Compensating Wage Differentials and Wage Discrimination in Major League Baseball

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Abstract

Using Major League Baseball (MLB) players who had the ability to bargain for new contracts between the years 2009 and 2013 as a sample, empirical results indicated that contract length had a significant positive influence on salary. The salaries of players who had extended their current contracts met the assumptions of the theory of compensating wage differentials, while those of free agents showed no compensating wage differential effects. Finally, the results suggest discrimination against Latino players.

Keywords: compensating wage differentials, contract length, major league baseball, salary

1. Introduction

As the baseball league with the highest standards in the world, the MLB attracts baseball players from all over the world with its high salaries and intense competitiveness. During the early years of the MLB, players found it difficult to obtain fair pay due to its systems still being in their infancy. In 1994, the league's players collectively went on strike over the salary cap issue. After this event, some attributed the strike to the free market system. The league has since repeatedly amended its salary regulations. Now, the league's players have a guaranteed minimum salary, but no salary cap.

In recent years, in order to attract star players, MLB teams tend to provide high salaries and long-term contracts. As a result, the negotiation of these contracts has become more important to the players than ever before. Krautmann and Oppenheimer (2002) found that contract length and salary have a positive correlation. Moreover, they also found a negative correlation between contract length and a player's return to performance—the longer the contract, the lower the return to performance. It can thus be inferred that players are willing to accept a lower return of compensation in exchange for a longer contract. In other words, a cautious player would be willing to accept a lower salary if the length of his contract were extended. The above results match the theory of compensating wage differentials.

Wage differential is a term used in labor economics. It analyzes the relation between the wage rate and the unpleasantness, risk (Biddle *et al*, 1988), or other undesirable attributes of a particular job. A compensating wage differential is defined as the additional amount of income that a given worker must be offered in order to motivate she/he to accept a given undesirable job, relative to other jobs that worker could perform (Rosen, 1986). That is, for a professional player who had the risk of injury, a given players would be willing to accept a lower salary for a longer contract length, relative to a shorter one.

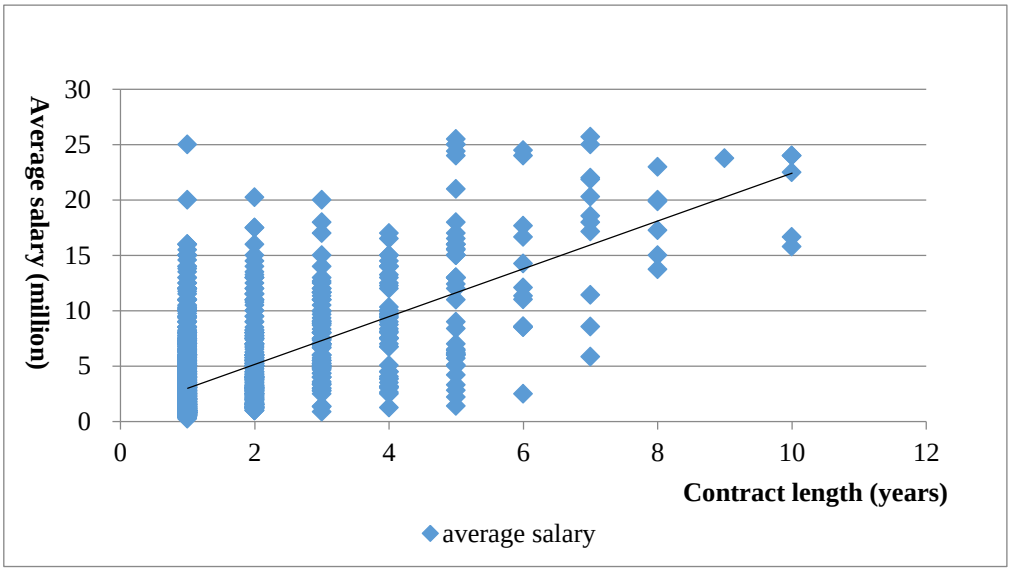

Figure 1. The relationship between average salary and contract length of MLB players

Figure 1 shows the average annual salaries and contract lengths of 1,681 baseball players between the years 2009 and 2013. The average annual salary was $4.17 million USD, and the average contract length was 1.53 years. The information in Figure 1 indicates that average salary increased in correspondence with contract length. However, the information presented fails to control for player performance. The primary purpose of this study is to examine the relationship between contract length and salary in more detail, and particularly to determine whether player status affects the relationship between the two variables. This study also seeks to verify whether the theory of compensating wage differentials can be applied to players of differing statuses. This study employs the random effects model to conduct an empirical analysis to differentiate between player characteristics.

2. Literature Review

Many past studies have analyzed factors that influence player salaries. Some factors that have often undergone analysis are player performance, race and nationality, seniority, number of days on the disabled list, age, awards won, and selection for the All-Star Game; from the studies conducted by Scully (1974); Krautmann and Oppenheimer (2002); Krautmann, Gustafson, and Hadley (2003); Yosifov (2006); Holmes (2010); Link and Yosifov (2012); and Jane, Chen, and Kuo (2013). Only Krautmann and Oppenheimer (2002), Link and Yosifov (2012), and Meltzer (2005) analyzed contract length as a factor.

Using batters signing new contracts with the MLB between the years 1990 and 1994 as a sample, Krautmann and Oppenheimer (2002) used the two-stage least squares (2SLS) method to analyze which variables affected the first year's salary. After controlling for other variables, they found that the longer the contract, the higher the first year's salary, indicating that the best players received both higher pay and longer contracts. Additionally, they found that after controlling for other conditions, longer contract lengths resulted in lower salaries, which corresponds to the theory of compensating wage differentials. (Note 1)

Link and Yosifov (2012) took samples from 1984–1989, 1990–1994, and 2003–2006 and performed a regression analysis, taking the first year's salary and the average salary per season, respectively, as dependent variables. They concluded that free agent position players appear willing to trade monetary returns to performance for the security of a longer guaranteed contract. Their results supported those of Krautmann and Oppenheimer (2002). They also split the dummy variable for race into African American and Latino, and found that the percentages of African American signing contracts fell from 22% to 24% during the period 2003-2006. However, the opposite trend had occurred for Latin players. Using the ordinary least square (OLS) method (without including contract length), Meltzer (2005) found that the players with the best performance had higher salaries and longer contracts. Using 2SLS regression analysis, he found that contract length had a significant positive effect on salary, and determined that eliminating contract length from the salary regression formula would generate errors.

Players may favor long contracts, but long contracts create risk for the team. Maxcy, Fort, and Krautmann (2002) and Marburger (2003) found that the performance of players differed significantly before and after signing contracts. However, Harder (1989) and Krautmann (1993) concluded that the performance of players before and after signing a contract did not change. Perry (2005) drew 212 free agents between the years of 1972 and 2000 as a sample and investigated the performance of these players the year during, the year before, and the year after the contract. He found that the performance of players was better during the year of the signing of a new contract than in the year before or the year after signing, indicating that players worked hardest during that year to obtain a new contract, then lost momentum once the contract was signed.

Salary contracts are agreed upon only after lengthy negotiations between the player and the team. Players of differing status have differing degrees of bargaining power, but the literature above has not considered this. This study adds a dummy variable for player status in order to understand its effect on contract length.

3. Methods

This study used the contract length and performance of MLB players who have re-signed their contracts as independent variables to investigate the effect of contract length and performance on salary. Players who re-sign obtain substantial salaries, including signing bonuses and buyouts. This study used players who were able to bargain for new contracts between the years 2009 and 2013 (1737 players in all) as a sample. Only when a player has the power to bargain for a better deal does the analysis of his contract length hold meaning. Players who had renewed their contracts were divided into three categories corresponding to the league's system: players eligible for salary arbitration, free agents, and players extending their current contracts. It can be inferred that free agents and players eligible for salary arbitration are in a stronger position to negotiate; if so, when all other conditions are identical, these two types of players should receive a higher salary than players who are extending their current contracts.

