

A Look at Pay and Performance for the American Association's Cincinnati Club during the 1880s

Michael McAvoy*

ABSTRACT

Using a new salary data series, we correlate characteristics and performance measures with salary differentials. The new salary data are obtained for the American Association's Cincinnati Reds between the years 1882-1884, and 1886-1888. We find evidence that current season real salaries are significantly explained by performance: prior season batting averages for fielders and prior season wins for pitchers. In addition, fielders receive higher pay for experience but reduced pay as they age.

SALARIES OF PROFESSIONAL BASEBALL PLAYERS IN CINCINNATI DURING THE 1880S

Cincinnati, Ohio has had a long presence in professional and major league baseball, organizing the first recognized all-professional nine in 1869, and the city later obtained a franchise in the newly formed National League for the inaugural 1876 season. Expelled after the 1880 season for permitting alcohol in its park as well as renting it for the playing of Sunday baseball, baseball interests in the city sought other means to obtain major league baseball. The Cincinnati Base Ball Club organized and obtained a franchise in the American Association for that major league's inaugural 1882 season (Ellard, 2004).

We build a salary list for the Cincinnati AA club. Many of its business records, including accounting books, correspondence, and player contracts, for portions of the 1880s, are preserved in the archives at the Cincinnati Museum Center. In total, we record a fairly complete list of Reds players' salaries during the years 1882-1884, and 1886-1888. Salaries are unavailable for 1885 and post-1889. Where the contract is present, we record that salary, and rely upon the accounting records if no contract is present. This era covers a nationwide boom in professional baseball following 1884 (Roberts and Cunningham, 2012, pp. 17-18).

The Appendix shows the salary list for salaries recorded by player name, season, and nominal amount. In general, the salary is paid over a period of time as defined in the contract, commonly specified by the National Agreement, and usually began April 1 and ended November 1 (seven months). Players were typically paid every two weeks. Beginning with the 1883 season, the National Agreement specified the minimum salary for players in the major leagues as \$1,000. Prior to 1886, several salaries below \$1000 are apparent. Perhaps the Reds purchased a minor league player's contract while trying out the player at the major league level; however, we do not know why several salaries below \$1000 are observed for the 1883 and 1884 seasons. The nominal amounts shown are based upon the salary rates

*SUNY Oneonta, School of Economics and Business, 223 Netzer Administration, Oneonta, New York 13820, michael.mcavoy@oneonta.edu.

across the seven month season and do not include incentives, bonuses, or deductions from the nominal pay. The standard contract specified the player was to purchase his uniform and equipment and maintain them at his expense, and allowed 50 cents per diem when the club travelled. Bonuses were not specified in the standard contract nor were fines. The standard contract demanded performance from the player, and permitted the club to release the player without further payments at any time during the term of the contract (Gelzheiser, 1997, pp. 47-50).

Table 1: Summary measures of 105 Cincinnati baseball salaries

Year	Sample size	Mean	Median	Maximum	Minimum	Standard Deviation
1882	13	780.77	750	1400	500	250.45
1883	14	1382.14	1400	2500	600	469.70
1884	23	1370.87	1400	2500	525	553.18
1886	17	1606.27	1800	2000	605	452.20
1887	20	1635.00	1725	2000	600	344.16
1888	18	1986.11	2000	3000	900	468.04
All	105	1493.21	1500	3000	500	552.15

Source: Cincinnati Base Ball Club Records, boxes 1, 6, 7

The salary list is summarized by season in Table 1. The list reveals large jumps in salaries between 1882, when NL rosters were largely filled and the AA respected the NL reserve list, and 1883 when the AA determined its business model was successful and adopted its own reserve lists. An increase in the number of players is apparent in 1884, and salary increases are evident in 1886 and 1888.

