Full-Length Papers

Journal of Sports Economics
13(1) 3-19

DOI: 10.1177/1527002510396984
http://jse.sagepub.com
SAGE

Contract Length and Salaries Compensating Wage Differentials in Major League Baseball

Charles R. Link[1] and Martin Yosifov[1]

Abstract

This study investigates the relationship between free agent salaries and contract length in Major League Baseball (MLB) to examine whether players trade-off returns to performance for additional job security. This study is the first to conduct a comprehensive, multiperiod study of salary determination for all MLB position players who were free agents and signed contracts between 1984-1994 and 2003-2006. The authors use the same technique and variables in all models so that comparisons across time are possible. The empirical results of this study indicate that free agent position players appear willing to trade monetary returns to performance for the security of a longer guaranteed contract. The results are not sensitive to the definition of salary used but are sensitive to the productivity measure employed. The results are least compelling for 1990-1994, a result that is different from the finding of Krautmann and Oppenheimer.

Keywords

Player Salaries and Contract Length

The compensation of baseball players has been a topic of interest for economists because of the availability of detailed productivity and salary data as well as interesting issues involved in contracting such as collective bargaining, market structure, and discrimination. Most studies of salary determination in Major League Baseball

[1] Department of Economics, University of Delaware, Newark, DE, USA

Corresponding Author:
Charles R. Link, Department of Economics, University of Delaware, Newark, DE, USA
Email: clink@udel.edu

(MLB) use factors such as player performance, player experience, and team and market characteristics to model player compensation. Besides direct monetary compensation for their services to the teams, however, players may also receive nonpecuniary benefits such as job security via multiyear contracts. The theory of compensating differences suggests that players might be willing to substitute some salary in exchange for certain nonmonetary aspects of their job.

Our main objective in this article is to explore further the relationship between player salaries and contract length. Only a few studies have dealt with the issues of contract length (e.g., Kahn, 1993; Krautmann & Oppenheimer [KO], 2002; Lehn, 1982; Maxcy, 1998). There is disagreement, however, about how to incorporate contract length into the analysis. Kahn (1993) viewed length of contract as another outcome of the negotiation process and included it as a dependent variable, while Maxcy (1998) along with KO (2002) included length of contract as an explanatory variable in salary regressions. KO looked at a sample of free agent contracts between 1990 and 1994, in the tumultuous years just prior to the 1994 strike and found evidence of a trade-off between monetary returns to performance (slugging average [SA]) and the security of a longer contract. Since the 1980s, however, a number of important arbitrator rulings, the long strike of 1994, large national media contracts, revenue sharing, and the luxury tax have had a pronounced effect on the employment and salary environments in MLB. These changes raise the question of whether salary relationships that existed in earlier time periods still hold.

In this article, we provide additional evidence about the effects of contract length on the salary determination process using official Major League contract data covering three time periods—1984-1989, 1990-1994, and 2003-2006. Our data include detailed contract information for all free agent eligible position players who are on a team's 25-man roster each year as of August 31. To our knowledge, no other researcher has had access to this data.

Our results add to the literature in several ways. First, we test the theory set out by KO (2002) that players are willing to trade-off salary for contract security, when being rewarded for performance using their measure of salary (first year of the contract) and performance (SA). Our empirical results for free agents provide some support for the trade-off hypothesis for the years 1984-1989 and 2003-2006 but not for 1990-1994. Second, we reestimate the model using another measure of salary, the average salary over the length of the player's contract. The results for average salary are similar to those when the salary in the first year of the contract is used as the dependent variable. Third, using each of the above definitions for salary, the models are estimated using an alternative measure of productivity, Winshares, which measures a player's contribution to a team's wins. Here, the results support the idea of a trade-off in all years and with both definitions of player salary.

The article is organized as follows: the section on Salary and Length of Contract reviews prior studies dealing with the potential relationship between salaries and contract length in MLB. The second section on Data and Variables discusses the data

and the methodology; and results are presented in the section on Empirical Results. The final section provides concluding statements.

Salary and Length of Contract

It is well-known that when MLB players accumulate 6 years of Major League experience, they have a great amount of bargaining power since they are able to sell their services to the highest bidder.[1] As with KO (2002), this is the group of players whose behavior is studied in this article.

Unlike other variables discussed in the MLB salary literature, which are more or less accepted as exogenous to the salary negotiation process, the role of contract length in salary negotiations is unclear. From a theoretical point of view, long-term labor contracts facilitate the allocation of risk between workers and firms. The first labor contract models appeared in 1970s and are summarized in the excellent overview by Hart and Holmsrom (1987). In such models, risk-averse workers seek, over their work lives, to smooth their income, which in turn motivates them to enter into long-term contracts. Risk-neutral firms, on the other hand, are willing to provide insurance to workers by offering a contracted wage that is lower than the expected average wage in the spot market. The difference between the former and the latter is the risk premium collected by the firm. This type of arrangement is a form of the compensating wage differential originally attributed to Adam Smith.

