of experience is increasing in terms of the minimum price of a player with 0 years of experience. Players with 0 years of experience are expected to be substitutes for players with 1 to 2 years of experience, therefore the expected sign of the coefficient on *relative_min_price_1to2_0* is positive. The expected signs on the coefficients on *relative_min_price_3to6_0* and *relative_min_price_7ormore_0* are ambiguous. The sign of these coefficients depend on whether players with 3 to 6 years of experience and players with 7 or more years of experience are complements to or substitutes for players with 0 years of experience. If players with 3 to 6 years of experience and players with 7 or more years of experience are complements to players with 0 years of experience, the expected signs of the coefficients on *relative_min_price_3to6_0* and *relative_min_price_7ormore_0* are negative. This is because when *relative_min_price_3to6_0* and *relative_min_price_7ormore_0* increase the price of a complement to players with zero years of experience increases, decreasing the amount of players with zero years of experience. If players with 3 to 6 years of experience and players with 7 or more years of experience are substitutes for players with 0 years of experience, the expected signs of the coefficients on *relative_min_price_3to6_0* and *relative_min_price_7ormore_0* are positive. This is because when

relative_min_price_3to6_0 and *relative_min_price_7ormore_0* increases the price of a substitute for players with zero years of experience increases, increasing the amount of players with zero years of experience.

In the model where *percent_1to2_years_experience* is the dependent variable the expected sign of the coefficient on *relative_min_price_1to2_0* is negative. An increase in this variable indicates that at the minimum salaries players with 1 to 2 years of experience are becoming more expensive in terms of players with 0 years of experience. The expected signs on the coefficients on *relative_min_price_3to6_0* and *relative_min_price_7ormore_0* are ambiguous. The sign of these coefficients depend on whether players with 3 to 6 years of experience and players with 7 or more years of experience are complements to or substitutes for players with 1 to 2 years of experience. If players with 3 to 6 years of experience and players with 7 or more years of experience are complements to players with 1 to 2 years of experience, the expected signs of the coefficients on *relative_min_price_3to6_0* and *relative_min_price_7ormore_0* are negative. If players with 3 to 6 years of experience and players with 7 or more years of experience are substitutes for players with 1 to 2 years of experience, the expected signs of the coefficients on *relative_min_price_3to6_0* and *relative_min_price_7ormore_0* are positive.

In the model where *percent_3to6_years_experience* is the dependent variable the expected sign of the coefficient on *relative_min_price_3to6_0* is negative. An increase in this variable indicates that at the minimum salaries players with 3 to 6 years of experience are becoming more expensive in terms of players with 0 years of experience. The expected signs of the coefficients on *relative_min_price_3to6_0* and

relative_min_price_7ormore_0 are ambiguous. The sign of these coefficients depend on whether players with 1 to 2 years of experience and players with 7 or more years of experience are complements to or substitutes for players with 3 to 6 years of experience. If players with 1 to 2 years of experience and players with 7 or more years of experience are complements to players with 3 to 6 years of experience, the expected signs of the coefficients on *relative_min_price_1to2_0* and *relative_min_price_7ormore_0* are negative. If players with 1 to 2 years of experience and players with 7 or more years of experience are substitutes for players with 3 to 6 years of experience, the expected signs of the coefficients on *relative_min_price_1to2_0* and *relative_min_price_7ormore_0* are positive.

In the model where *percent_7ormore_years_experience* is the dependent variable the expected sign of the coefficient on *relative_min_price_7ormore_0* is negative. An increase in this variable indicates that at the minimum salaries players with 7 or more years of experience are becoming more expensive in terms of players with 0 years of experience. The expected signs of the coefficients on *relative_min_price_1to2_0* and *relative_min_price_3to6_0* are ambiguous. The sign of these coefficients depend on whether players with 1 to 2 years of experience and players with 3 to 6 years of experience are complements to or substitutes for players with 7 or more years of experience. If players with 1 to 2 years of experience and players with 3 to 6 years of experience are complements to players with 7 or more years of experience, the expected signs of the coefficients on *relative_min_price_1to2_0* and *relative_min_price_3to6_0* are negative. If players with 1 to 2 years of experience and players with 3 to 6 or more years of experience are substitutes for players with 7 or more years of experience, the

expected signs of the coefficients on *relative_min_price_1to2_0* and *relative_min_price_3to6_0* are positive.

I control for the amount the team is under the salary cap, *under_the_salary_cap_in_ten_millions*, in order to account for the team's ability to substitute a player with a higher minimum salary for a player with a lower minimum. The expected sign of the coefficient is ambiguous because a team can have any experience distribution and still be well below or well above the salary cap. I also control for team effects by including team specific dummy variables, **team**. An observation in this model is determined by the team and year. Table 3.4 displays the summary statistics for the variables used in the model.