3.1 Empirical Model of Player Salary

This study utilized a multiple regression model to investigate which factors affected salaries when players renewed their contracts. The factors were divided into five categories: contract length, player performance, player characteristics, team characteristics, and other control variables. The formula for performing this analysis is as follows:

$$\begin{aligned} \mathrm{SAL}_{ij} \quad &= \beta_0 + \beta_1 \mathrm{LENGTH}_{ij} + \beta_2 \left(\mathrm{LENGTH}_{ij} * \mathrm{DFA}_i\right) + \beta_3 (\mathrm{LENGTH}_{ij} * \mathrm{DE}_i) \\ &\quad + \beta_4 \mathrm{PLAYER}_i + \beta_5 \mathrm{PERF}_{ij} + \beta_6 \mathrm{TEAM}_j + \varepsilon_{\mathrm{ji}}, \end{aligned} \tag{1}$$

The dependent variable SAL_{ij} represents the average annual salary of the ith player in the jth team; i represents different players and $i = 1,2,3, \ldots M$; j represents different teams and $j = 1,2,3, \ldots N$. The salaries include signing bonuses and buyouts. The variable LENGTH_{ij} represents the length of the contract between player i and team j, and is the primary focus of this study.

The salary of professional players is often agreed upon only after lengthy negotiations and, when negotiating salary, player bargaining power is dependent on status. This study divided player status into three categories corresponding to the information collected: players eligible for salary arbitration, free agents, and players extending current contracts. In formula (1), DFA represents the dummy variable *free agent* and DE represents the dummy variable *players extending current contracts*. Therefore, $\mathrm{LENGTH}_{ij} * \mathrm{DFA}_i$ is the cross product of contract length and the dummy variable *free agent*. It shows that, compared with the salary of a player eligible for salary arbitration, the amount by which a free agent's salary increases when free agent increases his contract length by one year. In the same reference, $\mathrm{LENGTH}_{ij} * \mathrm{DE}_i$ shows that, compared with the salary of a player eligible for salary arbitration, the amount by which the salary of a player extending his current contract increases when he increases the player extending current contract by one year.

In formula (1), PLAYER_i represents the characteristics of the player, including whether the player is African American or Latino, the player's seniority, the number of days on the disabled list, player age, square of the player's age, awards won, and selection for the All-Star Game. African American players (BLACK) and Latino players (LATIN) are dummy variables and determine whether African American and Latino players are paid lower salaries than white players. Seniority was determined by the number of years a player has signed with the league. The number of days on the disabled list was determined according to the average number of days per year a player spent on the disabled list in the three years prior to signing a contract. Square of the player's age was the square of the age of the player at the time of signing a new contract. We examined whether these four factors affected salary. Awards won is a dummy variable and seeks to investigate whether prestigious awards won in the three years prior to signing the contract have any effect on salary. These awards include the Cy Young Award, the Most Valuable Player Award

(MVP), Rookie of the Year, the Rawlings Gold Glove Award (Gold Glove), and the Louisville Silver Slugger Award (Silver Slugger). Selection for the All-Star Game is a dummy variable used to determine whether being selected in the three years prior to the new contract results in a higher salary.

PERF_{ij} represents the ith player's performance on the jth team. This study considers pitchers and fielders separately. (Note 2) According to Jane (2012), Cy Young Points (CYP) and Louisville Silver Slugger index (SSI) are employed to measure pitchers' performance and fielders' performance, respectively. A pitcher's performance is calculated as follows:

$$CYP = ((5 * IP/9) - ER) + (SO/12) + (SV * 2.5) + \text{Shutouts} + ((W * 6) - (L * 2)) + VB, \quad (2)$$

IP represents the number of innings pitched; ER represents the number of earned runs; SO represents the number of strikeouts; SV represents the number of saves; Shutouts represents the number of shutouts; W is the number of successful pitches; and L is the number of unsuccessful pitches. VB (victory bonus) is a weighted measure of divisional rankings, which can be as high as 12 points, and reflects the pitcher's contribution to the team getting into the postseason. Fielder performance measurement is calculated by SSI as follows:

$$SSI = BA * 1000 + HR * 20 + RS * 5 + TR, \quad (3)$$

BA represents batting average, HR represents home runs, RS represents runs batted in, and TR represents total bases. Using earned run average (for pitchers), and batting average and total bases (for batters) as proxy variables for performance, we were able to test for robustness. The larger the values of CYP and SSI are, the better the fielders and pitchers performance. Therefore, both variables positively related to salary, and the coefficients β_5s are expected positive.

Lastly, TEAM_j represents team characteristics, and includes team size and the population of the team's home base. Jane, Ou and Chen (2011) investigated the effect of team size on team salary and thus player salary. Team size was measured by total number of players and coaches. Moreover, as teams in the MLB are territory-based, the population of the team's home base was included as a control variable (Kahn *et al*, 2005). This study references their methods. Another control variable was major events, which controlled for random salary increases.

3.2 Endogeneity Problem

As contract length and salary are determined at the same time, they are decided simultaneously and have bidirectional causation, indicating that the regression model has an endogeneity problem. This study aimed to find a suitable instrumental variable to resolve this endogeneity problem. However, a suitable instrumental variable needs to fulfill two predictions: the instrumental variable should be independent of the error $[Cov(z,u) = 0]$; and the instrumental variable should be corrected with the explained variable $[Cov(x,z) \neq 0]$, where z is the instrumental variable, x is endogeneity, and u is error. This study defined *average days per year spent on the disabled list in the three years prior to signing the contract* as the instrumental variable; after obtaining the instrumental variable, the random effects (RE) model underwent a two-stage regression analysis.

According to Krautmann and Oppenheimer (2002), *average days per year spent on the disabled list in the three years prior to signing the contract* was the instrumental variable because a player who was easily injured might receive a shorter contract as an easily injured player tended to spend more time on the disabled list. However, a player who was injured is less related to salary. (Note 3)

$$\mathrm{LENGTH}_{ij} = \alpha_0 + \alpha_1 \mathrm{DL}_{ij} + \alpha_2 \mathrm{DOM}_{ij} + v_{ij}, \quad (4)$$

Variable DL_{ij} represents the average number of days per year the ith player on the jth team spends on the disabled list. DOM_{ij} represents the characteristics of the team's home base. It includes the population of the team's hometown and city size. Population of the team's hometown refers to the population of the city to which the team belongs; the dummy variable for a city population is 1 if the population exceeds 5 million and 0 if not.

The second stage was estimated by the RE model (4). The fitted value indicates LENGTH_{ij}. Replacing $\mathrm{LE\hat{N}GTH}_{ij}$ with the fitted value, the regression formula for the two-stage RE model is as follows:

$$\begin{aligned} \mathrm{SAL}_{ij} \quad &= \beta_0 + \beta_1 \mathrm{LE\hat{N}GTH}_{ij} + \beta_2 \left(\mathrm{LE\hat{N}GTH}_{ij} * \mathrm{DFA}_i\right) + \beta_3 (\mathrm{LE\hat{N}GTH}_{ij} * \mathrm{DE}_i) \\ &\quad + \beta_4 \mathrm{PLAYER}_i + \beta_5 \mathrm{PERF}_{ij} + \beta_6 \mathrm{TEAM}_j + \varepsilon_{\mathrm{ji}}, \end{aligned} \quad (5)$$

Therefore, the endogenous problems in the important variables in this study can be resolved by two-stage RE modeling, with *average days per year spent on the disabled list in the three years prior to signing the contract* as the instrumental variable.

4. Empirical Results and Discussion

This study's primary focus was to analyze the relationship between contract length and salary. Krautmann and Oppenheimer (2002) used free agents for their sample and found a positive correlation between contract length and salary, indicating that the players with the best performance not only obtained higher salaries, but also longer contracts. This study extends this analysis to players eligible for salary arbitration and players extending their current contracts. Free agents have the fewest restrictions, and thus the greatest bargaining power. Players who are eligible for salary arbitration also have some level of bargaining power. Therefore, under the same conditions, it is difficult to discern whether free agents or players eligible for salary arbitration can obtain higher salaries. In contrast, players extending their current contracts have no advantage over players with salary arbitration, inferring that their salaries are lower. If so, β_3 in formula (1) should be a negative value.