Because both salaries and contract length are outcomes of the contract negotiation process in MLB, the degree of risk aversion of the parties involved will likely have an important impact on outcomes. If players are risk-averse, they might be willing to trade-off a lower salary for a longer contract. Such a trade-off would be consistent with the traditional theoretical notion of a compensating differential in the labor market for MLB players. It is also possible that players might require some sort of compensation (e.g., a higher salary than would have otherwise been accepted) for signing short-term contracts. On the other hand, risk-averse team owners might have an opposite effect on salary negotiations. Owners would prefer short-term contracts as they reduce their exposure to the variability in players' performance. However, if owners believe wages will be rising in the near future, they might reduce the risk of paying high wages in the future through signing long-term contracts with players.

Other than risk aversion, there could be other reasons explaining why players might prefer long-term contracts. It can be argued that short-term contracts would result in frequent relocations of players and their families. If players want to reduce such stress, they will value long-term contracts more than a series of short-term contracts which offer similar income and compensation streams but require the player to move between teams. It seems likely that players would trade-off salary for some other contract terms such as increased length of contract.

Kahn (1993) investigated how free agency and arbitration eligibility impact contract length and salaries. He estimated separate regressions for salary and contract length and found that both arbitration eligibility and free agency were positively

related to salaries. But only free agency was associated with greater average contract length. Although he recognizes that contract length is an important part of the negotiation process between players and teams, his model does not account for a possible direct relationship between salary and contract length, since he does not include contract length in his salary regression. Originally, he included length as a right-hand side variable, but obtained "counterintuitively" positive and significant coefficients, suggesting that contract length is correlated with time-varying productivity effects. Kahn therefore chose not to include contract length in his salary regression.

Maxcy (1998) also found a positive relationship between contract length and salaries. The results of Kahn (1993) and Maxcy (1998) are consistent with the idea that the best players receive both the highest salaries and the longest contracts. This result seems contradictory to the idea of compensating wage differences, since there appears to be no trade-off between contract length and salary.

KO (2002) offered an alternative approach for explaining the contract length–salary relationship by developing a model allowing for a positive relationship to exist between length of contract and salary. The trade-off is incorporated by including a multiplicative interaction SA $\times$ LENGTH as shown in Equation 1 (see the discussion below), where a player's return to performance (RTP) is defined as the incremental monetary compensation that a player receives for an incremental unit of performance. KO report a negative relationship between the length of contract and RTP and argue that players do purchase "insurance" when signing long-term contracts by trading-off some of the RTP for longer contracts.

Although such a measure (the interaction term) does not correspond directly to the traditional compensating wage differentials concept where differences in salary can be explained by differences in contract length (which is a nonpecuniary part of the employment relationship), it still shows that a trade-off might exist in the negotiation process. KO (2002) argue that because contract negotiations take place between clubs who are risk-neutral (or at least less risk-averse than players), and players who are more risk-averse, the more risk-averse party (player) will tend to insure himself against future performance uncertainty by "purchasing" long-term contracts.[2] If, as we expect, risk aversion on the part of the club is less than that of individual players, the risk preferences of players will dominate the negotiated contract terms.

KO (2002) used a sample of free agent hitters who signed contracts for the 1990-1994 seasons to estimate the salary model below where RSAL is real salary in the first year of the player's contract:

$$\ln(\mathrm{RSAL}_{ij}) = \beta_1 + \beta_2 \mathrm{PERF}_{ij} + \beta_3 (\mathrm{PREF}_{ij} \times \mathrm{LENGTH}_{ij}) + \beta_4 \mathrm{LENGTH}_{ij} + \beta_5 \mathrm{PLAYER}_i + \beta_6 \mathrm{TEAM}_J + \epsilon_{ij} \quad (1)$$

where i and j represent the player and team, respectively. LENGTH_{ij} is the length in years of a player's contract, PERF_{ij} is the player's performance, and TEAM_j measures team-specific characteristics. This model allows contract length to be positively related to salaries (i.e., $\beta_4 > 0$) and allows returns to performance to vary

with contract length. Any trade-off between the RTP and contract length is captured by β_3 (expected to exhibit a negative sign). KO found a statistically significant and positive β_4 and a statistically significant and negative β_3.