3.3 Data

This analysis uses NFL data from 2000 to 2009 to measure the impact of minimum salaries on the experience distribution through changing relative prices. The salary and team roster data are collected from the USA Today's NFL salary database located on the USA Today's website (http://content.usatoday.com/sportsdata/football/nfl/salaries/team). The player experience data are collected from the NFL's official website (http://www.nfl.com/players). The relative price data are calculated using the minimum salary schedule in the NFL's Collective Bargaining Agreement.

In order to measure the impact of changing relative minimum prices on the experience distribution, I merge the team roster and salary data from the USA Today's website with the experience data from the NFL's website. The combined data provide me with the salary and experience information for the players on each of the 32 NFL teams. I observe all of these teams' player experience and player salary information for

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ten years except for the Houston Texans. I only observe the player experience and player salary information for the Houston Texans for eight years because they were not an NFL franchise until 2002.

The USA Today's NFL salary database has salary information for some players who earn less the minimum salary. During the NFL's preseason, teams are allowed to employ more than the 53 player allowed on the roster during the regular season. In order to measure the impact of changing relative prices on the experience distribution in the regular season, I only include the players from the USA Today's website who earn more than the minimum salary for their experience level in the analysis. Even though a team is allowed only 53 players on its active roster at any given time during the regular season, over the course of a regular season a team could employ more than 53 players. Instead of using the number of players on a team in an experience level group, I use the percent of players on a team in an experience level group to account for the fact that all teams do not always employ the same number of players during the course of the regular season.

Figure 3.1 shows the average percent of players with 0 years of experience, the average percent of players with 1 to 2 years of experience, the average percent of players with 3 to 6 years of experience, and the average percent of players with 7 or more years of experience from 2000 to 2009. Figure 3.2 shows the average percent of players in each experience level group from 2000 to 2009 when the sample is restricted to players who earn less than $200 thousand above the minimum salary. These figures provide evidence that the distribution of experience has changed over the ten years in the sample. Figure 3.3 shows the relative minimum price patios of 1 to 2, 3 to 6, and 7 or more years

of experience to 0 years of experience. This figure provides a visual depiction of the relative minimum price ratios used in the models.

3.4 Results

Table 3.5 provides the regression results for the impact of changing relative prices on the 4 experience level groups. Model (1) indicates that players with 1 to 2 years of experience are substitutes for players with 0 years of experience as expected because the sign of the coefficient on relative_min_price_1to2_0 is positive and statistically significant. The coefficient of 4.458 indicates that a one standard deviation (0.062) increase in *relative_min_price_1to2_0* leads to a 27.6% increase in the percent of players with 0 years of experience. The sign of the coefficient on *relative_min_price_3to6_0* is negative and statistically significant indicating that players with 0 years of experience are complements to players with 3 to 6 years of experience. The sign of the coefficient on *relative_min_price_7ormore_0* is positive and statistically significant indicating that players with 0 years of experience are substitutes for players with 7 or more years of experience. Model (2) indicates that a change in the relative prices do not have a statistically significant impact on the percent of players with 1 to 2 years of experience. Contrary to the expected result, Model (3) indicates that the percent of players with 3 to 6 years of experience increases when *relative_min_price_3to6_0* because the sign of the coefficient is positive and statistically significant. The coefficient of 1.490 indicates that a one standard deviation (0.131) increase in *relative_min_price_3to6_0* leads to a 19.5% increase in the percent of players with 3 to 6 years of experience. The sign of the coefficient on *relative_min_price_1to2_0* is negative and statistically significant indicating that players with 3 to 6 years of experience are complements to players with 1

to 2 years of experience. The sign of the coefficient on *relative_min_price_7ormore_0* is negative and statistically significant indicating that players with 3 to 6 years of experience are complements to players with 7 or more years of experience. As expected, Model (4) indicates that the percent of players with 7 or more years decrease as *relative_min_price_7ormore_0* increases. The coefficient of -0.392 indicates that a one standard deviation (0.391) increase in *relative_min_price_7ormore_0* leads to a 15.3% decrease in the percent of players with 7 or more years of experience. The sign of the coefficient on *relative_min_price_1to2_0* is negative and statistically significant indicating that players with 7 or more years of experience are complements to players with 1 to 2 years of experience. The sign of the coefficient on *relative_min_price_3to6_0* is positive and statistically significant indicating that players with 7 or more years of experience are substitutes for players with 3 to 6 years of experience.

The variable *under_the_salary_cap_in_ten_millions* is positive and statistically significant in Model (1), it is not statistically significant in Model (2), and it is negative and statistically significant in Models (3) and (4). Model (1) indicates that a $10 million increase in a team's amount under the salary cap leads to a 1.0% increase in the percent of players with 0 years of experience. Model (3) indicates that a $10 million increase in a team's amount under the salary cap leads to a 0.8% increase in the percent of players with 3 to 6 years of experience. Model (4) indicates that a $10 million increase in a team's amount under the salary cap leads to a 0.5% increase in the percent of players with 7 or more years of experience. Even though these results indicate that teams employ more players with no experience and fewer players with medium and high levels of

experience, the magnitude of the impact of a $10 million dollar change in this variable is fairly small.

