Marquette University
e-Publications@Marquette

Economics Faculty Research and Publications   Economics, Department of

12-1-2017

Revenue Sharing and Player Salaries in Major League Baseball

James Richard Hill
Central Michigan University

Nicholas A. Jolly
Marquette University, nicholas.jolly@marquette.edu

Economics Faculty Research and Publications/College of Business Administration

Contents

Revenue Sharing and Player Salaries in Major League Baseball

James Richard Hill

Department of Economics, Central Michigan University, Mount Pleasant, MI

Nicholas A. Jolly

Department of Economics, Marquette University, Milwaukee, WI

Abstract

This article analyzes how changes made to the revenue sharing agreement in the 2007 Major League Baseball collective bargaining agreement influenced the salaries of position players and pitchers. The tax rates associated with revenue sharing decreased following ratification of the 2007 agreement. Theoretically, these changes should increase players' marginal revenue product and, therefore, salaries. Results indicate that position players experienced an increase in salary following the 2007 agreement. Pitchers' salaries also increased, but by a smaller amount. The effect of the 2007 agreement was different throughout the salary distribution for position players, but uniform throughout the distribution for pitchers.

Keywords

MLB, revenue sharing, collective bargaining, quantile regressions

Introduction

The arena of professional sports is considered the ultimate meritocracy through which productivity is the sole determinant of salaries. Throughout history, various institutional forces arose that mitigated true productivity-based determination of pay. The unionization among professional athletes, along with the increased bargaining power of the athletes' unions, is one example. The four major professional team-based sports in the United States, basketball, football, hockey, and baseball, all have unions representing the athletes. Today, representatives of the owners and players' unions must negotiate any changes made to the industrial relations system that might affect the determination of player pay. Negotiations for free agency, salary arbitration, and the lack of a salary cap have allowed the free market to determine Major League Baseball (MLB) player salaries more than in the other three team-based sports.

Revenue and payroll imbalances between MLB teams have increased since the early 1990s (Levin, Mitchell, Volcker, & Will, 2000). The growing revenue and payroll inequities have come at a cost of less competitive balance between teams. In 1999, Commissioner Allan "Bud" Selig convened the Blue Ribbon Panel to study these inequities' effects on competitive outcomes in MLB.[1] The Panel divided teams into payroll quartiles, with Quartile 1 containing teams with the highest payrolls and Quartile 4 containing teams with the lowest payrolls. The 1995-1999 seasons contained 158 post-season games played. No

teams from Quartile 3 or 4 won a post-season game during this period. No teams from the bottom two quartiles advanced to the World Series. Furthermore, each World Series champion during those five seasons was from Quartile 1. The Panel's report also showed that teams' payrolls are linked directly to revenues, that is, those teams with the highest revenues tend to be the teams with the highest payrolls. Therefore, the Blue Ribbon Panel concluded that the growing revenue disparities lead to growing payroll disparities, which hurt competitive balance in the league during the mid- to late 1990s. In wake of the Panel's report, negotiations between the owners and the MLB Players Association (MLBPA) resulted in changes to the revenue sharing agreement starting with the 2003 season.

The revenue sharing plan negotiated in the 2003-2006 collective bargaining agreement (CBA) increased the marginal tax rates associated with teams' revenues from the 1997 CBA levels. Owners and players agreed to these changes in the hopes of increasing competitive balance on the field. These changes did not have the intended effects. The redistribution mechanisms associated with the revenue sharing plan resulted in marginal tax rates equaling 40% for high-revenue teams and 47% for low-revenue teams (Zimbalist, 2003). Anecdotal evidence suggests some teams lowered their payrolls to hold down costs. Doing so resulted in lower attendance and revenues, which increased the funds received through revenue sharing. Maxcy (2009) suggests that teams not only divested their player talent but also did not compete rigorously in the talent market. This incentive to divest in talent exacerbated the competitive inequities.