Although the study by KO (2002) is the most comprehensive to date estimating the potential trade-off between contract length and salary, it has some limitations. First, because of the unique source of our data from MLB, we include the total population of free agent players. Between 1990 and 1994, the population of free agents signing new contracts used in our study is significantly larger than the sample used by KO; and consequently, their results may be not be representative of the population of free agents. Second, even if the KO results are robust for 1990-1994, they are based on the tumultuous 5 years, leading to the strike in 1994. Therefore, the reported relationships may not hold in other periods. We analyze data for two time periods other than the one which includes the 1994 strike, 1984-1989 and 2003-2006. Third, KO use salary in the first year of the player's contract as their dependent variable and test their theory using SA as the measure of productivity. We test the sensitivity of the estimates to the definition of salary as well as the measure of player productivity employed. Our additional salary variable measures the average salary over the length of the player's contract, and our additional productivity measure employed is Winshares, which captures a player's contribution to a team's games won.

Data and Variables

The database underlying our study includes data for all free agent position players who signed new contracts between 1984-1989, 1990-1994, and 2003-2006. Noncontractual data are included, such as a player's MLB experience at the time of signing a particular contract (important for determining whether the player is eligible for free agency), a player's performance statistics (e.g., SAs, on base percentages, at bats [AB], etc.), personal data (e.g., ethnicity, etc.), team statistics, and league statistics.

Most of the player performance data are publicly available. However, our information about length of contract, salary, and experience is based on what are called the joint exhibits and are official documents published by MLB. Other studies have based their contract data on sources such as the popular press; we are not aware of any studies that have had access to the joint exhibits. What is unique about the joint exhibits is that the edition for each year provides official summaries of the contracts for every player who was on the 25-man active roster or the disabled list as of August 31 of the season in question. It includes among other things, the player's official MLB experience, the contract length, option years (including who holds the option), signing bonuses, and base salary.

Our salary variables (RSAL) include the guaranteed portion of a player's compensation and exclude any incentive bonuses. Salary (in thousands of dollars) is defined as the sum of the base salary and prorated signing bonus. Real salary is in 2005 dollars and is measured in thousands of dollars. Given this definition, there are

two salary variables used to test the trade-off theory: salary in the first year of the contract (used by KO) and the average salary over the total length of the contract. Because a player's productivity is not absolute but tied to the productivity of his team, we also include a variable measuring a team's revenues (REV). Real revenue (in thousands of dollars) for 1984-1989 reflects local radio and television revenue by team (Quirk & Fort, 1992). Team revenue data for 1990-1994 and 2003-2006 (in millions of dollars) reflect total revenue per team that was gathered from two websites.[3]

As a primary measure of hitter's performance, we use his SA over the 3 years prior to the signing of the contract in question. A player's average AB for the prior three seasons are also used as a measure of player's performance. AB is a statistic highly correlated with hitter's playing time, which is a measure of the player's overall contribution to his team both offensively and defensively, as managers will give better position players more playing time. In addition, in some models (Tables 1 and 2) the measure of player performance is average Winshares in the 3 years prior to the contract in question. In these models, AB is dropped from the equation since Winshares would incorporate the same factors that we are trying to measure in the models that use SA for player productivity, a player's contribution to team wins.

A key variable included in the joint exhibit is the length of the current contract (LENGTH). To control for the experience–salary relationship, we include a player's Major League service at the time of signing a contract (EXP). Because MLB service determines a player's bargaining category (e.g., eligibility for final offer arbitration or free agency) at the time of contract negotiations, it plays a major role in negotiating contract terms.[4] Trend variables are included for each time period to account for growth in real salaries over time.

Table 3 presents the means for the variables for the three periods under study. Real average annual salaries during the first year of a contract (base salaries plus prorated signing bonuses) rose from around $950,000 in 1984-1989 to about $2.25 million in the 2003-2006. When using the average salary over the length of the contract, the average salaries range from $962,000 in 1984-1989 to $2,400,000 in the last period. Although the long-term contracts of such players as Alex Rodriguez and Manny Ramirez have grabbed the headlines, the average length of contract was only 1.7, 1.9, and 1.6 years, respectively, during the three periods analyzed in our study.

The 3-year moving average SA is between 380 and 390 for the first two periods and then it rises after 2002 to over 410. The 3-year average AB range from 347 to 373. The 3-year average for Winshares is 10.20, 10.79, and 9.16 for the earliest through the latest period.

Local TV and radio revenue (REV) for 1984-1989 was just under $9 million. Teams signing free agents during 1990-1994 had average real total revenue of $66 million and more than $122 million in 2003-2006. The percentages of Blacks signing contracts fell from 26% to 20% between the 1980s and 2003-2006.