I do not report the coefficients of the 31 team dummy variables in Models (1) through (4). The omitted team dummy variable from the analysis is the Green Bay Packers. In Model (1) there are 3 teams that have a statistically significant lower percentage of players with 0 years of experience compared to the Green Bay Packers. There are no teams in Model (1) with a statistically significant higher percentage of players with 0 years of experience compared to the Green Bay Packers. In Model (2) there are 12 teams that have a statistically significant lower percentage of players with 1 to 2 years of experience compared to the Green Bay Packers. There are no teams in Model (2) with a statistically significant higher percentage of players with 1 to 2 years of experience compared to the Green Bay Packers. In Model (3) there are no teams that have a statistically significant lower percentage of players with 3 to 6 years of experience compared to the Green Bay Packers. There are 9 teams in Model (3) with a statistically significant higher percentage of players with 3 to 6 years of experience compared to the Green Bay Packers. In Model (4) there is only one team that has a statistically significant lower percentage of players with 7 or more years of experience compared to the Green Bay Packers. There are 13 teams in Model (4) with a statistically significant higher percentage of players with 7 or more years of experience compared to the Green Bay Packers.

Table 3.6 provides the regression results for the impact of changing relative prices on the 4 experience level groups with the models restricted to only the players who earn less than $200 thousand above the minimum salary. The amount of these players'

salaries is close to the minimum salaries. Model (5) indicates that players who are close

to earning the minimum salary with 1 to 2 years of experience are substitutes for players

who are close to earning the minimum salary with 0 years of experience. As expected,

the sign of the coefficient on *relative_min_price_1to2_0* is positive and statistically

significant.   The coefficient of 2.704 indicates that a one standard deviation (0.062)

increase in *relative_min_price_1to2_0* leads to a 16.8% increase in the percent of players

with 0 years of experience who are close to earning the minimum salary. The sign of the

coefficient on *relative_min_price_3to6_0* is negative and statistically significant

indicating that players with 0 years of experience who earn close to the minimum salary

are complements to players with 3 to 6 years of experience who earn close to the

minimum salary.   The sign of the coefficient on *relative_min_price_7ormore_0* is

positive and statistically significant indicating that players with 0 years of experience

who earn close to the minimum salary are substitutes for players with 7 or more years of

experience who earn close to the minimum salary. As expected, Model (6) indicates that

the percent of players with 1 to 2 years of experience who earn close to the minimum

salary decrease as *relative_min_price_1to2_0* increases.   The coefficient of -2.447

indicates that a one standard deviation (0.062) increase in *relative_min_price_1to2_0*

leads to a 15.2% decrease in the percent of players with 1 to 2 years of experience who

earn   close   to   the   minimum   salary.   The   sign   of   the   coefficient   on

relative_min_price_3to6_0 is positive and statistically significant indicating that players

with 1 to 2 years of experience who earn close to the minimum salary are substitutes for

players with 3 to 6 years of experience who earn close to the minimum salary. The sign

of   the   coefficient   on   *relative_min_price_7ormore_0*   is   negative   and   statistically

significant indicating that players with 1 to 2 years of experience who earn close to the minimum salary are complements to players with 7 or more years of experience who earn close to the minimum salary. Model (7) indicates that a change in the relative prices do not have a statistically significant impact on the percent of players with 3 to 6 years of experience who earn close to the minimum salary. Model (8) indicates that a change in the relative prices do not have a statistically significant impact on the percent of players with 7 or more years of experience who earn close to the minimum salary.

The variable *under_the_salary_cap_in_ten_millions* is positive and statistically significant in Model (5), it is not statistically significant in Model (6), and it is negative and statistically significant in Models (7) and (8). Model (5) indicates that a $10 million increase in a team's amount under the salary cap leads to a 1.2% increase in the percent of players with 0 years of experience who earn close to the minimum salary. Model (7) indicates that a $10 million increase in a team's amount under the salary cap leads to a 0.9% increase in the percent of players with 3 to 6 years of experience who earn close to the minimum salary. Model (8) indicates that a $10 million increase in a team's amount under the salary cap leads to a 0.4% increase in the percent of players with 7 or more years of experience who earn close to the minimum salary. Even though these results indicate that teams employ more players with no experience and fewer players with medium and high experience who earn close to the minimum salary, the magnitude of the impact of a $10 million dollar change in this variable is fairly small.