To rectify this situation, owners and players agreed to changes to the revenue sharing agreement in the CBA covering the 2007-2011 seasons. These changes reduced the marginal tax rate to 31% for all teams (Major League Baseball [MLB], 2006). Since representatives of the owners and players' union agreed to these changes to alter team incentives to invest in player talent and increase competitive balance, it is reasonable to expect that these changes to the CBA affected players' salaries. The differing treatments found in these MLB CBAs offer an interesting test of labor market theory. The changes in the revenue sharing plan amounted to a change in tax rates on marginal revenue and, therefore, the marginal revenue product (MRP) of players. The availability of performance and salary data for MLB players allow for a comparison between periods to see if clubs altered their valuation of players in any systematic manner in the labor market.

To date, no study has analyzed the effect of these CBA changes on player salaries. The purpose of this article is to examine how changes made to the CBA covering the 2007-2011 seasons altered MLB player salaries. Using data from the 2003-2011 seasons, this article uses regression analysis to determine whether there were changes to the determination of player pay between the pre- and post-2006 period. In MLB, there are clear distinctions between pitchers and position players, and previous research has shown that uniform regulations within bargaining agreements can have different effects on each group.[2] The analysis estimates salary regressions separately for each group to see if modifications to the 2007 CBA differentially affected salaries.

The article proceeds by discussing the institutional background, relevant theory, and earlier literature. The third section details the data and empirical methodology, the fourth section presents the results, and the fifth section offers conclusions.

Institutional Considerations, Theory, and Literature

Some form of revenue sharing has always existed in MLB, and negotiations between owners and MLBPA representatives formally introduced it into the CBA covering the 1997-2002 seasons. Under this formal revenue sharing agreement, the marginal tax rates for high- and low-revenue teams equaled 20% and 41%, respectively (Maxcy, 2009). The Blue Ribbon Panel recommended that teams share at least 40%, and as much as 50%, of all local revenues less stadium expenses. The provisions in the 2003 CBA called for a two-part plan. In the base plan, teams contribute 34% of their net local revenue. The receipts from this tax are distributed equally to all teams. Under this redistribution plan, some teams are net recipients of funds and some are net payers. Part 2 of the plan was to distribute revenues from a central fund. Teams that were net payers in the base plan contributed money to the central fund through a tax. However, those teams were ineligible to receive money from the central fund. Only teams that were net recipients from the base plan were eligible to receive revenues. The proportion received was based upon how far below median league net local revenue the team was. Receipts from the central fund increased as teams moved further below the median.[3]

The revenue sharing plan resulted in marginal tax rates that equaled approximately 40% for high-revenue clubs and 47% for low-revenue clubs (Maxcy, 2009; Zimbalist, 2003). Additionally, while teams were supposed to use these revenues to enhance payrolls, there was no explicit requirement to do so. Critics of the plan note that the tax structure, combined with no requirements to enhance payrolls, created an incentive for lower revenue teams not to improve their franchise through player acquisitions and instead to use the revenues to increase profitability.[4] Maxcy (2009) finds that the changes in the 2003 CBA led to greater payroll disparity and worse competitive balance. Maxcy (2009) further suggests that some lower revenue teams divested the talent level of their rosters.

The 2007 CBA modified the two-part revenue sharing plan. The percentage of net local revenue each team was required to contribute under the base plan was lowered from 34% to 31%. The formula for allocation to teams from the central fund was changed and based on a performance factor. The performance factor was determined from net local revenues from 2005 and 2006 and projected revenues from 2007 and 2008. More importantly, the performance factors were fixed and reported in the CBA for each team. Any team with a positive performance factor contributed to the central fund, and any team with a negative performance factor received funds. Under this approach, a team could be a net receiver of funds under the base plan but contribute revenues to the central fund.[5] The goal of this change to redistribution from the central fund was to correct the disincentives mentioned previously. Under the 2007 CBA, a team's proportion of sharing through the central fund was fixed and did not change as revenues fluctuated. This also altered the tax structure of the revenue sharing system. Now, all teams faced the same marginal tax rate of 31% (MLB, 2006; Zimbalist, 2006).