Table 1. Salary Determinants for Free Agents by Time Period Using Winshares to Measure Productivity

	1984-1989		1990-1994		2003-2006	
Salary Definition	First	Average	First	Average	First	Average
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Constant	3.828** (18.93)	3.725** (17.96)	4.753** (13.92)	4.783** (13.82)	5.268** (25.68)	5.140** (25.88)
Winshares	0.127** (13.32)	0.128** (12.45)	0.120** (8.52)	0.122** (8.61)	0.139** (15.35)	0.151** (18.10)
EXP	0.039** (4.28)	0.040* (4.57)	0.005 (0.38)	0.002 (0.16)	0.006 (0.66)	0.007 (0.80)
REV DUMMY	—	—	0.378 (1.55)	0.326 (1.60)	−0.07 (−0.47)	−0.062 (−0.43)
REV	0.006 (1.19)	0.009* (1.84)	0.003 (1.52)	0.001 (0.47)	−0.0002 (−0.22)	−0.0004 (0.48)
Black	−0.043 (−0.55)	−0.02 (−0.23)	0.001 (0.02)	0.012 (0.15)	−0.239** (2.85)	−0.224** (−2.66)
Latin	0.024 (0.29)	0.008 (0.09)	−0.047 (−0.39)	−0.07 (−0.59)	−0.009 (−0.12)	−0.075 (−1.19)
Trend	0.089** (4.79)	0.096** (5.08)	0.081** (2.06)	0.114** (2.77)	0.061 (1.35)	0.056 (1.28)
LENGTH	0.675** (10.98)	0.701** (9.75)	0.492** (2.84)	0.494** (2.88)	0.549** (7.76)	0.675** (10.86)
Winshares × LENGTH	−0.028** (−7.66)	−0.029** (−7.14)	−0.016** (–2.24)	−0.016** (–2.27)	−0.019** (–6.27)	−0.024** (–9.91)
R^2	.61	.59	.55	.56	.71	.76
Sample size	368		327		330	

Note: REV = revenue; EXP = Major League years of service. *t* statistics in parenthesis; Columns 1, 3, and 5 have as the dependent variable the salary for the first year of the contract; Columns 2, 4, and 6 have as the dependent variable the average salary over the whole contract length.

*Significant at the 10% level.

**Significant at the 5% level.

Table 2. Selected Coefficient Estimates for Winshares and Contract Length for Free Agents by Major League Experience

	1984-1989		1990-1994		2003-2006	
	First	Average	First	Average	First	Average
Years of MLB experience 6–10						
Winshares	0.142** (10.37)	0.138** (9.45)	0.122** (6.90)	0.123** (6.79)	0.148** (14.73)	0.150** (15.41)
LENGTH	0.753** (10.46)	0.679** (8.72)	0.445** (2.53)	0.437** (2.58)	0.597** (7.16)	0.662** (9.56)
LENGTH × Winshares	−0.032** (−6.54)	−0.031** (−5.76)	−0.015* (−1.90)	−0.014* (−1.91)	−0.022* (−6.43)	−0.024* (−9.15)
Sample size	178		203		180	
Years of MLB experience 10+						
Winshares	0.113** (7.23)	0.123** (7.65)	0.131** (5.06)	0.139** (5.44)	0.121** (8.45)	0.154** (10.96)
LENGTH	0.638** (4.67)	0.803** (5.64)	0.936** (5.98)	1.040** (6.80)	0.429** (2.66)	0.790** (4.41)
LENGTH × Winshares	−0.043** (3.40)	−0.033** (4.51)	−0.032 (−3.84)	−0.036** (−4.55)	−0.013** (−2.30)	−0.028** (−4.49)
Sample size	190		124		150	

Note: MLB = Major League Baseball. *t*-statistics in parenthesis; Regressions include the variables shown in Table 4 except "at bats" which is deleted.
*Significant at the 10% level.
**Significant at the 5% level.

Table 3. Means (*SD*) for Free Agents

Variables	1984-1989	1990-1994	2003-2006
RSAL in first year of contract (2005$)	$951,565 (773,273)	$1,929,901 (1,802,380)	$2,247,911 (2,728,248)
AVGSAL over the contract period (2005$)	$962,563 (855,030)	$1,941,372 (1,922,115)	$2,401,107 (2,906,494)
LENGTH (contract length)	1.73 (1.03)	1.89 (1.18)	1.58 (1.09)
SA (slugging average 3-year average)	389.16 (55.97)	381.96 (57.63)	413.79 (64.12)
AB (at bats, 3-year average)	347 (142.00)	373 (132.00)	351 (150.00)
Winshares (3-year average)	10.2 (6.41)	10.79 (6.26)	9.16 (6.13)
EXP (Major League years of service)	10.8 (3.57)	9.72 (3.29)	10.04 (3.23)
REVa (revenue 2005$)	$8,959,000 (5,620,000)	$66,590,000 (41,190,000)	$122,414,000 (72,748,000)
Black	0.261 (0.44)	0.287 (0.45)	0.202 (0.40)
Latin	0.109 (0.31)	0.143 (0.35)	0.277 (0.45)
Age	34.1 (3.60)	33.4 (3.00)	34.8 (3.30)
Sample size	368	327	330

The opposite trend has occurred for Latin players, where the corresponding figures are 10% in the 1980s and 27% after 2002.