I do not report the coefficients of the 31 team dummy variables in Models (5) through (8). The omitted team dummy variable from the analysis with the sample restricted to players who earn less than $200 thousand is also the Green Bay Packers. In

Model (5) there are 3 teams that have a statistically significant lower percentage of players with 0 years of experience who earn close to the minimum salary compared to the Green Bay Packers. There are no teams in Model (5) with a statistically significant higher percentage of players with 0 years of experience who earn close to the minimum salary compared to the Green Bay Packers. In Model (6) there are 10 teams that have a statistically significant lower percentage of players with 1 to 2 years of experience who earn close to the minimum salary compared to the Green Bay Packers. There are no teams in Model (6) with a statistically significant higher percentage of players with 1 to 2 years of experience who earn close to the minimum salary compared to the Green Bay Packers. In Model (7) there is one team that has a statistically significant lower percentage of players with 3 to 6 years of experience who earn close to the minimum salary compared to the Green Bay Packers. There are 9 teams in Model (7) with a statistically significant higher percentage of players with 3 to 6 years of experience who earn close to the minimum salary compared to the Green Bay Packers. In Model (8) there is only one team that has a statistically significant lower percentage of players with 7 or more years of experience who earn close to the minimum salary compared to the Green Bay Packers. There are 14 teams in Model (8) with a statistically significant higher percentage of players with 7 or more years of experience who earn close to the minimum salary compared to the Green Bay Packers.

Models (1), (3), (4), (5), and (6) provide evidence that changing the relative price for the minimum salary of one experience level to the minimum salary of another experience level changes the experience distribution. The fact that changing the relative minimum price between 2 different experience levels changes the experience distribution

provide evidence that adjusting relative minimum prices can be used to influence the experience distribution. This is an important result for the NFL and other industries that employ minimum salary schedules because it shows that adjusting relative prices has the ability to be used as a policy instrument to change the experience distribution.

Even though changing the relative price between 2 different experience levels change the experience distribution, some of the changes are opposite of the expected result. This could mean that the roster constraint in the NFL is playing a role in how teams adjust to changes in relative prices that I am unable to observe. Another possibility is the unlikely possibility of the percentage of players of a specific experience level increasing when they become relatively more expensive. This could happen when the absolute price of the experience level that becomes relatively more expensive in terms of another experience level is less than the absolute price of the experience level that becomes relatively cheaper. Due to salary cap constraints teams may only be able to employ the players who become relatively more expensive because employing more of the players who become relatively cheaper could cause the team to go over the salary cap. Another possibility is that it may be costly for teams to seek out players who are at experience level that becomes relatively cheaper. For example, if a kicker or punter becomes relatively more expensive, it may be costly for a team to locate a kicker or a punter that is at an experience level that becomes relatively cheaper. One possibility to address this issue is to look at how the experience distribution changes across positions instead of teams when the relative price between certain experience levels change.

Figure 3.1: Average Percentage of Players with 0, 1 to 2, 3 to 6, and 7 or More Years of Experience
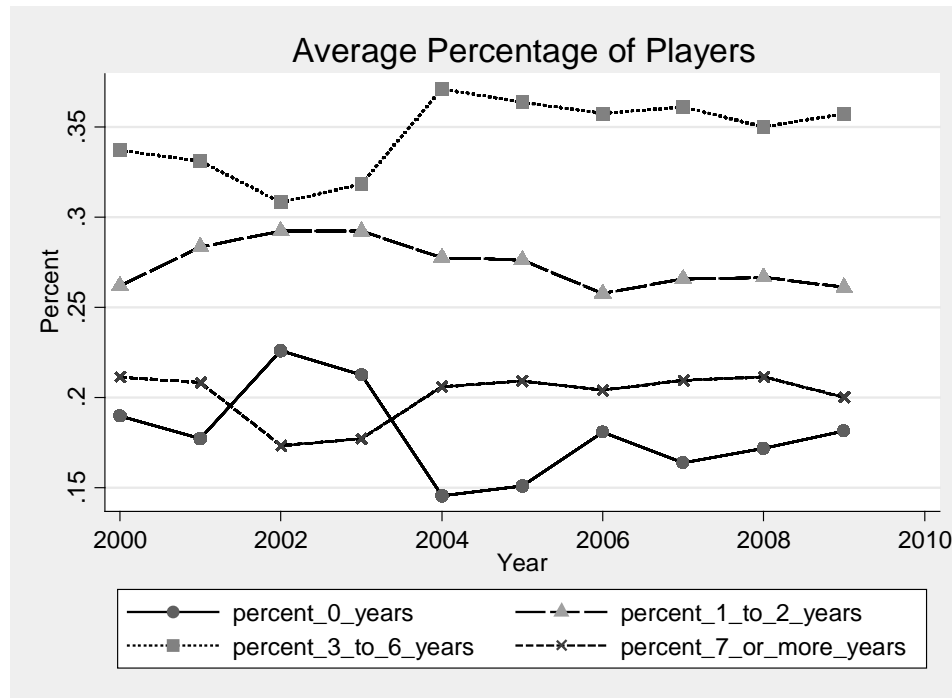