As for the other variables, the indices for the Cy Young Award and the Silver Slugger should show positive results. The better the performance of the pitcher or fielder, the higher salary is. Player seniority, player age, square of the player's age, awards won, and selection for the All-Star Game are also expected to yield positive with salary (Krautmann *et al*, 2002; Krautmann *et al*, 2003). Players accumulate experience with age and players with lengthy experience confirmed through the receipt of awards earn the trust of the team and thus a higher salary. Number of days spent on the disabled list is expected to show a negative correlation (Krautmann *et al*, 2003), for when a player enters the disabled list, he is unable to play, and if a player spends a great deal of time on the disabled list, his salary should decrease. For the discrimination of African-American and Latino players, Kahn and Shah (2005) found that there were large, statistically significant ceteris paribus nonwhite shortfalls in salary for players who were neither free agents nor on rookie scale contracts. Also, when prejudice exists on the part of consumers, player salaries will be lower (Krautmann *et al*, 2002) and the results are expected to be negative. However, since the nineties, consumer prejudice has become less and less obvious, and so results are unclear. The variable *team characteristics* is expected to produce a positive correlation (Jane *et al*, 2011). The larger the size of the team and the higher the hometown population, the higher the player's salary. For more details, see Table 1.

Table 1. Definitions in regression model for salary of re-signing players and source of information.

	Abbreviations	Variable definition	Source of information	Expected results
Dependent variable				
Salary of re-signing players	SAL	Salary of re-signing player, including signing bonuses and buyouts.	*baseball prospectus*	
Independent variable				
Contract length	LENGTH			
1. Player with salary arbitration		Length of contract signed by player with salary arbitration (years).	*baseball prospectus, FOX SPORTS*	+
2. Free agent		Length of contract signed by free agent (years).		+
3. Player who extends his contract		Length of contract signed by player who extends his contract (years).		n
Performance				
Cy Young Points	CYP	Cy Young Points for pitchers.	*baseball-reference*	+
Louisville Silver Slugger points	SSI	Fielder's SSI points (for Silver Slugger).		+
Player characteristics				
African American player	BLACK	Dummy variable; if player is African American, then 1, if not, 0.	*baseball prospectus, baseball-reference*	n
Latino player	LATIN	Dummy variable; if player is Latino, then 1, if not, 0.		n

Player seniority	EXP	Years the player has been with the major league.		+
Disabled list	DL	Average number of days per year on the disabled list the three years prior to signing.		–
Age of player	AGE	Age of the player the year the contract is signed.		+
Square age of player	AGE2	Square age of the player the year the contract is signed.		+
Prize received (or not)	PRIZE	Dummy variable, if player has received prestigious awards in the three years prior to signing: 1 if yes, 0 if not.		+
Selection for the All-Star Games (or not)	ASB	Selection for the All-Star Games in the three years prior to signing: 1 if yes, 0 if not.		+
Team characteristics				
Size of the team	SIZE	Number of people on the team.	*RodsSportsBusiness Data*	+
Population of the team's home	HOSTP	Population of the city the team belongs to.	*United States Census Bureau, Statistics Canada*	+
Other control variables				
Dummy variable for free agents	DFA	If player is a free agent, then 1, if not, 0.	*FOX SPORTS*	+
Dummy variable for players who extend their contracts	DE	If player has extended his contract, then 1, if not, 0.		–

Note: + signifies a positive impact, – signifies a negative impact, n signifies uncertainty

baseball prospectus: *http://www.baseballprospectus.com/*

baseball-reference: *http://www.baseball-reference.com/*

FOX SPORTS: *http://www.foxsports.com/*

United States Census Bureau: *http://www.census.gov/*

Statistics Canada: *http://www.statcan.gc.ca/start-debut-eng.html*

RodsSportsBusinessData: https://umich.app.box.com/s/41707f0b2619c0107b8b

Contract salaries were measured by the average salaries over the length of the contract, and the salaries had been adjusted for inflation. Table 2 lists the results of the regression analysis for contract length and average salary. For the 1737 players between the years 2009 and 2013, the average salary was $4.18 million USD. The player with the highest average salary was Justin Verlander with $25.71 million USD. Verlander played for the Detroit Tigers and in 2013 extended his contract. The average contract length was 1.53 years. Five players had the longest contracts at ten years and, of those five, Albert Pujols and Robinson Cano had the highest salaries. The former signed as a free agent with the Los Angeles Angels of Anaheim in 2011 and the latter signed as a free agent with the Seattle Mariners in 2013.

As for player characteristics, African American players comprised 19% of all players, while Latino players made up 23%. On average, players had played for 6.53 years and spent 28.95 days on the disabled list in the three years prior to signing. The average player age was 30.24. Players had, on average, about a 20% chance of receiving awards, and a 19% chance of selection for the All-Star Game. The Cy Young Award index had an average 55.3 points and the Silver Slugger factor averaged 639.2 points. Teams, on average, had 28.2 people and the population of teams' hometowns averaged 1.78 million. Free agents made up 0.39% of all players and players extending their current contracts made up 0.18%.

Table 2. Descriptive statistics of independent variables when performing regression analysis of player salary. (n=1,688)

Variable	Observed value	Average/mean	Standard deviation	Minimum	Maximum
Average salary	1,688	4,183,453	4,240,219	225,000	2.57E+07
LENGTH	1,736	1.53	1.24	1	10
LENGTH * DFA	1,736	0.60	1.04	0	10
LENGTH * dummy variable for player who extends his contract	1,736	0.49	1.31	0	10
BLACK	1,737	0.19	0.39	0	1
LATIN	1,737	0.23	0.42	0	1
Seniority	1,737	6.53	3.58	0	21
Number of days on the disabled list in the three years prior	1,732	86.76	90.50	0	575
Average number of days per year spent on the disabled list in the three years prior	1,732	28.95	30.21	0	191.67
Number of games missed	1,732	64.17	71.34	0	464
Average number of games missed per year	1,732	21.41	23.81	0	154.67
Player age	1,737	30.24	3.73	21	43
Square of player age	1,737	928.54	235.18	441	1,849
Prizes won (or not)	1,732	0.20	0.40	0	1
Selection for the All-Star Games (or not)	1,732	0.19	0.40	0	1
Innings pitched	853	97.04	64.19	0	240
Earned run average	853	41.26	30.17	0	118
Number of strikeouts	853	79.41	52.48	0	269
Number of saves	853	3.81	9.55	0	51
Number of shutouts	853	0.16	0.49	0	5
Number of successful pitches	853	5.79	4.63	0	21
Number of unsuccessful pitches	853	5.38	4.12	0	17
Bonus awarded to pitcher for leading the team to a district championship	853	2.33	4.64	0	12
Cy Young points/predictor	853	55.30	42.58	−42.75	209.17
Batting average	1,368	0.20	0.12	0	1
Number of home runs	1,368	7.61	9.51	0	54
Runs batted in	1,368	31.63	32.53	0	152
Number of first base hits	1,368	64.91	61.41	0	212

Number of second base hits	1,368	13.09	13.06	0	51
Number of third base hits	1,368	1.30	2.16	0	16
Total bases hit	1,368	125.43	122.73	0	467
Louisville Silver Slugger points	1,368	639.20	536.07	0	2,409
Team size	1,737	28.20	1.88	23	34
Population of the team's home	1,737	1,779,896	2,240,347	244,646	8,438,379
DFA	1,737	0.39	0.49	0	1
Dummy variable of players who extend their contracts	1,737	0.18	0.38	0	1

As Table 3 shows, players extending their current contracts had the highest average salary ($4.34 million USD) as well as the longest contracts (2.68 years). The performance of pitchers (84.4 points) and fielders (805.7) was quite pronounced; they had a higher likelihood (41%) of receiving awards as well as a greater chance (38%) of selection for the All-Star Game. They spent an average of 23.17 days per year on the disabled list in the three years prior to signing. However, players extending their current contracts did not necessarily have more seniority. When the positions played were factored in, fielders showed higher average salaries, longer contracts, more seniority, a higher probability of receiving awards and selection for the All-Star Game, and fewer days per year on the disabled list. When status and player position were combined, the results were the same: fielders who extend their contracts had the highest salaries, the longest contracts, and the highest chance of receiving awards, as well as higher chance of selection for the All-Star Game. They also spent the least number of average days per year on the disabled list (in the three years prior to signing).