Table 2: Summary measures of 77 Cincinnati baseball salaries in estimation sample

Season	Sample Size	Mean	Median	Maximum	Minimum	Standard Deviation
1882	10	725.00	725	1200	500	191.85
1883	12	1445.83	1450	2500	850	447.95
1884	13	1682.69	1600	2500	875	414.50
1886	16	1612.92	1800	2000	605	466.17
1887	13	1765.38	1800	2000	1200	230.38
1888	14	1967.86	2000	2500	1500	305.47
All	77	1575.09	1700	2500	500	512.16

Source: Cincinnati Base Ball Club Records, boxes 1, 6, 7

Position and experience, and prior season performance are factors used to explain player salaries. 77 salaries show major league experience during a prior season. Table 2 summarizes these salaries. Similar to the Appendix, salaries increased for 1883, 1884 and 1888, and are stable in 1886 and 1887. Players with major league playing experience show increases for 1884 due to an increase in demand for players when the AA expanded from eight to 12 clubs, and the Union Association (UA) entered major league baseball with eight clubs.

POSITION, EXPERIENCE, AND PERFORMANCE

Different positions in the field require different competencies. Traditionally, the battery – pitcher and catcher – were the most desirable and difficult to fill. The pitcher in this era worked the entire game, took his place in the batting order, and often pitched on no rest. The catcher was often rested and a change catcher employed, because the position was very physical in performance, demanding on the arms, hands and legs, and dangerous, for the body was exposed to wild pitches, fast moving hard hit foul tip balls and runners, in an era of equipment and skill development. Often, pitcher and catcher moved together through baseball, as they knew each other's playing style. As the game developed, the infield positions required agility, intuition, speed, accuracy, and teamwork in play. Finally, the outfield positions were considered least skilled (*Beadle's*, 1860; Rader, 1995, p. xviii). In the 1880s, the club rosters began to increase in size, growing from 11 or 12 players at the beginning of the decade and approaching 15 or more by the end of the decade. Most clubs were staffed with their starting nine, an extra battery, placing catchers at a premium, and one or more other position players. Primary positions are recorded from baseball-reference.com.

Human capital is reflected in age and experience. The adult body continues to develop, peaks in physical condition, then begins to decline. On the other hand, as the player practices and works more championship games, and watches the play of opponents, he gains knowledge of how to more effectively apply his skills to his position. The statistics are obtained from baseball-reference.com. For each player, his age during each season is recorded as is the number of previous seasons' experience.

Table 3: Summary measures, all players and seasons, 1882-1884, 1886-1888

Variable	Mean	Median	Maximum	Minimum	Standard Deviation
Salary rate (nominal)	1575.09	1700.00	2500.00	500.00	512.16
Age	27.1429	27.0000	35.0000	19.0000	3.3901
Career # Seasons	4.2468	4.0000	12.0000	1.0000	2.7823
Pitcher	0.2208	0.0000	1.0000	0.0000	0.4175
Catcher	0.1948	0.0000	1.0000	0.0000	0.3986
Infielder	0.3377	0.0000	1.0000	0.0000	0.4760
Season batting average	0.2345	0.2523	0.3419	0.0667	0.0618
Season runs average	0.5139	0.5161	1.0000	0.0909	0.1583
Season fielding percentage	0.8874	0.8902	1.0000	0.6667	0.0648

For each season, fielding ability is measured as fielding percentage, the ratio of errors to chances, from the prior season. Table 3 shows summary measure for all players in the estimation sample. The hitting skill is measured through batting average, the ratio of hits to at bats. Once on base, the player was expected to score. The running skill is measured in the ratio of runs to (hits + walks).

The pitching skill is measured for pitchers. The vast majority of pitchers in the 1880s were starters who generally completed the games they started throughout the decade. Most clubs carried one starter at the start of the decade, employed two starters a few years later as the number of scheduled championship games increased, and employed more pitchers, both regular and spot starters, towards the later-1880s as the number of championship games increased again as well as recognition of the need to rest starters who were by then throwing overhand from greater distances due to changes in the rules.