Figure 3.2: Average Percentage of Players with 0, 1 to 2, 3 to 6, and 7 or More Years of Experience (Sample Restricted to Players who Earn Less than $200 Thousand Above the Minimum Salary)
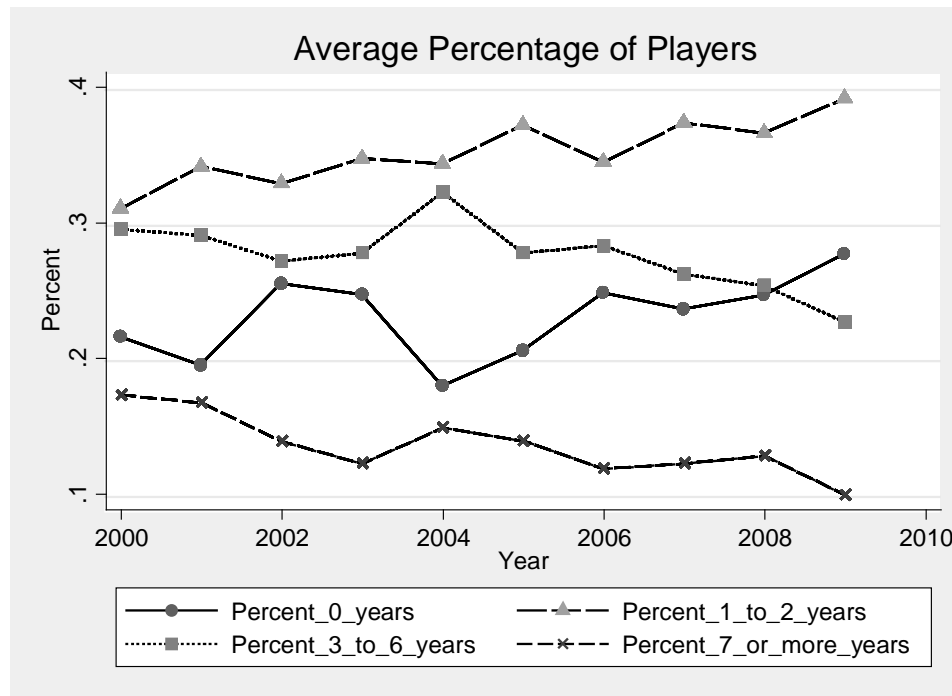
Figure 3.3: Relative Minimum Price Ratios of 1 to 2, 3 to 6, and 7 or More Years of Experience to 0 Years of Experience
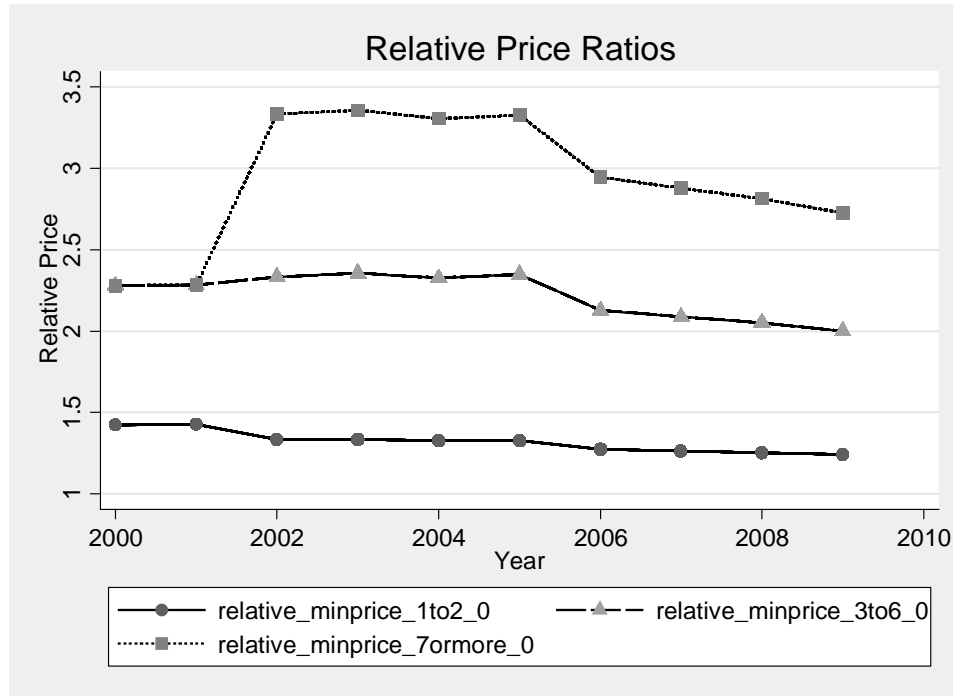
Table 3.1: Relative Minimum Prices of All Experience Levels in Terms of the Minimum Price for Zero Years of Experience