The amount of money transferred between teams through the revenue sharing system grew considerably over time. Brown (2010) notes that US$433 million was transferred between clubs in 2009. Brown (2009) published a complete list of figures for the 2003 season showing a transfer of US$220,350,000 between paying and receiving teams. In 2009 dollars, this equals approximately US$256.9 million, which represents a 68.5% increase in revenue sharing transfers between periods. In nominal terms, total team revenue in MLB equaled US$3,878 million in 2003 and US$5,898 million in 2009. After adjusting the 2003 revenue figures to 2009 dollars, this represents a growth of 30.4%. Therefore, the growth in transfers was more than double that of total league revenues. Furthermore,

revenue sharing funds represented approximately 5.7% of overall league revenue in 2003 and 7.3% in 2009 under the new plan.

Fort and Quirk (1995) and Rascher (1997) develop a model of sports leagues to examine the effects of cross-subsidization measures (salary cap, revenue sharing, and draft) on league profits and competitive balance. Fort and Quirk (1995) conclude that enhanced revenue sharing lowers pay by reducing the marginal return to teams' winning percentages. The reduction in the marginal return to a team's winning percentage decreases the incentive for a team to pay the same salary as before. With a reduction in the return to winning, salaries throughout the league should be lower.

Utilizing a variation of Fort and Quirk's (1995) model, Marburger (1997) finds that increased revenue sharing can improve competitive balance but agrees that enhanced revenue sharing reduces player salaries. In Marburger's (1997) model, enhanced revenue sharing reduces player salaries through a reduction in the MRP associated with a given stock of talent. Unlike Fort and Quirk (1995), Marburger (1997) shows that it is possible for revenue sharing to increase the MRP for smaller market teams and decrease it for large market teams. However, the large market team's reduction will outweigh the increase experienced by the smaller market clubs, thereby reducing salaries league-wide. Cavagnac (2009) removes the assumption that teams are price takers in the market for players and agrees with Marburger (1997) that competitive balance can be improved by increased revenue sharing; Cavagnac's (2009) model finds a decrease in the value of talent at the margin and lower salaries.

Fort and Quirk (1995), Marburger (1997), and Cavagnac (2009) assume that the team's objective is to maximize profits. Profit maximization leads to teams paying their players a salary equal to their MRP. Vrooman (2009) alters the basic model and assumes that owners maximize wins. The author assumes that season length and zero profits constrain team owners, which leads to teams paying their players a salary equal to their average revenue product. Using this win-maximizing model, Vrooman (2009) concludes that increased revenue sharing can improve competitive balance and increase payrolls. The author provides some transient evidence suggesting that all four team-based sports leagues in the United States are moving toward the win-maximizing assumption.

Rascher (1997) and Dietl, Grossman, and Lang (2011) develop a utility maximization model for owners in which profits and winning enter directly into the objective function. Rascher (1997) shows that under the assumption of pure profit maximization, increased revenue sharing leads to lower wages for the same reason as Fort and Quirk (1995). When profits and winning enter the objective function, revenue sharing's effect on wages is ambiguous. Teams with relatively low talent levels may bring the wage down, while highly talented teams could push the wage higher. On net, however, the author notes that revenue sharing's effect on wages is most likely negative. Dietl et al. (2011) note that if the effect of competitive balance on teams' revenue is sufficiently large, then revenue sharing causes a positive impact on player MRP. This increases the investment in player talent and, therefore, salaries. The authors label this the "sharpening effect." The authors do examine the opposite case, the "dulling effect," whereby the contribution of competitive balance to a team's revenue is sufficiently small to lead to revenue sharing reducing a player's MRP and, therefore, salary.