Table 4: Summary measures, 60 fielders, 1882-1884, 1886-1888

Variable	Mean	Median	Maximum	Minimum	Standard Deviation
Salary rate (nominal)	1554.03	1725.00	2350.00	500.00	473.27
Age	27.5167	28.0000	35.0000	20.0000	3.2390
Career # Seasons	4.5167	4.0000	12.0000	1.0000	2.9198
Catcher	0.2500	0.0000	1.0000	0.0000	0.4367
Infielder	0.4333	0.0000	1.0000	0.0000	0.4997
Season batting average	0.2419	0.2535	0.3419	0.0667	0.0610
Season runs average	0.5198	0.5200	1.0000	0.1667	0.1514
Season fielding percentage	0.8941	0.8963	1.0000	0.7059	0.0593

Table 5: Summary measures, 17 pitchers, 1882-1884, 1886-1888

Variable	Mean	Median	Maximum	Minimum	Standard Deviation
Salary rate (nominal)	1649.41	1600.00	2500.00	600.00	623.07
Age	25.8235	26.0000	33.0000	19.0000	3.5684
Career seasons	3.2941	3.0000	7.0000	1.0000	1.9633
Season fielding percentage	0.8634	0.8571	0.9833	0.6667	0.0764
Season strikeouts per 9 innings	3.0748	3.0303	5.2388	0.8067	1.3826
Season earned runs per 9 innings	2.9754	3.2444	4.1062	1.5192	0.8152
Season hits per 9 innings	8.8551	8.5204	11.9348	7.1053	1.3633
Season walks per 9 innings	2.4072	2.3108	5.4848	1.2761	1.0296
Season wins	18.5294	14.0000	43.0000	1.0000	13.9879

Tables 4 and 5 show the Cincinnati pitchers were on average almost two years younger and had almost 1.5 fewer seasons than the fielders. That they were more scarce is shown in average earnings almost \$100 more per season. The pitching skill is measured in strikeouts per 9 innings, walks per nine innings, hits per nine innings, and earned runs per nine innings. Pitchers also field, and fielding percentage is measured. Ultimately, effective pitchers are winners, and the ratio of wins per games started is recorded to measure winning competitiveness. While pitchers in the 1880s took their place in the batting order, hitting skill is not measured here. Pitchers were expected to pitch, and a weak hitter was acceptable if the pitching skills were effective. Also, the sample size is small for use in estimation.

VALUATION OF SKILLS

At the margin, in competitive markets, an additional unit of labor effort is compensated up to the value of its marginal revenue product (Fort, 1992, p. 137). In sports, the player is compensated by the expenditures from additional attendance directly due to his efforts. Players contract for their payments with management prior to the season, obtaining a fixed salary rate. A player might consider his opportunity costs, how much money his team mates earn, how much money players on other clubs earn in his position, as well as how much is his value to the club. Management estimates an expected marginal impact on revenues from engaging a player as well as his expected replacement cost.

In the sports compensation literature, where information may not be readily available to determine marginal revenue product, compensation is related to productivity. If attendance increases as a result of winning, and winning depends upon competitive play, attendance is related to performance, or player productivity (Hakes and Sauer, 2006). Baseball is a multi-skill game requiring effectiveness in hitting,

running, fielding, and throwing (Roberts and Cunningham, 2012, pp. 29-33). The more tools a player has, the more valuable he will be to his club.

We follow the approach of Fort, in which the player's salary for time period t depends upon his performance during time period $t-1$. Like Fort, we use the natural logarithms of pay and performance variables to reduce effects from any nonlinearities (1992, pp. 137-138).

Table 6: Real season salary rate on prior-season performance, 1882-1884, 1886-1888

Variable	77 players (A)	60 Fielders (B)	17 Pitchers (C)
Constant	9.6144*** (1.3929)	8.5259*** (1.4161)	11.9361*** (1.4532)
1882	-1.0040*** (0.1208)	-0.8089*** (0.0932)	-1.1770** (0.3284)
1883	-0.3194*** (0.0990)	-0.2743*** (0.0755)	-1.2402*** (0.2521)
1886	-0.1395 (0.0927)	0.0326 (0.0769)	0.1237 (0.2514)
1887	-0.0018 (0.0992)	0.1153 (0.0799)	1.2750** (0.3331)
1888	0.0613 (0.0975)	0.1475* (0.0758)	0.8448** (0.2793)
Age	0.0424 (0.1091)	0.1491 (0.1103)	
Age ²	-0.0014 (0.0021)	-0.0033 (0.0020)	
Number of seasons	0.0976** (0.0415)	0.0440 (0.0326)	
Number of seasons ²	-0.0031 (0.0036)	0.0007 (0.0028)	
Pitcher	-0.0405 (0.0875)		
Catcher	-0.1125 (0.0945)	-0.0173 (0.0700)	
Infielder	0.0262 (0.0746)	0.0064 (0.0539)	
Batting average	-0.3388 (0.0036)	0.9355* (0.5137)	
Runs average	-0.5854*** (0.1929)	-0.3450* (0.1718)	
Fielding percentage	1.1498** (0.4728)	0.2359 (0.4108)	4.7013** (1.2560)
Wins per game started			-1.8526* (0.7993)
Strikeouts per 9 innings			-0.1687* (0.0723)
Walks per 9 innings			0.0276 (0.0888)
Hits per 9 innings			-0.2458** (0.0717)
Earned runs average			-0.7522*** (0.1728)
R ²	0.7617	0.8766	0.9717
Adjusted R ²	0.7031	0.8382	0.9095
F	12.9975***	22.8298***	15.6172***