Experience	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0 years	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1 year	1.425	1.426	1.333	1.333	1.326	1.326	1.273	1.263	1.254	1.242
2 years	1.855	1.861	1.667	1.667	1.652	1.652	1.545	1.526	1.508	1.484
3 years	1.995	2.000	2.000	2.000	1.978	1.978	1.818	1.789	1.763	1.726
4 years	2.140	2.144	2.333	2.356	2.326	2.348	2.127	2.088	2.051	2.000
5 or 6 years	2.280	2.282	2.333	2.356	2.326	2.348	2.127	2.088	2.051	2.000
7, 8, or 9 years	2.280	2.282	2.889	2.911	2.870	2.891	2.582	2.526	2.475	2.403
10 or more years	2.280	2.282	3.333	3.356	3.304	3.326	2.945	2.877	2.814	2.726

Table 3.2: Variable Descriptions

Variable	Description
Dependent	
percent_0_years_experience	percentage of players with 0 years of experience on given team in a given year
percent_1to2_years_experience	percentage of players with 1 to 2 years of experience on given team in a given year
percent_3to6_years_experience	percentage of players with 3 to 6 years of experience on given team in a given year
percent_7ormore_years_experience	percentage of players with 7 or more years of experience on given team in a given year
percent_0_years_restricted	percentage of players with 0 years of experience on given team in a given year when the sample is restricted to players who earn less than $200 thousand above the minimum
percent_1to2_years_restricted	percentage of players with 1 to 2 years of experience on given team in a given year when the sample is restricted to players who earn less than $200 thousand above the minimum
percent_3to6_years_restricted	percentage of players with 3 to 6 years of experience on given team in a given year when the sample is restricted to players who earn less than $200 thousand above the minimum
percent_7ormore_years_restricted	percentage of players with 7 or more years of experience on given team in a given year when the sample is restricted to players who earn less than $200 thousand above the minimum
Independent	
relative_min_price_1to2_0	the ratio of the minimum salary for 1 to 2 years of experience to the minimum salary for 0 years of experience
relative_min_price_3to6_0	the ratio of the minimum salary for 3 to 6 years of experience to the minimum salary for 0 years of experience
relative_min_price_7ormore_0	the ratio of the minimum salary for 7 or more years of experience to the minimum salary for 0 years of experience
under_the_cap_in_ten_millions	the amount a team is under the salary cap in ten million dollars
team	a vector of indicator variables representing the NFL teams

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Table 3.3: Correlation Coefficients between the Relative Prices for the Minimum Salary for All Experience Levels in Terms of the Minimum Salary for 0 Years of Experience

	relative_min_ price_1_0	relative_min_ price_2_0	relative_min_ price_3_0	relative_min_ price_4_0	relative_min_ price_5to6_0	relative_min _price_7to9 _0	relative_min _price_10or more_0
relative_min_price _1_0	1.0000	0.9999	0.8408	0.3641	0.7177	-0.1667	-0.3796
relative_min_price _2_0	0.9999	1.0000	0.8340	0.3525	0.7090	-0.1789	-0.3910
relative_min_price _3_0	0.8408	0.8340	1.0000	0.8086	0.9782	0.3932	0.1814
relative_min_price _4_0	0.3641	0.3525	0.8086	1.0000	0.9096	0.8569	0.7222
relative_min_price _5to6_0	0.7177	0.7090	0.9782	0.9096	1.0000	0.5654	0.3697
relative_min_price _7to9_0	-0.1667	-0.1789	0.3932	0.8569	0.5654	1.0000	0.9754
relative_min_price _10ormore_0	-0.3796	-0.3910	0.1814	0.7222	0.3697	0.9754	1.0000

Table 3.4: Summary Statistics

Variable	Mean	Std. Dev.	Obs.
percent_0_years_experience	0.180	0.057	318
percent_1to2_years_experience	0.273	0.603	318
percent_3to6_years_experience	0.346	0.072	318
percent_7ormore_years_experience	0.201	0.378	318
percent_0_years_ restricted	0.233	0.071	318
percent_1to2_years_ restricted	0.354	0.082	318
percent_3to6_years_ restricted	0.277	0.078	318
percent_7ormore_years_ restricted	0.136	0.078	318
relative_min_price_1to2_0	1.319	0.062	318
relative_min_price_3to6_0	2.219	0.131	318
relative_min_price_7ormore_0	2.928	0.391	318
under_the_cap_in_ten_millions	0.472	1.462	318