Empirical Results

Table 4 shows estimates of Equation 1 using the SA as the measure of player performance. Following KO (2002), in Columns 1, 3, and 5 of Table 4, we focus on salaries for the first playing season after a player signed a new contract as the dependent variable. In order to test the sensitivity of our results to changing the definition of the salary, Columns 2, 4, and 6 use the average salary over the length of the contract as the dependent variable. The three samples include all free agent players who signed contracts in the period 1984-1989, 1990-1994, and 2003-2006. Separate regressions are estimated for each of the three time periods.[5]

Since Equation 1 includes LENGTH as an explanatory variable, and because the variable is potentially endogenous in the salary equation, we conduct the Hausman (1978) specification test for each time period.[6] The instrument chosen for the LENGTH equation is the number of disability days in the 2 years prior to the signing of the most recent contract.[7] We agree with the intuition given by KO (2002), who argued that disability days affect LENGTH but not salaries. Namely, although star players who are prone to injuries may receive large salaries, teams are likely to be hesitant to make such players the beneficiaries of long-term contracts.[8] The coefficient of disability days is always significant at the 5% level or higher in the length of contract equation. Also, the coefficient of the residual term in the lnRSAL equation is never statistically significant. This result provides support for using ordinary least squares (OLS) to estimate Equation 1.

The results of the salary regressions using the salary in the first year of the player's contract are shown in Columns 1, 3, and 5 of Table 4. The important result is whether or not there is a significant and negative sign on β_3, which would provide evidence of the willingness that players trade-off returns to performance (in this case SA) in exchange for a longer contract. Between 1984 and 1989, the coefficient is negative and statistically significant at better than the 1% level. However, this result does not carry over in 1990-1994 and 2003-2006, where β_3 does not approach significance at conventional levels.

When average salary over the whole contract is the dependent variable (see Columns 2, 4, and 6), the results for the first two periods are unchanged. The only difference occurs when using average salary for 2003-2006, where β_3 is now negative and statistically significant.

Is it possible the finding of no significance for β_3 for 1990-1994 and 2003-2006 is at least partially explained by differences in Major League service between players? Table 5 presents results of reestimating Equation 1 using SA and separate equations for players by years of service: less than 10 years (top of Table 5) and 10 or more years (bottom of Table 5). The coefficients for SA, LENGTH, and SA $\times$ LENGTH are shown for both definitions of salary. These results appear to be driven by free

Table 4. Salary Determinants for Free Agents by Time Period, Using Slugging Average to Measure Productivity

	1984-1989		1990-1994		2003-2006	
Salary Definition	First	Average	First	Average	First	Average
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Constant	2.147** (4.08)	2.054** (3.70)	2.988** (4.34)	2.887** (4.28)	3.597** (2.98)	3.294** (8.16)
SA	6.031** (4.54)	6.135** (4.36)	6.208** (3.73)	6.294** (3.71)	4.537** (5.05)	5.225** (5.51)
AB	0.002** (6.00)	0.002** (5.67)	0.002** (4.83)	0.002** (4.71)	0.003** (12.64)	0.003** (12.47)
EXP	0.029** (3.01)	0.030** (3.22)	0.011 (0.81)	0.009 (0.64)	0.003 (0.30)	0.003 (0.37)
REV DUMMY	—	—	0.098 (0.55)	0.114 (0.61)	−0.059 (−0.41)	−0.048 (0.34)
REV	0.009* (1.76)	0.012** (2.24)	0.002 (1.26)	0.0002 (0.12)	−0.0003 (−0.22)	−0.0004 (−0.61)
Black	−0.126 (−1.49)	−0.103 (−1.20)	0.047 (0.57)	0.055 (0.53)	−0.298** (−3.35)	−0.275** (−2.98)
Latin	−0.045 (−0.42)	−0.034 (−0.35)	0.035 (0.29)	0.002 (−0.02)	−0.032 (–0.42)	–0.091 (–1.29)
Trend	0.097** (4.53)	0.101** (5.31)	0.009 (0.22)	0.073* (1.78)	0.072 (1.59)	0.081* (1.88)
LENGTH	0.845** (4.18)	0.834** (3.56)	0.578 (1.50)	0.626 (1.60)	0.590** (3.57)	0.729** (4.22)
SA × LENGTH	−1.175** (−2.46)	−1.157** (2.12)	−0.649 (−0.81)	−0.730 (−0.90)	−0.590 (−1.58)	−0.752** (−2.05)
R^2	.53	.53	.57	.68	.71	.74
Sample size	368		327		330	

Note: SA = slugging average; AB = at bats; REV = revenue, EXP = Major League years of service. *t* statistics in parenthesis. Columns 1, 3, and 5 have as the dependent variable the salary for the first year of the contract; and Columns 2, 4, and 6 have as the dependent variable the average salary over the whole contract length.
*Significant at the 10% level.
**Significant at the 5% level.