Maxcy (2009) is the only article empirically examining MLB's revenue sharing agreement on competitive balance. The author finds that the changes in the 2003 CBA led to greater payroll disparity and worse competitive balance. Maxcy (2009) further suggests that some lower revenue teams divested the talent level of their rosters. Additionally, Zimbalist (2010) presents some descriptive evidence suggesting that

the increased marginal tax rates associated with the 2003 CBA may be responsible for the lower share of total player compensation as a percentage of league revenues. This empirical evidence supports the theoretical conclusions developed by Fort and Quirk (1995), Rascher (1997), Marburger (1997), and Cavagnac (2009) and the dulling effect discussed in Dietl et al. (2011). Combined, these empirical and theoretical findings suggest that the reduced marginal tax rates and the equalization of marginal tax rates across teams in the revenue sharing agreement in the 2007 CBA should increase player salaries by increasing net MRP. The simplified theoretical model assuming profit maximization of team owners discussed by Maxcy (2009) highlights this. Define MRP_i to equal player i's MRP and define τ_k to equal the marginal tax rate associated with team k as defined in the CBA. In equilibrium, player i's salary, w, should equal the after-tax MRP:

$$w_{ik} = MRP_i(1 - t_k). \text{ (1)}$$

A reduction in the marginal tax rate should increase net MRP and, therefore, salary. Furthermore, since all teams experienced a reduction in the marginal tax rate after 2006, salaries should, on average, increase league-wide.

Maxcy's (2009) model has additional implications. Define τ to equal the marginal tax rate in 2007. Based on Equation 1, player i's salary in 2007 would equal $w_{ik} = MRP_i(1 - t)$. If Equation 1 represents a player's salary for a given period before 2007, then the percentage change in salary experienced by the player would equal:

$$\%\Delta W = \frac{(t_k - t)}{(1 - t_k)}. \text{ (2)}$$

Using the marginal tax rates referenced in Zimbalist (2003) and Maxcy (2009), Equation 2 suggests that a player's salary should increase between 15% and 30%. Furthermore, players on teams subject to higher initial marginal tax rates should experience larger wage growth when compared to those players on teams subject to smaller initial marginal tax rates. In other words, salary growth may be larger for those who play for lower revenue/smaller market teams.[6]

Data and Methodology

The analysis sample includes players on the opening day rosters reported by *USA Today* from the period 2003-2011. Teams have a flexible roster size, which ranges from 25 to 40 players. The 25-player roster represents the team limit from opening day through the end of August. During this time, however, the team can have 40 players signed to major league contracts. Teams assign those not on the 25-player rosters to minor league affiliates of the major league franchises. Beginning in September, rosters expand from 25 to 40 to allow younger players the opportunity to gain major league experience. This study uses data on salaries and statistics of players on the opening day roster to maintain consistency with previous research on factors affecting overall pay inequities in MLB (Jewell, McPherson, & Molina, 2004). Data on salaries come from the USA Today salaries databases (all dollar amounts have been converted to real figures by dividing by the appropriate year's consumer price index for all urban consumers with 1982/1984 = 100); player and team statistics come from Doug's National Basketball Association (NBA) and MLB statistics; and data on team revenue come from Rodney Fort's database.[7]

The overall goal of revenue sharing is to increase the competitive balance between teams. The purpose of this article is to analyze how this change to the 2007 CBA affected the salaries of players. To this end,

the analysis estimates salary regressions by ordinary least squares (OLS). The general form of the estimated equation is:[8]

$$\ln y_{it} = x'_{it}\beta_1 + z'_{it}\beta_2 + \beta_3 \text{post} - 2006 + \beta_4 T + c_j + u_{it}. \quad (3)$$

In Equation 3, y_{it} is the real salary of player i in period t, x_{it} is a vector of time-varying player statistics, z_{it} is a vector of time-varying team variables, T is a time trend, and c_j is a set of club fixed effects.[9] The main variable of interest, post-2006, is a dummy variable equaling 1 for years 2007 onward and 0 otherwise. Finally, u_{it} is an error term.

Sports researchers understand that there is a large degree of heterogeneity between position players and pitchers, particularly since position players potentially play in more games. Therefore, the 2007 CBA may have disproportionate effects on these two groups. Equation 3 is estimated separately for position players and pitchers. When the sample includes position players, the variables contained in x_{it} include experience and experience squared, on-base percentage, slugging percentage, games played, and dummy variables for the player's main position. When the sample contains pitchers, on-base percentage, slugging percentage, games played, and position dummies are replaced by earned run average and strikeout-to-walk ratio. Those variables contained in z_{it} include the team's winning percentage, real revenue (measured in millions of dollars), and a dummy variable equaling 1 if the team is in the National League.