Table 3.5: Regression Results

	percent_0_years _experience (1)	percent_1to2_years _experience (2)	percent_3to6_years _experience (3)	percent_7ormore_years _ experience (4)
	Dependent Variable			
relative_min_price_1to2_0	4.458***	1.148	-3.384***	-2.223***
	(0.000)	(0.197)	(0.001)	(0.008)
relative_min_price_3to6_0	-2.025***	-0.468	1.490***	1.002**
	(0.000)	(0.265)	(0.002)	(0.012)
relative_min_price_7ormore_0	0.526***	0.143	-0.392***	-0.278***
	(0.000)	(0.174)	(0.001)	(0.005)
under_the_cap_in_ten_millions	0.010***	0.003	-0.008***	-0.005**
	(0.000)	(0.174)	(0.003)	(0.033)
constant	-2.739***	-0.584	2.632***	1.691***
	(0.000)	(0.295)	(0.000)	(0.001)
R-squared	0.29	0.30	0.26	0.44
Number of obs	318	318	318	318

P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

Table 3.6: Regression Results (Sample Restricted to Players Who Earn Less than $200 Thousand Above Their Minimum Salary)

	Dependent Variable			
	percent_0_years _restricted	percent_1to2_years _restricted	percent_3to6_years _restricted	percent_7ormore_years _restricted
	(5)	(6)	(7)	(8)
relative_min_price_1to2_0	2.704***	-2.447**	-0.464	0.207
	(0.007)	(0.037)	(0.679)	(0.833)
relative_min_price_3to6_0	-1.388***	1.017*	0.339	0.032
	(0.003)	(0.066)	(0.526)	(0.945)
relative_min_price_7ormore_0	0.345***	-0.262*	-0.069	-0.015
	(0.004)	(0.057)	(0.599)	(0.900)
under_the_cap_in_ten_millions	0.012***	0.001	-0.009***	-0.004*
	(0.000)	(0.763)	(0.001)	(0.097)
constant	-1.254*	2.140***	0.320	-0.205
	(0.051)	(0.003)	(0.640)	(0.737)
R-squared	0.27	0.31	0.25	0.43
Number of obs	318	318	318	318

P-values are in parentheses. Significance Level: ***1%, **5%, *10%.

4 Conclusion

This dissertation uses NFL data to measure the impact of minimum salaries on firm tenure, career length, and the experience distribution. Chapter two focuses on the impact of minimum salaries on firm tenure and career length. I present Kaplan Meier survival estimates that demonstrate that players who require an income increase have lower survivor rates than players who do not require an income increase. The statistical significance and the negative sign of some of the mandatory raise and income increase variables in the various model specifications provide evidence that minimum salaries shorten a player's firm tenure and career length when they require a team to give a player a mandatory raise or an income increase. I provide further evidence that minimum salaries shorten firm tenure and career length by producing Weibull regression survival estimates that show that players who require a mandatory raise or an income increase have a lower survival rate.

This analysis shows that firm tenure and career length are shortened when minimum salaries force a worker's pay to be higher than his value to the firm. This has implications for other industries because whenever minimum salaries force a worker's pay to be higher than their value to firm, the worker's firm tenure or career length is expected to be shortened regardless of industrial structure, gender, or magnitude of minimum salaries. One potential problem with this study is that I am not able to control for injuries. In spite of not controlling for injuries, I argue that the estimated models are not impacted negatively because what matters is not whether a player is injured but whether a player plays in the game or not. This analysis also has direct implications for the NFL because shortening careers give more players an opportunity to play in the NFL.

If the goal of the NFL Management Council and the NFL Players Association is to give as many players as possible a chance to play in the NFL in order to increase overall interest in the NFL, shortening careers would be seen as a desirable result. If the goal of the NFL Management Council and the NFL Players Association is to put the best players on the field, minimum salaries are not aligned with this objective because they limit a team's ability to pay some players who are more productive than inexperienced players their value to the team.

Future research could examine another sports league like the National Basketball Association (NBA) to analyze the impact of minimum salaries on firm tenure and career length to see whether the results found here are confirmed. One advantage of looking at another sports industry is that even though the salaries are still higher than most other industries and only one gender is employed, it allows us to see if the industrial structure of the NFL is driving the results.

Chapter three focuses on the impact of minimum salaries on the experience distribution. The fact that minimum salaries in the NFL's minimum salary schedule change in a way that changes the relative minimum prices between two experience levels provide teams with an incentive to substitute away from the experience level whose relative minimum price becomes more expensive. I control for the amount a team is under the salary cap and team effects and find some evidence that changing relative minimum prices change the experience distribution. I believe that some of the unexpected results for the relative price variables are due to the NFL's industrial structure. The NFL has a team salary constraint and a team roster constraint in place that limits the total amount that can be paid to a team and the total amount of players that can

be on a team. It is unlikely but possible that the salary cap constraint cause teams to employ more of an experience level when it becomes more relatively more expensive. The reason for this possibility is that players who are becoming relatively more expensive may be cheaper and absolute terms and the salary cap may not allow for substitution towards the relatively cheaper experience level. The team roster constraint may also be playing a role because teams may not be able to respond changing relative prices because of the roster limit.