Standard errors in parentheses; *** significant at 1 percent, ** at 5 percent, and * at 10 percent

For the first set of estimations of salaries on performance, ordinary least squares is used to estimate the value of skills. Real season salary rate is measured as a function of year, age, number of seasons experience, position, batting average, runs average, and fielding percentage, for the seasons of 1882-1884, and 1886-1888. The real salary rate is adjusted by the consumer price index, 2010 the base year, using the deflator given by Williamson (2013), and explained by Officer and Williamson (2012). The real salaries are logged. For the year dummy variables, 1884 is excluded, the year when the UA entered the market for major league baseball. To capture impacts of nonlinearities in experience, such as learning by doing, the square of age and completed seasons are included. For the position dummy variables, the relatively lower skilled outfield position dummy is excluded.

Table 6 explains players' salaries with prior season performance measurements, year, position, and experience. For the entire sample, shown in panel A, the model is significant at 1 percent significance, and the variables taken together explain approximately 76 percent of the variation in salary. The number of seasons is significant at 5 percent, an additional career season increasing salary an estimated 0.098 percent. The runs average is significant at 1 percent. An increase of one percentage point in prior season runs average decreases salary an estimated expected 0.006 percent. Fielding percentage is significant at 5 percent. An increase of one percentage point in prior season fielding percentage increases salary an estimated expected 0.011 percent.

Excluding the 17 pitchers, column B in Table 6 shows the estimated model for non-pitchers is significant at 1 percent. The explanatory variables taken together explain 88 percent of the variation in salary. Prior season batting average and runs average are significant at 10 percent. While the model has high estimated explanatory power, little inference is possible from the estimated coefficients.

For the pitchers, Table 6, column C shows the estimated model significant at 1 percent, and the variables taken together explain 97 percent of the variation in pitchers' salaries. Significant at 5 percent, a one percentage point increase in prior season fielding percentage increases the pitchers salary an estimated 0.047 percent. At 10 percent significance, a one percentage point improvement in prior season wins per game started decreases salary an estimated 0.019 percent. Significance shown at 10 percent, an increase of one prior season strikeout per nine innings decreases salary an estimated 0.169 percent. At 5 percent significance, an increase of one prior season hit per nine innings decreases salary 0.246 percent. Finally, significant at 1 percent, a decrease of one prior season earned run per nine innings increases salary 0.752 percent. As expected, a pitcher who puts fewer runners on base or who allows fewer runs scored enjoys higher estimated compensation.

ENTRY AND COMPETITION FOR LABOR

As production increases and firms require additional resources, the resources for which competition is relatively greatest will tend to increase in price. In baseball, clubs used fixed capital inputs, a park and a club house, and labor inputs: a manager and players. Players provided the service that generated the revenues and were able to change their employers. The clubs held a franchise with territorial rights and

located their consumable in parks that seated thousands of customers. Clubs could not relocate their capital nor easily alter their territory (Hauptert, 2007). Any entrant into major league baseball would require at least nine players. All else equal, entry increases demand for labor and raises salaries while exit will have the opposite effect. Prior to 1882, the NL began seasons with between six and eight franchises. In 1882, the AA entered major league baseball with six clubs, expanded to eight clubs in 1883, increased to 12 clubs in 1884 when the UA entered with eight clubs, then thereafter reduced the number of franchises to eight for 1885. Major league clubs increased from 16 in 1883 to 28 in 1884, then were reduced to 16 in 1885 for the remainder of the 1880s.