Table 5. Selected Coefficient Estimates for Slugging Average and Contract Length for Free Agents by Major League Experience

	1984-1989		1990-1994		2003-2006	
Salary Definition	First	Average	First	Average	First	Average
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Years of MLB experience GE 6–10						
SA	5.88** (−3.63)	6.065** (−3.5)	7.329** (−3.43)	7.409** (−3.4)	3.897** (−3.37)	4.190** (−3.54)
LENGTH	0.720** (−2.94)	0.683** (−2.46)	0.644 (−1.56)	0.659 (−1.58)	0.484** (−2.26)	0.641** (−2.95)
LENGTH × SA	−1.011* (−1.70)	−0.984 (−1.44)	−0.904 (−1.05)	−0.925 (−1.07)	−0.352 (−0.79)	−0.597 (−1.29)
Sample size	178		203		180	
Years of MLB experience 10+						
SA	7.025** (−3.52)	7.118** (−3.49)	4.573** (−2.15)	5.192** (−2.36)	5.702** (−4.14)	6.920** (−4.35)
LENGTH	1.353** (−3.81)	1.375** (−3.87)	0.660* (−1.72)	0.883* (−1.77)	1.039** (−3.39)	1.300** (−3.02)
LENGTH × SA	−2.177** (−2.69)	−2.182** (−2.67)	−0.369 (−0.42)	−0.826 (−0.72)	−1.272** (−2.11)	−1.663** (−1.95)
Sample size	190		124		150	

Note: MLB = Major League Baseball; SA = slugging average. Regressions include the variables shown in Table 4; *t* statistics in parenthesis. Columns 1, 3, and 5 have as the dependent variable the salary for the first year of the contract; Columns 2, 4, and 6 have as the dependent variable the average salary over the whole contract length.
*Significant at the 10% level.
**Significant at the 5% level.

agents with 10 or more years of experience, where the signs on β_3 are negative and significant at the 5% level or higher in 1984-1989 and 2003-2006. But as was the case for the pooled (by period) models in Table 4, the trade-off for 1990-1994 is still not significant. In the results for 1984-1989 and 2003-2006, β_3 is larger for the players with more than 10 years of service. One might speculate that this result reflects insecurity by older players (who are more likely to be married with children) who are beginning to realize that their careers will not go on forever.

How do our results compare to those of KO (2002)? They found a significant and negative coefficient for LENGTH $\times$ SA for 1990-1994, while we did not. We cannot attribute this result to different variables since we both use essentially the same variables. One major difference is in sample sizes. Our data include the population of free agent salaries while that of KO does not. Our data include 327 free agents, while the corresponding number for KO is 272, a difference of over 20%. We benefited from having access to the joint exhibits, which in addition to providing the population of relevant free agents yields official salary and length of contract data.

Is it possible that the results in Tables 4 and 5 are sensitive to the measure of player performance used in Equation 1? Table 1 shows results for estimates of Equation 1 but uses Winshares as the measure of player performance and drops the "AB" variable. Otherwise this model is identical to the one estimated in Table 4. With this model specification, β_3 is statistically significant and negative in all three time periods and in both specifications of salary. The size of the coefficient of the interaction term is about $-.028$ in the 1980s, $-.016$ in the 1990s, and between $-.019$ and $-.025$ after 2002; 1990-1994 again shows up as different in that β_3 appears to be smaller, with a *t* statistic that is less than half of that in 1984-1989 or 2003-2006.

Table 2 shows the results when Equation 1 is reestimated using Winshares while at the same time estimating separate regressions for two-player samples by years of service—less than 10 (top of Table 2) and more than or equal to 10 years (bottom of Table 2). With one exception, in all periods and both service groups (irrespective of the definition of salary used), the trade-off exists, and is statistically significant at better than the 5% level. The exception is 1990-1994 for service levels less than 10 years. The negative coefficient on β_3 is not significant at the 5% level and the coefficients were smaller than in the earlier or later periods. So again, the trade-off is weaker in 1990-1994, compared to the other periods, for free agents having less than 10 years of service. Veteran players with 10 or more years of service show a decline in β_3 from the 1980s ($-.043$), to the 1990s ($-.032$) to the post-2002 period ($-.013$), when salary in the first year of the contract is employed. This trend is diminished when average salary is used. In contrast to the results from Table 5, veteran players are willing to trade-off returns to Winshares performance more than their younger counterparts only in three of the six models, 1984-1989 using first year salary and in 1990-1994 using either definition of salary.