Results

Table 1 presents averages of the main variables used in the analysis. The first column shows the variables, Column 2 shows the statistics calculated prior to 2007, and the final column contains the measures calculated after 2006. There are not many differences in the performance measures of either position players or pitchers between the two periods. Players tend to have slightly less experience after 2006. Additionally, position players have a somewhat lower on-base percentage and slugging percentage, and pitchers have a lower earned run average and a higher strikeout-to-walk ratio. Large differences between periods do exist when examining average salaries and team revenue. The average position player's salary increases approximately 7.8% between the two periods, whereas average pitcher salary increases 11.5% after 2006. Furthermore, average team revenue is 17.9% higher in the latter period. The increase in player salaries between periods is not as large as the increase in team revenues. Zimbalist (2010) notes how high competitive balance tax rates, in addition to clubs having to pay significant minor league player costs, lead to revenues increasing at faster rates when compared to player pay in MLB.

Table 1. Means of Selected Variables.

	2003-2006	2007-2011
Position players		
Real salary	US$1,538,169	US$1,658,380
Experience	6.485	6.148
On-base percentage	0.325	0.321
Slugging percentage	0.406	0.395
Games played	105.198	104.332
Pitchers		
Real salary	US$1,200,885	US$1,338,940
Experience	5.669	5.293
Earned run average	4.935	4.670
Strikeout-to-walk ratio	2.119	2.227
Team variables		
National league	53.333%	53.333%
Winning percentage	0.500	0.500
Real revenue (US$1,000,000)	77.72	91.60

Note. Entries come from authors' calculations from the data.

Tables 2 and 3 present results from Equation 3 for position players and pitchers, respectively. The first column displays the independent variables used. Columns 2–7 present the regression results based upon estimating Equation 3 using different subsamples of the data. The subsamples differ by the player observations used (indicated by the row labeled "Sample"). Focusing on Model 1 in Table 2, the parameter estimate associated with the post-2006 dummy variable indicates that the 2007 CBA tended to increase significantly position player salaries by 19.7%, on average.[10]

Table 2. OLS Salary Regressions—Position Players.

	1	2	3	4	5	6
Experience	0.414 (0.018)***	0.159 (0.044)***	−0.320 (0.037)***	0.041 (0.03)	−0.171 (0.11)	0.328 (0.025)***
Experience^2	−0.016 (0.001)***	−0.006 (0.002)***	0.112 (0.006)***	0.009 (0.003)***	0.021 (0.010)**	−0.012 (0.002)***
On-base percentage	1.066 (0.515)**	1.810 (0.850)**	0.356 (0.42)	−0.097 (0.42)	−0.614 (1.83)	0.388 (0.66)
Slugging average	1.242 (0.334)***	2.151 (0.537)***	0.580 (0.280)**	0.070 (0.28)	0.402 (0.76)	0.974 (0.455)**
Games played	0.006 (0.001)***	0.008 (0.001)***	0.004 (0.000)***	0.002 (0.001)***	0.002 (0.002)	0.004 (0.001)***
National League = 1	−0.164 (0.16)	−0.749 (0.232)***	−0.173 (0.092)*	0.248 (0.24)	0.847 (0.75)	−0.408 (0.26)
Team winning percentage	−0.409 (0.28)	−0.854 (0.411)**	−0.142 (0.30)	−0.540 (0.46)	0.536 (1.19)	0.041 (0.55)
Team revenue (US$1,000,000)	0.003 (0.00)	0.004 (0.00)	0.001 (0.00)	−0.003 (0.00)	−0.006 (0.01)	0.007 (0.004)*
Post-2006 = 1	0.180 (0.050)***	0.208 (0.073)***	0.155 (0.065)**	0.249 (0.108)**	0.613 (0.327)*	0.050 (0.13)
Trend	−0.006 (0.01)	−0.010 (0.02)	0.002 (0.02)	0.012 (0.02)	0.091 (0.06)	0.003 (0.03)
R^2	.57	.39	.46	.36	.46	.56
n	3,746	1,866	1,880	463	163	733
Sample	Entire	Experience ≥ 6	Experience < 6	First and last observation	First observation < 2007; last observation ≥ 2007	One observation per player