Future research on changing relative minimum prices could also examine another sports league like the NBA. An advantage of looking at the NBA in this case is that it will also allow us to see if the industrial structure of the NFL is driving the results.

These findings are important because any industry that employs a minimum salary schedule must be aware that this salary structure has the potential to reduce an employee's firm tenure or career length. Minimum salaries may also be set in a way that they change relative minimum prices giving them the potential to change the experience distribution in an undesirable manner.

References

Brown, Charles, Curtis Gilroy, and Andrew Kohen, "The Effect of the Minimum Wage on Employment and Unemployment", *Journal of Economic Literature*, June 1 982, 20(2), 487-528.

Behrman, Jere R., Robin C. Sickles, and Paul Taubman, "The Impact of Minimum Wages on the Distributions of Earnings for Major Race-Sex Groups: A dynamic Analysis" *American Economic Review*, September 1983, vol. 73, no. 4, 766–778

Card, David, "Using Regional Variation in Wages to Measure the Effects of the Federal Minimum Wage", *Industrial and Labor Relations Review*, October 1992a, 46(1), 22-37.

Card, David, "Do Minimum Wages Reduce Employment? A Case Study of California, 1987-1989", *Industrial and Labor Relations Review*, October 1992b, 46(1), 38-54.

Card, David and Alan B. Krueger, "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania" *American Economic Review*, September 1994, 84, 772–93

Cardoso, Ana Rute and Pedro Portugal, "Contractual Wages and the Wage Cushion under Different Bargaining Settings", *Journal of Labor Economics*, 2005, vol. 23, no. 4, 875–885.

Cleves, Mario, William Gould, Roberto Gutierrez, Yulia Marchenko, An Introduction to Survival Analysis Using Stata, Stata Press, College Station, TX, 2008.

Conlin, Mike and Patrick M. Emerson, "Multidimensional Separating Equilibria and Moral Hazard: An Empirical Study of the National Football League Contract Negotiations", *Review of Economics and Statistics*, August 2003, vol. 85, no. 3, 760–765.

Dickens, Richard, Stephen Machin, and Alan Manning, "The Effects of Minimum Wages on Employment: Theory and Evidence from Britain", *Journal of Labor Economics*, 1999, vol. 17, no. 1, 1–21.

Hamlen Jr., William A., "Deviations from Equity and Parity in the National Football League," *Journal of Sports Economics*, December 2007, vol. 8, no. 6, 596-615.

Holzer, Harry J., Lawrence F. Katz, and Alan B. Krueger, "Job Queues and Wages: New Evidence on Minimum Wage and Inter-Industry Wage Structure," Working Paper #230, Industrial Relations Section, Princeton University, April 1988.

Fort, Rodney and James Quirk, "Cross-subsidization, Incentives, and Outcomes in Professional Team Sports Leagues," *Journal of Economic Literature*, September 1995, vol. 33, 1265-1299.

Johnson, William R. and Edgar K. Browning, "The Distributional and Efficiency Effects of Increasing the Minimum Wage: A Simulation," *American Economic Review*, March 1983, 73, 204–211.

Kahn, Lawrence M., "The Sports Business as a Labor Market Laboratory," *Journal of Economic Perspectives*, Summer 2000, vol.14, no. 3, 75–94.

Katz, Lawrence F. and Alan B. Krueger, "The Effects of the Minimum Wage on the Fast-Food Industry," *Industrial and Labor Relations Review*, October 1992, 46(1), 6-21.

MacDonald, Don N. and Morgan O. Reynolds, "Are Baseball Players Paid Their Marginal Products?," *Managerial and Decision Economics*, September/October 1994, 15, 443-457.

Neumark, David, Mark Schweitzer, and William Wascher, "Minimum Wage Effects throughout the Wage Distribution," *Journal of Human Resources*, Spring 2004, vol. 39, no. 2, 425-450.

Manton, Kenneth G., Burton Singer and Max A. Woodbury. "Some Issues in the Quantitative Characterization of Heterogeneous Populations," In James Trussell, editor, Issues in Event History Analysis. Oxford University Press.

NFL Players Association and NFL Management Council, NFL Collective Bargaining Agreement 2006-2012 , March 2006.

Rosen, Sherwin and Allen Sanderson, "Labor Markets in Professional Sports," NBER Working Paper 7573, February 2000, Cambridge, MA.

Scully, Gerald W., "Pay and Performance in Major League Baseball," *American Economic Review*, December 1974, vol. 64, no. 6, 915-30.

Vrooman, John, "A General Theory of Professional Sports Leagues," *Southern Economic Journal*, April 1995, vol. 61, no. 4, 971-990.

Wooldridge, Jeffrey, Chapter20: Duration Analysis, <u>Econometric Analysis of Cross Section and Panel Data</u>, MIT Press, Cambridge, MA, 2002, 685-719.

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