How does LENGTH affect the RTP? Suppose we use the Winshares estimates for β_2 and β_3 shown in Table 1, where RSAL is the first year salary for the contract in question. We can calculate the RTP as follows:

$$\delta \ln \left(\mathrm{RSAL}_{ij}\right)/\delta \mathrm{Winshares} = \beta_2 + \beta_3 \times \mathrm{LENGTH}.$$

For 1984-1989 and Column 1 of Table 1, $\beta_2 = .127$ and $\beta_3 = -.028$, and from Table 3, the average contract length for the sample is 1.73 years. Assuming the sample averages, $\delta \ln (\mathrm{RSAL}_{ij})/\delta \mathrm{Winshares} = .127 - .028 \times 1.73 = .079$. In other words, as the average player's Winshares increases by 1, his salary increases approximately 7.9%. Assuming the sample average salary was \$951,565, this return translates to about \$74,754 for each additional Winshares. Suppose, on the other hand, that the player wants the security of an extra year in his contract, LENGTH in this case would equal 2.73 years and implies that $\delta \ln (\mathrm{RSAL}_{ij})/\delta \mathrm{Winshares} = .127 - .028 \times 2.73 = .051$. The player in this case would see his salary increase by only 5.1% for every extra Winshares he earned, or \$48,111. The difference in these two estimates of the RTP (a 2.8% trade-off) yields \$26,643 as what the player is willing to pay to have the extra year. If the player's salary is \$5,000,000 instead of the mean, the effect of an extra year of security is \$140,000. For 2003-2006 when evaluated at the mean salary of \$1,929,901 and then a salary of \$10,000,000, the values of the extra year of security are respectively \$42,710 and \$190,000. Thus, the absolute value of the trade-off rises with the size of the player's salary. Even to the average free agent that difference is most likely to be a significant number.

Concluding Remarks

We have investigated the relationship between free agent salaries and contract length in MLB to see whether free agents in MLB are willing to trade-off returns to performance (SA or Winshares) for additional job security in the form of longer contracts. We build on the work of KO (2002) who based their study on a sample of free agents who signed contracts in 1990-1994. This was a tumultuous period which ended in a strike that had damaging effects on the industry. Although we include this time period, we also include two other periods that were based on different collective bargaining agreements between the MLB owners and players. Salary regressions were estimated for three time periods (1984-1989, 1990-1994, and 2003-2006). We further extend the KO model by testing whether the trade-off is sensitive to the definition of salary, the definition of performance, or the time period.

The trade-off exists and for the most part does not seem to be very sensitive to the definition of the dependent variable salary (salary in the first year of the contract or average salary over the length of the contract), but evidence of the trade-off is stronger when player performance is proxied by Winshares rather than SA. The trade-off is sensitive to the time period of the estimates, especially when using a player's SA as the performance measure. In this case, the trade-off applies to the late 1980s but not during 1990-1994 or 2003-2006. However, when the sample is broken into free

agents with less than 10 years and 10 or more years of experience, both the beginning and ending periods show a trade-off for players having 10 or more years of Major League service.

Similar regressions were estimated when Winshares was used as the measure of player performance. The coefficients of the LENGTH $\times$ Winshares variable were statistically significant with the expected signs for all groups, salary definitions, and periods except for free agents with less than 10 years of experience for 1990-1994, where the coefficient of the interaction was significant only at the 10% level. In the latest period under analysis, 2003-2006, and using Winshares as the measure of performance, players appear to be willing to accept a reduction in the RTP of about 2% in exchange for an extra year on their contract.

Our results corroborate the claim by KO (2002) that including the LENGTH variable in the salary regression reduces the RTP. The size of the reduction was a function of the time period and the measure we used for performance. When analyzing returns to SA, and if we only look at the years where the coefficient of the LENGTH $\times$ SA interaction was significant, in 1984-1989 the coefficient of SA is between 7% and 10% lower with the introduction of the length of contract variable.[9] The decline was over 30% for 2003-2006. When using Winshares, the decline in the returns falls by around 16–18%. Whether these reductions apply to other measures of performance or during future time periods is of course an empirical issue.