Table 3. Summary of average salary, contract length, and player performance by position and status

	Average salary		LENGTH		Cy Young points		Silver Slugger points		Seniority		DL		Prizes won (or not)		All-Star Games (or not)	
Status of player	Mean	Freq.	Mean	Freq.	Mean	Freq.	Mean	Freq.	Mean	Freq.	Mean	Freq.	Mean	Freq.	Mean	Freq.
Free agent	4,341,644.8	626	1.543	672	46.814	290	651.234	531	8.886	673	31.078	669	0.155	669	0.173	669
extend contract	**7,322,664.1**	313	**2.682**	314	**84.430**	144	**805.655**	267	6.341	314	**23.170**	313	**0.406**	313	**0.380**	313
salary arbitration	2,739,392.8	749	1.041	750	51.157	419	550.007	570	4.488	750	29.474	750	0.143	750	0.133	750
Total sum	4,183,453	1,688	1.532	1,736	55.298	853	639.195	1,368	6.527	1,737	28.954	1,732	0.195	1,732	0.193	1,732
Player position																
Fielder	**4,385,337.1**	848	**1.652**	874					**6.913**	875	**26.030**	872	**0.259**	872	**0.218**	872
Pitcher	3,979,646.2	840	1.411	862					6.135	862	31.920	860	0.130	860	0.169	860
Total sum	4,183,453	1,688	1.532	1,736					6.527	1,737	28.954	1,732	0.195	1,732	0.193	1,732
Type of player																
Free agent (fielder)	4,311,239.4	352	1.613	377	73.667	1	869.519	370	9.249	378	27.193	375	0.205	375	0.187	375
Free agent (pitcher)	4,380,705.8	274	1.454	295	46.721	289	149.584	161	8.420	295	36.034	294	0.092	294	0.156	294
extend	**7,403,511.4**	170	**2.900**	170	—	0	**1178424**	170	6.459	170	**22.734**	**170**	**0.471**	**170**	**0.424**	**170**

contract (fielder) extend																
contract (pitcher)	7,226,552	143	2.424	144	84.430	144	152.351	97	6.201	144	23.688	143	0.329	143	0.329	143
salary arbitration (fielder)	2,891,449.9	326	1.049	327	—	0	889.214	327	4.450	327	26.409	327	0.211	327	0.147	327
salary arbitration (pitcher)	2,622,204.5	423	1.035	423	51.157	419	93.543	243	4.518	423	31.843	423	0.090	423	0.123	423
Total sum	4,183,453	1,688	1.532	1,736	55.298	853	639.195	1,368	6.527	1,737	28.954	1,732	0.195	1,732	0.193	1,732

Average salary generally increased with contract length (Table 4). With every added year, salary increased by at least $1 million USD up to $6 million USD. The correlation coefficient of the variables was analyzed to determine whether collinearity existed between the independent variables. Table 5 shows that age and seniority were closely linked. Their correlation coefficient was 0.8, while others were below 0.6. However, a correlation already exists between age and seniority, so the regression results were not affected.

Table 4. The salary ladder: Results of contract length and average salary

	Average salary	
LENGTH	Mean	Freq.
1. One year	2,991,647	1,260
2. Two years	5,227,170.5	220
3. Three years	7,551,016.2	82
4. Four years	8,449,453.1	48
5. Five years	12,030,816	42
6. Six years	13,303,472	12
7. Seven years	17,675,325	11
8. Eight years	18,767,857	7
9. Nine years	23,777,778	1
10. Ten years	20,588,333	5
Total sum	4,183,453	1,688

Table 5. Correlations of variables

	Average salary	LENGTH	Cy Young points	Silver Slugger points	BLACK	LATIN	Seniority	DL	age	Square of age	PRIZE	All-Star Games (or not)	Team size	Population of the team's home
Average salary	1.00													
LENGTH	0.61	1.00												
Cy Young points	0.57	0.44	1.00											
Silver Slugger points	0.16	0.14	0.08	1.00										
BLACK	−0.01	0.00	−0.01	−0.01	1.00									
LATIN	−0.02	0.01	0.00	0.01	0.41	1.00								
Seniority	0.21	−0.04	−0.02	0.14	0.05	−0.02	1.00							
DL	−0.10	−0.12	−0.26	0.08	−0.06	0.04	0.09	1.00						
age	0.07	−0.16	−0.08	0.05	0.06	−0.05	**0.80**	0.04	1.00					
Square of age	0.07	−0.14	−0.07	0.05	0.07	−0.05	**0.81**	0.04	**1.00**	1.00				
PRIZE	0.41	0.28	0.35	0.07	0.05	−0.02	0.01	−0.09	−0.04	−0.03	1.00			
All-Star Games (or not)	0.44	0.25	0.42	0.00	0.05	−0.10	0.09	−0.04	0.01	0.03	0.53	1.00		
Team size	0.07	0.04	0.02	−0.03	0.03	0.03	0.00	0.01	0.07	0.07	0.03	0.05	1.00	
Population of the team's home	0.07	−0.02	0.06	−0.05	−0.04	−0.06	0.12	−0.06	0.16	0.16	−0.07	0.02	0.05	1.00

Tables 6–9 track the RE of the information. When the panel data was included, individual effects can be controlled. Using the Lagrange Multiplier (LM), we compared the RE model and the OLS method. The results refuted a null hypothesis, showing that RE was more favorable than OLS, so only the results of the RE model are shown.

4.1 Empirical Analysis of the Random Effects Model

Tables 6 and 7 show the empirical results of the random effects model for the effect of contract length on player salary. This study used 22 models to investigate the effect of contract length on player salary. Model 1 included the key variable of this study, contract length, and then successively added player characteristics: African-American players, Latino players, player seniority, number of average days per year spent on the disabled list in the three years prior to signing, player age, square of the age of the player, awards won, and selection for the All-Star Game. It also controlled for the dummy variable *year*; and forms the basis of the regression analysis. Model 2 included fielder performance and Model 3 added team characteristics (team size and the population of the team's hometown); Model 4 included the dummy variables *free agents* and *players extending their current contracts* to observe the effect of bargaining power on average salary.

Models 5 and 6 added the cross product of contract length and the dummy variable *free agent*, and the cross product of contract length and the dummy variable *players extending their current contracts*, respectively. They showed the amount by which the salaries of free agent fielders and fielders extending their current contracts exceed that of fielders with salary arbitration per year added to the contract. Models 7–11 concern pitchers. In accordance with Model 11, pitcher performance, team characteristics, the dummy variables *free agent* and *players extending their current contracts*, the cross product of contract length and the dummy variable *free agent*, and the cross product of contract length and the dummy variable players *extending their current contracts* were added in succession.

As with Models 1–11 in Table 6, Models 7–12 in Table 7 took the natural logarithm of the average salary, the robustness checks are performed in these regressions. Taking Table 6 as an example, the results of the regression analysis of Models 1 to 11 showed that contract length had a significant positive impact at the 1% significance level in all 11 models. The results reflect those of Krautmann and Oppenheimer (2002). Model 1 shows that players received $1.64 million USD more for every additional year in their contract. When fielder performance was added in Model 2, fielders received $1.59 million USD more for every additional year in the contract. In Model 3, with the addition of team characteristics, fielders received $1.59 million USD more per additional year in the contract. Model 4 added in the dummy variables *free agent* and *players extending their current contracts*, showing that fielders received $1.63 million USD more for every additional year in the contract.

Model 5 added in the cross product of contract length and the dummy variable *free agent*, showing that fielders received $1.27 million USD more for every additional year in the contract. Model 6 added in the cross product of contract length and the dummy variable *players extending their contracts*, showing that fielders received $2.02 million USD more for every additional year in the contract. Model 7 added in pitcher performance, showing that pitchers received $1.74 million USD more for every additional year in the contract. Model 8 added in team characteristics, showing that pitchers received $1.74 million USD more for every additional year in the contract. Model 9 controlled for player status, showing that pitchers receive $1.74 million USD more for every additional year in the contract.

Model 10 then added the cross product of contract length and the dummy variable *free agent*, showing that pitchers received $1.38 million USD more for every additional year in the contract. Finally, Model 11 added in the cross product of contract length and the dummy variable *players extending their current contracts*, showing that pitchers receive $2.09 million USD more for every additional year in the contract. This study also performed a robustness check using Models 12–22 from Table 7, with results concurring with those of Models 1–11 in Table 6, wherein contract length had a significant positive impact on average salary.