Note. Dependent variable is the log of real salary. Additional independent variables include team and position fixed effects. For Models 1–3, robust standard errors clustered at the individual level are shown in parentheses. For Models 4–6, robust errors cannot be calculated because of a lack of degrees of freedom. Entries come from authors' calculations from the data.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table 3. OLS Salary Regressions—Pitchers.

	1	2	3	4	5	6
Experience	0.398 (0.018)***	0.080 (0.05)	−0.261 (0.038)***	−0.086 (0.030)***	−0.019 (0.08)	0.289 (0.021)***
Experience^2	−0.014 (0.001)***	−0.002 (0.00)	0.103 (0.007)***	0.034 (0.004)***	0.022 (0.008)***	−0.008 (0.001)***
Earned run average	−0.011 (0.006)**	−0.016 (0.01)	−0.012 (0.005)**	0.002 (0.01)	0.001 (0.01)	−0.014 (0.01)
Strikeout-to-walk Ratio	0.130 (0.020)***	0.192 (0.026)***	0.095 (0.024)***	0.013 (0.03)	−0.053 (0.06)	0.121 (0.029)***
National League = 1	−0.454 (0.155)***	−1.208 (0.278)***	−0.108 (0.14)	−0.076 (0.23)	−0.907 (0.540)*	−0.146 (0.24)
Team winning percentage	0.220 (0.26)	0.045 (0.46)	0.396 (0.30)	−0.219 (0.36)	−0.362 (0.79)	0.517 (0.49)
Team revenue (US$1,000,000)	0.000 (0.00)	−0.001 (0.00)	0.002 (0.00)	0.000 (0.00)	0.002 (0.01)	−0.002 (0.00)
Post-2006 = 1	0.083 (0.049)*	0.240 (0.084)***	−0.017 (0.06)	0.118 (0.09)	0.176 (0.21)	0.003 (0.11)
Trend	0.015 (0.01)	0.018 (0.02)	0.011 (0.01)	0.039 (0.018)**	0.074 (0.042)*	0.023 (0.02)
R^2	.53	.21	.39	.43	.63	.54
n	3,430	1,384	2,046	614	196	781
Sample	Entire	Experience ≥ 6	Experience < 6	First and last observation	First observation < 2007; last observation ≥ 2007	One observation per player

Note. Dependent variable is the log of real salary. Additional independent variables include team fixed effects. For Models 1–3, robust standard errors clustered at the individual level are shown in parentheses. For Models 4–6, robust errors cannot be calculated because of a lack of degrees of freedom. Entries come from authors' calculations from the data.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

Models 2 and 3 restrict the observations used based upon years of experience. In MLB, players with fewer than 3 years of service time are ineligible for either free agency or final offer salary arbitration. Those with between 3 and 5 years of service qualify for salary arbitration; however, not all players file for arbitration. Players with 6 or more years of service qualify for free agency. The market determines salaries received by free agent players. Therefore, it is reasonable to expect that the 2007 CBA had differing effects on players with different years of experience. Model 2 presents results after limiting player observations to those with at least 6 years of experience, and Model 3 restricts observations to those players with no more than 5 years of service. The 2007 CBA had a relatively larger effect on players who qualify for free agency. The 2007 CBA increased salaries for free agent eligible players by 23% versus 17% for nonfree agent eligibles. While these estimates are not statistically different, they represent economically large differences in salary. From 2003 to 2006, the average salary of players with at least 6 years of experience is US$2.4 million; the average for those with less than 6 years of experience is approximately US$530,000. Using these as a baseline, the parameter estimate in Model 2 suggests an increase in salary for free agent eligible players equaling US$554,911, and the increase for nonfree agent eligible players suggested by Model 3 is US$88,858.