Although we do not obtain compensating differences in wages in the traditional sense that length of contract is negatively related to salaries, we do show that players appear to trade-off returns to their performance in exchange for longer-term contracts. This is done while at the same time we allow, as do KO (2002), for the observed result that the best players do have higher salaries and longer-term contracts. This finding should be of interest to personnel involved with the bargaining process in MLB. In speaking with an insider to the process, he indicated that there is anecdotal evidence of the sort of trade-off discussed in our article. Our results provide solid evidence that this type of behavior exists in MLB.

Declaration of Conflicting Interests

The author(s) declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The author(s) received no financial support for the research and/or authorship of this article.

Notes

1. For the three periods we analyzed, the rules underlying salary negotiations are set forth by Major League Baseball (1985, 1990, and 2003). Zimbalist (1992, 2003) provides a detailed discussion of the collective bargaining as it has evolved in MLB.

2. For two descriptions of models of risk as applied to MLB, see Lehn (1982) and Maxcy (2004).
3. See http://www.roadsidephotos.sabr.org/baseball/data.htm and http://www.forbes.com/2007/04/19/business-baseball-valuations-07mlb-cz_kb_0419baseball_land.html. Revenue for a player signing a contract for 1990 or 2003 would need team revenue data for 1989 and 2002, respectively. Since the data are not available for these 2 years, players signing in these 2 years are assigned a value for REV of zero and an accompanying dummy variable equal to one, REV DUMMY, is included as a right-hand side variable (see Cawley, 2004; Falaris, 2003). In models where REV was deleted from the equation, the results discussed below are unchanged.
4. Experience is in years and days but is converted to decimal format using the fact that 172 days comprise 1 year of MLB service.
5. In the regressions we provide robust estimates which account for the fact that a particular player may have signed multiple contracts in a given period of time. In some of the earlier models, we included population in the metropolitan areas associated with the team signing a particular player in a particular year. The variable was never close to being statistically significant and dropped. These results are available on request from the authors.
6. In the first step, LENGTH is regressed on the same variables as are in the salary equation, with an extra identifying variable added. The residuals are saved and the salary equation is estimated with the residual as a right-hand side variable. If the coefficient of the residual in the salary equation is not statistically significant, ordinary least squares (OLS) should provide satisfactory estimates of Equation 1.
7. Over the population of free agent signing contracts in the periods under study, the 2-year average for the number of disability days rose from just over 9.5 in the 1980s to more than 15 in the latest period ending in 2006. This increasing number of disability days at least partially reflects the attempts by teams to protect the multimillion dollar investments made in players.
8. ''Disability days'' was entered as a right-hand side variable in salary regressions and its coefficient never came close to being significant at conventional levels.
9. The regressions that omit LENGTH are available on request.

References

Cawley, J. (2004). The impact of obesity of wages. *Journal of Human Resources*, *39*, 451-474.

Falaris, E. (2003). The effect of survey attrition in longitudinal surveys: Evidence from Peru, Cote D'Ivoire, and Vietnam. *Journal of Development Economics*, *70*, 133-157.

Hart, O., & Holmsrom, B. (1987). The theory of contracts. In T. F. Bewley (Ed.), *Advances in economic theory fifth world congress* (pp. 71-156). Cambridge: Cambridge University Press.

Hausman, J. (1978). Specification tests in econometrics. *Econometrica*, *46*, 1251-1271.

Kahn, L. (1993). Free agency, long-term contracts and compensation in Major League Baseball: Estimates from panel data. *Review of Economics and Statistics*, *75*, 157-164.

Krautmann, A., & Oppenheimer, M. (2002). Contract length and the return to performance in Major League Baseball. *Journal of Sports Economics*, *3*, 6-17.

Lehn, K. (1982). Property rights, risk sharing and player disability in Major League Baseball. *Journal of Law & Economics*, *25*, 343-366.

Major League Baseball. (1985). *Basic agreement*. New York.

Major League Baseball. (1990). *Basic agreement*. New York.

Major League Baseball. (2003). *Basic agreement*. New York.

Maxcy, J. (1998). *Motivating long-term employment contracts: Risk management in Major League Baseball*. Western Economic Association International Annual Meeting, Lake Tahoe, NV.

Maxcy, J. (2004). Motivating long-term employment contracts: Risk management in Major League Baseball. *Managerial and Decision Economics*, *25*, 109-120.

Quirk J., & Fort, R. (1992). *Pay dirt: The business of professional team sports*. Princeton, NJ: Princeton University Press.

Zimbalist, A. (1992). *Baseball and billions: A probing look inside the big business of our national pastime.* New York, NY: Basic Books.

Zimbalist, A. (2003). *May the best team win: Baseball economics and public policy.* Washington, DC: Brookings Institution Press.

Bios

Charles R. Link is the Bank of America Professor of Business and Professor of Economics. He specializes in labor and health economics.

Martin Yosifov received his PhD degree in Economics in 2006 and now resides in California. He runs his own business.