In Model 5 of Table 6, we see that fielders who signed as free agents received about $0.79 million USD more per additional year in their contract than fielders with salary arbitration did. In Model 6, we see that fielders who extended their current contracts received $0.74 million USD less per additional year in the contract than fielders with salary arbitration. Model 10 showed that pitchers who signed as free agents received about $0.84 million USD more per additional year in the contract than pitchers with salary arbitration. Model 11 shows that pitchers who signed as free agents received about $0.67 million USD more per additional year in the contract than pitchers with salary arbitration. This study used Models 16, 17, 21, and 22 from Table 7 to perform a robustness check and the results concurred with those found in Models 5, 6, 10, and 11 in Table 6.

Regarding player characteristics, the 11 models in Table 6 show that being African-American had a negative, but insignificant, impact on salary and shows that racism is not a significant factor in salary for African American players in the MLB. According to Krautmann and Oppenheimer (2002), African American players do not experience prejudice in terms of salary. In the same models in Table 6, however, Models 2–6 find that being Latino had a negative and significant impact on salary; therefore, Latino fielders are discriminated against when it comes to salary. Moreover, the results of the robustness check performed on Models 18–22 in Table 7 generally reflected those found in Models 7–11 in Table 6, wherein being Latino has a negative, but insignificant, impact on salary for pitchers.

Models 1–11 in Table 6 all showed that seniority had a positive and significant impact. Model 1 showed, at the 1% significance level, that with each added year of seniority, average salary increased by $0.33 million USD. Model 2 showed that with each additional year of seniority, the average salary for fielders increased by $0.4 million USD. Model 7 showed that with each added year of seniority, the average salary for pitchers increased by $0.3 million USD. Model 11 also showed that with each additional year of seniority, the average salary for pitchers increased by $0.3 million USD. From the viewpoint of Human Capital Theory, the more senior a player, the more experience he has obtained and thus the more he is paid. Models 12–22 in Table 7 were used to perform a robustness check, with the results matching those of Models 1–11 in Table 7, wherein seniority had a significant positive impact on salary.

Models 1–11 in Table 6 show that selection for the All-Star Game had a significant positive effect. Model 6 shows that players selected for the All-Star Game see a $2.47 million USD increase in average salary. Model 11 shows that pitchers selected for the All-Star Game see a $1.50 million USD increase in average salary. The more intense the Superstar Effect, the more intensely fans desire to see the player in the stadium, so the team will allot the player a higher salary. Models 12–22 in Table 7 were used to perform a robustness check and the results matched those of Models 1–11 in Table 6, wherein there was a positive and significant effect of selection for the All-Star Game.

Table 6 shows that the impact of player performance is positive and significant for both pitchers and fielders. Model 2 shows that when a fielder's performance level increased by one unit, his salary increased by $6.70 million USD. Model 6 shows that when a fielder's performance level increased by one unit, his salary increased by $6.30 million

USD. Model 11 shows that when a pitcher's performance level increased by one unit, his salary increased by $22,800 USD. The results reflect those of the regression analysis in which improved player performance, increased contributions of the player to the team, and higher team expectations led to increases in player salary. We used Models 12–22 in Table 7 to perform a robustness check and the results reflected those of Models 1–11 in Table 6, wherein player performance had a significant positive impact for both pitchers and fielders.

Table 6. Estimation results of the RE model investigating the effect of contract length on salary

	Dependent variables: Average salary (In thousands)										
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Factors affecting contract length											
LENGTH	1,640***	1,594***	1,592***	1,626***	1,274***	2,019***	1,739***	1,739***	1,741***	1,382***	2,093***
	(52.7)	(58.2)	(58.0)	(64.9)	(84.8)	(92.1)	(94.0)	(94.0)	(110)	(140)	(156)
LENGTH × DFA					788***					837***	
					(124)					(205)	
LENGTH × DE						−739***					-665***
						(124)					(207)
Player characteristics											
BLACK	−42.4	−227	−241	−201	−175	−176	−82.9	−101	−85.6	-3.80	-11.3
	(207)	(231)	(230)	(230)	(225)	(226)	(330)	(331)	(333)	(329)	(331)
LATIN	−553***	−501**	−501**	−488**	−512**	−507**	−353	−335	−332	-376	-356
	(197)	(219)	(218)	(219)	(214)	(214)	(296)	(296)	(299)	(295)	(296)
Seniority	325***	396***	399***	441***	412***	413***	299***	296***	308***	296***	297***
	(39.1)	(46.9)	(46.7)	(48.2)	(47.4)	(47.6)	(51.0)	(51.1)	(52.4)	(51.8)	(52.0)
DL	-7.87***	−5.46*	−5.74**	−4.97*	−3.58	−3.56	−0.29	−0.55	−0.59	-0.12	-0.18
	(2.28)	(2.89)	(2.88)	(2.87)	(2.84)	(2.84)	(2.82)	(2.83)	(2.84)	(2.81)	(2.82)
age	2,209***	2,617***	2,603***	2,807***	2,434***	2,451***	2,097***	2,108***	2,177***	1,978***	2,002***
	(246)	(291)	(290)	(292)	(292)	(293)	(324)	(324)	(328)	(328)	(330)
Square of age	−37.4***	−45.2***	−45.1***	−48.0***	−42.1***	−42.3***	−34.2***	−34.3***	−35.4***	-32.4***	-32.8***
	(3.97)	(4.72)	(4.70)	(4.73)	(4.73)	(4.74)	(5.21)	(5.21)	(5.26)	(5.26)	(5.29)
PRIZE	1,816***	1,728***	1,741***	1,674***	1,645***	1,659***	1,329***	1,341***	1,303***	1,321***	1,318***
	(200)	(226)	(225)	(224)	(221)	(221)	(307)	(307)	(308)	(305)	(306)
All-Star Games (or not)	2,583***	2,619***	2,584***	2,482***	2,468***	2,465***	1,496***	1,489***	1,482***	1,499***	1,504***
	(203)	(233)	(232)	(232)	(228)	(229)	(292)	(292)	(292)	(289)	(290)
Performance											
Cy Young points/predictor							24.0***	23.8***	22.9***	22.9***	22.8***
							(2.47)	(2.47)	(2.51)	(2.49)	(2.50)
Louisville Silver Slugger points		0.67***	0.68***	0.68***	0.63***	0.63***					
		(0.17)	(0.17)	(0.17)	(0.16)	(0.16)					
Team characteristics											
Team size			63.8	71.2*	64.4	68.6*		−2.96	0.28	-0.27	0.51
			(40.2)	(39.8)	(39.4)	(39.4)		(46.7)	(46.6)	(46.3)	(46.4)
Population of the team's home			0.000099***	0.00010***	0.000091***	0.000092***		0.000066	0.000067*	0.000057	0.000060
			(0.000034)	(0.000034)	(0.000033)	(0.000034)		(0.000040)	(0.000040)	(0.000040)	(0.000040)
Other control variables											
DFA [1]				−767***	−1,691***	−835***			−212	-1,235***	-304
				(214)	(257)	(212)			(235)	(343)	(236)
DE [1]				90.1	783***	1,546***			172	677**	1,310***

				(226)	(249)	(331)			(278)	(301)	(448)
Year Dummies [2]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−33,453*** (3,831)	−39,386*** (4,495)	−40,968*** (4,589)	−44,758*** (4,646)	−38,272*** (4,668)	−39,413*** (4,653)	−34,182*** (5,059)	−34,336*** (5,230)	−35,531*** (5,302)	-31,818*** (5,324)	-32,941*** (5,327)
Observations	1,683	1,328	1,328	1,328	1,328	1,328	829	829	829	829	829
R-squared	0.5538	0.5905	0.5927	0.6066	0.6049	0.6040	0.5387	0.5407	0.5458	0.5515	0.5483
LM test	130.33***	134.10***	125.76***	132.25***	118.98***	118.86***	29.01***	27.84***	25.26***	24.05***	23.48***
Number of id	1,132	934	934	934	934	934	557	557	557	557	557

Absolute value of *t* statistics in parentheses

*significant at 10% ; ** significant at 5% ; *** significant at 1%

[1] Players with salary arbitration as control group

[2] 2009 as control group

Table 7. Estimation results of the RE model investigating the effect of contract length on natural log of salary