Kahn observes nominal increases in average nominal Major League salaries during the 1880s, when players were presented with opportunities to change teams across two leagues (2000, pp. 76-77). Table 6 shows that player salaries were significantly lower in 1882 and 1883 relative to 1884 when the UA entered. For all players, a player's salary was an estimated approximately 1 percent lower in 1882 compared to 1884, and approximately 0.3 percent lower in 1883 compared to 1884. When controlling for prior season performance, the Cincinnati club increased salaries in 1887 over 1884 by an estimated 1.28 percent, and by 0.84 percent in 1888.

For fielders, table 6 shows that except for 1888, salaries were unchanged relative to 1884. Even though there were 12 fewer major league clubs after 1884, player salaries in the Cincinnati club did not decline. Players might have refused to accept cuts in compensation. Alternatively, player productivity improvements might have increased sufficiently to overcome any reduction in the size of the market for player services. The 1880s witnessed introduction of and improvements to equipment and numerous rule changes, which affected player performance. Or customer interest may have improved, with its corresponding increases in club revenues, and enabled management to increase player compensation.

CONCLUDING REMARKS

We build a salary list and determine that players' skills affect player salaries. In addition, UA entry into major league baseball in 1884 permanently increased salaries which did not decrease in years following the entrants exit following its single season.

Pay and performance studies estimate the marginal revenue product and the degree of exploitation (Scully, 1989). Although the reserve clause was included in the 1887 standard contract printed, the reserve lists for the AA were recognized within organized baseball beginning with the 1883 season. Using a smaller data set of 29 1880s stars, Ashcraft and Depken (2007) estimate the reserve clause significantly reduced salaries of stars by an expected \$3,000 to \$5,000, in year 2004 dollars. With additional information, a similar approach may identify whether the reserve lists impacted player salaries.

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APPENDIX

Nominal Salary Rates

Season	Player	Salary (\$)	Season	Player	Salary (\$)
1886	Baldwin	1500	1887	Nicol	1700
1887	Baldwin	1650	1888	Nicol	2000
1888	Baldwin	2000	1888	O'Connor	1650
1882	Carpenter	700	1882	Powers	750
1883	Carpenter	1100	1883	Powers	1500
1884	Carpenter	1600	1884	Powers	2000
1886	Carpenter	1800	1883	Reilly	1800
1887	Carpenter	1800	1884	Reilly	1800
1888	Carpenter	1800	1886	Reilly	1800
1884	Corkhill	1500	1887	Reilly	2000
1886	Corkhill	1800	1888	Reilly	2350
1887	Corkhill	2000	1882	Snyder	1200
1888	Corkhill	2200	1883	Snyder	1700
1886	Fennelly	1800	1884	Snyder	2000
1887	Fennelly	1800	1886	Snyder	2000
1888	Fennelly	2000	1882	Sommers	600
1882	Fulmer	800	1883	Sommers	1200
1883	Fulmer	1600	1882	Stearns	500
1884	Fulmer	2000	1888	Tebeau	2000
1883	Jones	1400	1883	Traffley	1100
1884	Jones	1450	1882	Wheeler	750
1886	Jones	1800	1884	Deagles	1300
1887	Jones	1800	1882	McCormick	600
1888	Kappel	1750	1883	McCormick	2500
1886	Keenan	2000	1887	McGinnis	1800
1887	Keenan	1700	1886	McKeon	2000
1888	Keenan	2000	1886	Mullane	2000
1886	Lewis	1800	1887	Mullane	2000
1882	Luff	750	1888	Mullane	2500
1882	Maculler	600	1886	Pechinery	1500
1883	Maculler	850	1886	Powell	605
1884	Mansell	1950	1886	Richmond	635
1886	Maskrey	966.67	1887	Serad	1500
1883	McPhee	1000	1888	Serad	1500
1884	McPhee	1400	1887	Smith	1200
1886	McPhee	1800	1888	Smith	2300
1887	McPhee	2000	1883	White	1600
1888	McPhee	1500	1884	White	2500
1884	Miller	875			

Source: Cincinnati Base Ball Club Records, boxes 1, 6,