	Dependent variables: lnAverage salary										
Variables	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22
Factors affecting contract length											
LENGTH	0.24*** (0.013)	0.20*** (0.014)	0.20*** (0.014)	0.20*** (0.015)	0.15*** (0.020)	0.26*** (0.022)	0.26*** (0.023)	0.26*** (0.023)	0.24*** (0.027)	0.15*** (0.034)	0.34*** (0.038)
LENGTH × DFA					0.11*** (0.029)					0.20*** (0.050)	
LENGTH × DE						−0.12*** (0.029)					-0.19*** (0.050)
Player characteristics											
BLACK	−0.052 (0.054)	−0.14** (0.059)	−0.14** (0.059)	−0.12** (0.059)	−0.12** (0.058)	−0.12** (0.058)	−0.13 (0.079)	−0.13* (0.079)	−0.13 (0.079)	-0.11 (0.078)	-0.11 (0.078)
LATIN	−0.091* (0.052)	−0.085 (0.056)	−0.085 (0.056)	−0.083 (0.056)	−0.085 (0.056)	−0.084 (0.055)	−0.0050 (0.071)	−0.0032 (0.071)	−0.0030 (0.071)	-0.013 (0.070)	-0.0097 (0.070)
Seniority	0.077*** (0.010)	0.085*** (0.012)	0.085*** (0.012)	0.093*** (0.012)	0.089*** (0.012)	0.089*** (0.012)	0.065*** (0.012)	0.064*** (0.012)	0.064*** (0.012)	0.061*** (0.012)	0.060*** (0.012)
DL	−0.0035*** (0.00058)	−0.0024*** (0.00070)	−0.0024*** (0.00070)	−0.0022*** (0.00070)	−0.0020*** (0.00069)	−0.0019*** (0.00069)	−0.00061 (0.00068)	−0.00059 (0.00068)	−0.00063 (0.00068)	-0.00049 (0.00067)	-0.00048 (0.00068)
age	0.35*** (0.063)	0.38*** (0.072)	0.38*** (0.072)	0.44*** (0.072)	0.40*** (0.073)	0.39*** (0.073)	0.36*** (0.078)	0.36*** (0.078)	0.37*** (0.078)	0.32*** (0.078)	0.32*** (0.079)
Square of age	−0.0063*** (0.0010)	−0.0071*** (0.0012)	−0.0071*** (0.0012)	−0.0079*** (0.0012)	−0.0072*** (0.0012)	−0.0071*** (0.0012)	−0.0059*** (0.0013)	−0.0059*** (0.0013)	−0.0061*** (0.0013)	-0.0053*** (0.0013)	-0.0053*** (0.0013)
PRIZE	0.38*** (0.051)	0.34*** (0.055)	0.34*** (0.055)	0.32*** (0.054)	0.31*** (0.054)	0.31*** (0.054)	0.14* (0.074)	0.14* (0.074)	0.12* (0.074)	0.13* (0.073)	0.13* (0.073)
All-Star Games (or not)	0.55*** (0.052)	0.50*** (0.056)	0.50*** (0.057)	0.47*** (0.056)	0.47*** (0.056)	0.46*** (0.056)	0.27*** (0.070)	0.27*** (0.070)	0.27*** (0.070)	0.27*** (0.070)	0.27*** (0.070)
Performance											
Cy Young points							0.0084*** (0.00059)	0.0084*** (0.00059)	0.0083*** (0.00061)	0.0084*** (0.00060)	0.0084*** (0.00060)
Silver Slugger points		0.00031*** (0.000042)	0.00031*** (0.000042)	0.00031*** (0.000041)	0.00030*** (0.000041)	0.00030*** (0.000041)					
Team characteristics											
Team size			−0.0035	−0.00027	−0.0011	−0.00051		−0.016	−0.015	-0.014	-0.014

			(0.0095)	(0.0093)	(0.0093)	(0.0093)		(0.011)	(0.011)	(0.011)	(0.011)
Population of the team's home			1.3e-09	7.7e-10	−5.9e-10	−7.8e-10		2.2e-09	2.4e-09	5.5e-10	1.0e-09
			(8.2e-09)	(8.1e-09)	(8.1e-09)	(8.0e-09)		(9.7e-09)	(9.6e-09)	(9.6e-09)	(9.6e-09)
Other control variables											
DFA [1]				−0.17***	−0.29***	−0.18***			0.013	-0.22***	-0.0090
				(0.050)	(0.061)	(0.050)			(0.057)	(0.083)	(0.057)
DE [1]				0.15***	0.25***	0.39***			0.13*	0.25***	0.46***
				(0.053)	(0.059)	(0.078)			(0.067)	(0.073)	(0.11)
Year Dummies [2]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	8.98***	8.58***	8.67***	7.55***	8.39***	8.38***	7.88***	8.32***	8.14***	9.06***	8.94***
	(0.99)	(1.12)	(1.14)	(1.15)	(1.16)	(1.15)	(1.21)	(1.26)	(1.27)	(1.27)	(1.27)
Observations	1,683	1,328	1,328	1,328	1,328	1,328	829	829	829	829	829
R-squared	0.3758	0.4374	0.4367	0.4718	0.4668	0.4684	0.4793	0.4816	0.4776	0.4701	0.4689
LM test	163.72***	133.85***	130.28***	139.64***	132.86***	132.35***	36.60***	36.74***	31.32***	28.23***	26.57***
Number of id	1,132	934	934	934	934	934	557	557	557	557	557

Absolute value of *t* statistics in parentheses

*significant at 10% ; ** significant at 5% ; *** significant at 1%

[1] Players with salary arbitration as control group

[2] 2009 as control group

4.2 Empirical Analysis of the Two-Stage RE Model

Using a two-stage RE model, the endogeneity problem can be resolved. Tables 8 and 9 show the empirical results of the effect of contract length on average salary through taking the 22 regression models to investigate the endogenous relationship between contract length and salary. Except for changing the variables *average number of days per year on the disabled list in the three years prior to signing the contract* and *population of the team's hometown* to instrumental variables, the variables of the 22 models in Tables 8 and 9 have the same permutations as the RE models in Tables 6 and 7.

In Table 8, for example, among the regression results for Models 1–11, Models 1–4, 6–8, and 11 all showed a significant positive effect. Model 1 shows, at a 1% significance level, that for every additional year in a contract, players on average received $3.17 million USD more annually; however, in the RE model, average annual salary only increased by $1.64 million USD. Model 2 shows, at a 5% significance level, that for every additional year in a contract, fielders received on average $3.32 million USD more per year; however, in the RE model, average annual salary only increased by $1.59 million USD. Model 6 shows, at a 1% significance level, that for every additional year in a contract, fielders received on average $4.06 million USD more per year; however, in the RE model, average annual salary only increased by $2.02 million USD. Model 7 shows, at a 10% significance level, that for every additional year in a contract, pitchers received on average $2.64 million USD more per year; however, in the RE model, average annual salary only increased by $1.74 million USD. Model 11 shows, at a 5% significance level, that for every additional year in a contract, pitchers received on average $4.53 million USD more per year; however, in the RE model, the average annual salary only increased by $2.09 million USD. This matches the regression results of Krautmann and Oppenheimer (2002), wherein contract length had a significant positive effect on salary. For every additional year in a contract, salary increased by 3.18% in the 2SLS RE model, but only by 0.82% in the RE model; RE underestimates the rise in salary.

This study used Models 12–15, 15–17, and 22 from Table 9 to perform a robustness check. The results matched those of Models 1–4, 6–8, and 11 from Table 8. Under the same conditions, using the 2SLS RE model obtained a higher (player salary) result than the RE model, proving that there is an endogeneity problem in the relationship between contract length and average annual salary. Therefore, if the 2SLS RE model is not used for analysis, the player salary increases will be underestimated.

Model 6 of Table 8 shows, at a 1% significance level, that for every additional year in a contract, a fielder who extends his contract will receive $2.72 million USD less than a fielder with salary arbitration; however, in the RE model, the former only receives $0.74 million USD less than the latter. This study used Model 17 of Table 9 to perform a robustness check and the results matched those of Model 6: there is indeed an underestimation.

Models 2–6 of Table 8 measure the effect of fielder performance on average annual salary. Models 2–4 show a negative, but insignificant impact, so it is impossible to tell if fielder performance has an impact on average annual salary at all. Models 7–11 of Table 8 measure the effect of pitcher performance on average annual salary. Model 11 shows, at a 10% significance level, that for every unit of performance increase, the average salary rises by $13,700 USD.

Table 8. Estimation results of the two-stage RE model investigating the effect of contract length on salary

	Dependent variables: Average salary (In thousands)										
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Factors affecting contract length											
LENGTH	3,172***	3,323**	3,348**	3,365***	-1,776	4,056***	2,643*	2,800*	2,266	971	4,532**
	(827)	(1,343)	(1,349)	(1,075)	(3,191)	(994)	(1,463)	(1,502)	(1,982)	(2,527)	(2,047)
LENGTH × DFA					3,749					1,253	
					(2,991)					(2,302)	
LENGTH × DE						−2,716***					-2,947
						(957)					(1,932)
Player characteristics											
BLACK	42.6	−54.8	−50.7	−59.1	−115	−54.1	−48.6	−22.8	−61.4	147	303
	(212)	(258)	(258)	(272)	(288)	(253)	(342)	(350)	(331)	(440)	(453)
LATIN	−524***	−520**	−517**	−490*	−695**	−564**	−292	−302	−346	-482	-493
	(194)	(240)	(240)	(256)	(304)	(239)	(269)	(274)	(292)	(375)	(356)
Seniority	215***	308***	309***	503***	202	380***	198***	194***	288***	343***	264***
	(44.9)	(58.9)	(59.0)	(77.2)	(191)	(53.8)	(68.6)	(69.9)	(50.8)	(63.6)	(68.9)
age	2,211***	2,901***	2,898***	3,306***	216	1,764***	1,942***	1,972***	2,159***	2,142***	1,524***
	(306)	(553)	(555)	(516)	(2,112)	(434)	(379)	(388)	(395)	(533)	(557)
Square of age	−35.3***	−47.4***	−47.3***	−53.5***	−8.78	−30.1***	−30.4***	−30.8***	−34.3***	-35.7***	-24.4***
	(4.60)	(7.80)	(7.83)	(7.34)	(31.2)	(7.34)	(5.54)	(5.67)	(5.33)	(6.71)	(9.39)
PRIZE	1,071*	1,092	1,082	1,126**	2,288***	1,282***	1,120*	1,057	1,270***	1,092***	1,157***
	(645)	(746)	(750)	(492)	(613)	(343)	(649)	(666)	(432)	(324)	(366)
All-Star Games	2,002***	1,780**	1,763**	1,795***	3,202***	1,988***	1,510***	1,507***	1,516***	1,361***	1,525***
(or not)	(497)	(858)	(857)	(571)	(714)	(381)	(301)	(307)	(298)	(343)	(332)
Performance											
Cy Young							23.5**	22.3*	21.6*	19.8**	13.7*
points							(11.8)	(12.1)	(12.9)	(9.30)	(7.88)
Silver Slugger		−0.26	−0.28	−0.026	1.00*	0.13					
points		(0.62)	(0.62)	(0.43)	(0.58)	(0.28)					
Team characteristics											
Team size			57.6	61.9	51.4	56.9		32.4	7.50	-1.51	-4.25
			(53.8)	(50.8)	(57.6)	(47.0)		(54.1)	(49.1)	(44.0)	(53.1)
Other control variables											
DFA [1]				−2,727**	−3,047**	−2,134***			−547	-1,847	-1,772
				(1,293)	(1,444)	(718)			(1,736)	(1,448)	(1,233)
DE [1]				−2,564	6,197	3,924***			−397	950	3,722*
				(1,706)	(5,541)	(1,156)			(2,429)	(3,095)	(2,118)
Year Dummies [2]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−36,888***	−47,073***	−48,632***	−55,423***	1,560	−30,875***	−33,454***	−35,014***	−36,380***	-33,147***	-27,690***
	(5,652)	(10,549)	(10,554)	(9,421)	(38,415)	(6,288)	(7,177)	(7,693)	(8,420)	(11,939)	(7,603)
Observations	1,683	1,328	1,328	1,328	1,328	1,328	829	829	829	829	829
R-squared	0.5358	0.5444	0.5458	0.5558	0.2001	0.5311	0.5436	0.5447	0.5600	0.5585	0.5364
Number of id	1,132	934	934	934	934	934	557	557	557	557	557

Absolute value of *t* statistics in parentheses

*significant at 10% ; ** significant at 5% ; *** significant at 1%

[1] Players with salary arbitration as control group

[2] 2009 as control group

Table 9. Estimation results of the two-stage RE model investigating the effect of contract length on natural log of salary

	Dependent variables: lnAverage salary										
Variables	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22
Factors affecting contract length											
LENGTH	1.10***	0.88**	0.86**	0.73***	0.10	0.75***	0.88*	0.82*	0.79	1.00	1.00*
	(0.30)	(0.38)	(0.37)	(0.24)	(0.60)	(0.21)	(0.47)	(0.45)	(0.63)	(1.76)	(0.56)
LENGTH × DFA					0.20					-0.57	
					(0.55)					(1.61)	
LENGTH × DE						−0.60***					-0.82
						(0.20)					(0.53)
Player characteristics											
BLACK	−0.045	−0.081	−0.083	−0.081	−0.080	−0.085	−0.055	−0.066	−0.088	-0.10	-0.023
	(0.083)	(0.082)	(0.081)	(0.077)	(0.050)	(0.065)	(0.11)	(0.11)	(0.094)	(0.10)	(0.11)
LATIN	−0.092	−0.093	−0.094	−0.088	−0.10*	−0.098	−0.039	−0.035	−0.019	0.0070	-0.042
	(0.077)	(0.077)	(0.075)	(0.073)	(0.056)	(0.062)	(0.093)	(0.089)	(0.082)	(0.079)	(0.086)
Seniority	0.036**	0.062***	0.062***	0.11***	0.067*	0.080***	0.031	0.033	0.054***	0.054**	0.049***
	(0.018)	(0.019)	(0.019)	(0.020)	(0.036)	(0.014)	(0.026)	(0.025)	(0.014)	(0.024)	(0.017)
age	0.46***	0.56***	0.55***	0.60***	0.28	0.23**	0.41***	0.40***	0.41***	0.53	0.19
	(0.12)	(0.16)	(0.16)	(0.13)	(0.39)	(0.10)	(0.12)	(0.11)	(0.13)	(0.58)	(0.14)
Square of age	−0.0069***	−0.0091***	−0.0090***	−0.0097***	−0.0053	−0.0042**	−0.0061***	−0.0060***	−0.0060***	-0.0078	-0.0030
	(0.0018)	(0.0023)	(0.0022)	(0.0019)	(0.0058)	(0.0017)	(0.0017)	(0.0016)	(0.0016)	(0.0077)	(0.0024)
PRIZE	−0.15	0.058	0.067	0.14	0.37***	0.23***	−0.066	−0.043	0.046	0.023	0.097
	(0.23)	(0.21)	(0.21)	(0.12)	(0.12)	(0.079)	(0.20)	(0.19)	(0.14)	(0.27)	(0.091)
All-Star Games	0.11	0.12	0.14	0.23	0.51***	0.34***	0.25**	0.25***	0.26***	0.27***	0.28***
(or not)	(0.19)	(0.25)	(0.25)	(0.14)	(0.12)	(0.086)	(0.096)	(0.092)	(0.086)	(0.098)	(0.082)
Performance											
Cy Young points							0.0045	0.0049	0.0057	0.0071	0.0061***
							(0.0037)	(0.0035)	(0.0041)	(0.0060)	(0.0021)
Silver Slugger		−0.000054	−0.000045	0.000095	0.00022**	0.00017***					
points		(0.00018)	(0.00018)	(0.00010)	(0.00011)	(0.000067)					
Team characteristics											
Team size			−0.0096	−0.0068	−0.0070	−0.0059		−0.012	−0.014	-0.014	-0.016
			(0.016)	(0.013)	(0.011)	(0.011)		(0.015)	(0.015)	(0.017)	(0.013)
Other control variables											
DFA [1]				−0.80***	−0.30	−0.50***			−0.40	0.39	-0.40
				(0.30)	(0.28)	(0.15)			(0.53)	(1.11)	(0.33)
DE [1]				−0.63*	0.42	0.99***			−0.52	-0.80	1.13**
				(0.38)	(1.04)	(0.25)			(0.78)	(2.29)	(0.57)
Year Dummies [2]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.48***	4.63	5.01*	4.30*	10.4	10.4***	6.20***	6.76***	6.56**	4.39	10.3***
	(2.12)	(3.03)	(2.93)	(2.25)	(7.18)	(1.49)	(2.19)	(2.18)	(2.75)	(11.7)	(1.92)
Observations	1,683	1,328	1,328	1,328	1,328	1,328	829	829	829	829	829
R-squared	0.2418	0.2521	0.2539	0.3014	0.4071	0.3305	0.3758	0.3889	0.4337	0.3903	0.3959
Number of id	1,132	934	934	934	934	934	557	557	557	557	557

Absolute value of *t* statistics in parentheses

*significant at 10% ; ** significant at 5% ; *** significant at 1%

[1] Players with salary arbitration as control group

[2] 2009 as control group

Table 10 references Krautmann and Oppenheimer (2002), and Link and Yosifov (2012) to verify whether the theory of compensating wage differentials does indeed stand up. This study finds that compensation does indeed occur for players who extend their contracts. After controlling for all the other variables, the longer the player extends his contract, the lower his average annual salary, which is the support of what the theory of compensating wage

differentials predicts. For free agents, contract length and average salary have a negative, but not significant relationship. Players extending their current contracts are more special. Table 10 shows that for players with salary arbitration, there is a positive relationship between contract length and average annual salary, which is the opposite of what the theory of compensating wage differentials predicts. Why the status of the player affects the result is a subject for another study.

Table 10. Estimation results of the method of least squares RE model investigating the effect of contract length on natural log of salary (referencing Krautmann and Oppenheimer (2002) and Link and Yosifov (2012))

	Dependent variables: lnAverage salary						
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Factors affecting contract length							
LENGTH	0.97**	0.76***	0.73***	1.02**	1.82**	1.93***	0.97***
	(0.47)	(0.21)	(0.26)	(0.49)	(0.82)	(0.57)	(0.28)
LENGTH × DFA × Louisville Silver Slugger points	−0.00033			−0.00036			
	(0.00022)			(0.00024)			
LENGTH × DE × Louisville Silver Slugger points		−0.00025***		−0.00037*			
		(0.000084)		(0.00020)			
LENGTH × dummy variable for players with salary arbitration × Louisville Silver Slugger points			0.00031***				
			(0.000063)				
LENGTH × DFA × Cy Young points					−0.0068		
					(0.0049)		
LENGTH × DE × Cy Young points						−0.0088***	
						(0.0030)	
LENGTH × dummy variable for players with salary arbitration × Cy Young points							0.0068***
							(0.00090)
Player characteristics							
BLACK	−0.027	−0.029	−0.084	0.032	−0.049	0.056	−0.074
	(0.083)	(0.070)	(0.069)	(0.081)	(0.14)	(0.17)	(0.099)
LATIN	−0.087	−0.089	−0.077	−0.087	−0.0026	−0.090	−0.0096
	(0.078)	(0.067)	(0.066)	(0.063)	(0.12)	(0.14)	(0.087)
Seniority	0.14***	0.097***	0.11***	0.11***	0.055**	0.052**	0.053***
	(0.032)	(0.015)	(0.018)	(0.020)	(0.022)	(0.024)	(0.015)
age	0.84***	0.54***	0.61***	0.74***	0.68**	0.18	0.42***
	(0.27)	(0.097)	(0.12)	(0.23)	(0.29)	(0.16)	(0.11)
Square of age	−0.014***	−0.0089***	−0.0098***	−0.012***	−0.0093**	−0.0022	−0.0060***
	(0.0039)	(0.0015)	(0.0017)	(0.0033)	(0.0038)	(0.0027)	(0.0017)
PRIZE	0.26**	0.29***	0.15	0.47***	-0.00080	0.24*	0.087
	(0.13)	(0.092)	(0.15)	(0.070)	(0.20)	(0.15)	(0.13)
All-Star Games (or not)	0.25	0.32***	0.25*	0.40***	0.48***	0.55***	0.30***
	(0.18)	(0.10)	(0.15)	(0.10)	(0.14)	(0.13)	(0.11)
Team characteristics							
Team size	−0.0055	−0.0051	−0.0062	−0.0047	−0.0057	−0.026	−0.010
	(0.015)	(0.012)	(0.013)	(0.013)	(0.026)	(0.023)	(0.016)
Other control variables							
DFA [1]	−0.60**	−0.69***	−0.54*	−0.37**	−0.53**	−1.12***	−0.18
	(0.28)	(0.22)	(0.32)	(0.17)	(0.24)	(0.38)	(0.25)
DE [1]	−1.09	−0.054	−0.43	−0.28	−1.82	0.014	−0.24
	(0.81)	(0.14)	(0.43)	(0.37)	(1.17)	(0.18)	(0.41)
Year Dummies [2]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.25	5.26***	4.04*	1.77	0.43	9.43***	5.93***
	(4.98)	(1.70)	(2.27)	(4.26)	(6.05)	(2.48)	(2.07)

Observations	1,328	1,328	1,328	1,328	829	829	829
R-squared	0.2514	0.2896	0.2947	0.2779	0.2756	0.2893	0.3959
Number of id	934	934	934	934	557	557	557

Absolute value of *t* statistics in parentheses

*significant at 10% ; ** significant at 5% ; *** significant at 1%

[1] Players with salary arbitration as control group

2 2009 as control group

5. Conclusion

The goal of this study was to investigate the effect of contract length on average salary of baseball players. According to data collected from 1,681 players between the years of 2009 and 2013, when controlling for player characteristics, performance, team characteristics, and dummy variables for free agents and players extending their current contracts, the RE model showed that contract length had a significant positive impact on average salary. Even for infielders and pitchers, the significant positive impact still exists. The above results indicate, for example, that if player A's contract is a year longer than player B's, his salary will be $1.64 million USD more in the estimation of Model 1 in Table 6.

Player status may positively influence salary negotiations. Therefore, this study compared the relationship between contract length and salary between the three types of player statuses. This study found, for fielders, that the average salary for players with salary arbitration was lower than that of free agents, but higher than that of players extending their current contracts. The reason for this may be due to seniority: the more senior a player, the more likely he is to receive a higher salary. The differing seniority requirements of these three player statuses (a player has to have six years of service to be considered a free agent, three years to be eligible for salary arbitration, and one year to extend his contract) could produce this result. Other factors that have a positive impact are age, awards won, selection for the All-Star Game, player performance, and the population of the team's hometown. For Latino fielders, their race has a negative and significant impact on their salary in a renewed contract. The evidence corresponds to Kahn and Shan (2005).

The effect of performance on average salary for those players with greater bargaining power is significant and positive for both pitchers and fielders in the RE model, but is only significant and positive for pitchers when using a 2SLS RE model. In the RE model, when controlling for variables, including player characteristics, team characteristics, and the dummy variables for free agents and players extending their contracts, the average salary for fielders increased by $670 USD for each point added to the performance mark. The average salary for pitchers increased by $32,000 USD for each point added to the performance mark when using a RE model and by $24,000 when using a 2SLS RE model.

As verified by the theory of compensating wage differentials, the results show that the compensation differential exists for players extending their current contracts, but this phenomenon is not as significant for free agents; for players with salary arbitration, the situation is the opposite of what the theory of compensating wage differentials predicts. Why player status has an effect is something to explore in a future study. This study takes the labor market for MLB players as a sample; other studies have been conducted for basketball players. If, in the future, the contracts, salary, and performance of professional athletes in a variety of sports can be standardized, we could better verify whether the theory of compensating wage differentials exists across a broad range of professional sports.

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Notes

Note 1. As the theory of compensating wage differentials shows, when other things equal, the longer the contract, the lower the salary.

Note 2. The pitchers referred to in this study are all players who have pitched and also include fielders who have pitched in a game; ‘fielders’ refers to all players who have batted in a game and also includes pitchers who step up to bat.

Note 3. Besides the disabled list, the population of the franchise’s home base should also be a good instrument variable and it was used as a variable in the first stage.