Models 1–3 include all player-year observations in the estimation. For those players who sign multiyear contracts, including all observations, may introduce a nonindependence problem in the estimation.[11] To try to account for this, Models 4–6 limit the number of observations included for each player. Models 4 and 5 only include a maximum of two observations per player, the first and the last. Model 5 differs from Model 4 in that Model 5 requires that the player's first observation occurs before 2007, and the last observation occurs in 2007 or later. Finally, Model 6 only includes one randomly chosen observation per player. In each case, the parameter estimate associated with the post-2006 dummy variable is positive, indicating a positive impact from the 2007 CBA on salary. The estimate is statistically significant in Models 4 and 5.

Results in Table 3 for pitchers are slightly different when compared to those for position players.[12] Model 1 indicates that the 2007 CBA increased salaries for pitchers by 8.7%.[13] While this is smaller in magnitude than the result for position players, the estimates are not statistically different. However, the estimate for pitchers is only statistically significant at the 10% level. Furthermore, the results represent economically large effects. Using the average salaries for position players and pitchers in the 2003-2006

period in Table 1 and the coefficients associated with the post-2006 dummy variable from Model 1 in Tables 2 and 3, the implied increase in salary for position players equals US$303,353. The implied increase for pitchers is US$103,926. In fact, the only result that shows a strongly significant effect of the 2007 CBA on pitcher salaries is that in Model 2 for free agent eligible players. In whole, the results in Table 3 provide only some evidence of the 2007 CBA positively affecting pitcher salaries.[14]

Many variables included in Equation 3 exhibit a high degree of collinearity. For example, the correlation coefficient between on-base percentage and slugging percentage equals .77. It is possible that multicollinearity among the independent variables drives the main results presented in Tables 2 and 3. To investigate this, versions of Equation 3 were reestimated using the full set of player observations by sequentially adding and subtracting variables. The magnitude of the coefficient associated with the post-2006 variable remained relatively stable throughout these additional regressions (available upon request), which suggests that collinearity among the independent variables does not drive the main findings in Tables 2 and 3.

Using OLS to estimate Equation 3 yields evidence as to how changes made to the 2007 CBA affected the conditional mean of the salary distribution. Specifically, the purpose of the modified revenue sharing agreement is to allow teams with relatively lower payrolls and revenues to use the additional funds to attract, retain, and develop higher quality players to improve competitive balance. Therefore, the 2007 CBA may have differing effects on players throughout the salary distribution. To this end, the general form of Equation 3 was reestimated using quantile regression techniques and the full set of player observations. One advantage that quantile regression has over OLS is that outlying observations have a smaller influence on estimates of the conditional quantile when compared to the conditional mean, which should aid in reducing heteroscedasticity in the distribution. An additional advantage of using quantile regression techniques over OLS is that estimating conditional quantiles provides a more complete picture of how players throughout the distribution can be affected differentially. The results of this estimation are provided in Tables 4 and 5 for position players and pitchers, respectively.

Table 4. Quantile Salary Regressions—Position Players.

Percentile	10	20	30	40	50	60	70	80	90
Experience	0.150 (0.013)***	0.228 (0.015)***	0.348 (0.019)***	0.418 (0.018)***	0.467 (0.018)***	0.485 (0.016)***	0.490 (0.016)***	0.479 (0.016)***	0.453 (0.022)***
Experience^2	−0.004 (0.001)***	−0.007 (0.001)***	−0.013 (0.001)***	−0.016 (0.001)***	−0.018 (0.001)***	−0.019 (0.001)***	−0.019 (0.001)***	−0.018 (0.001)***	−0.017 (0.001)***
On-base percentage	0.131 (0.231)	0.239 (0.381)	0.554 (0.538)	0.997 (0.554)*	0.771 (0.647)	0.492 (0.590)	0.980 (0.504)*	1.156 (0.527)**	1.132 (0.550)**
Slugging average	0.214 (0.139)	0.389 (0.218)*	0.695 (0.354)*	1.150 (0.375)***	1.541 (0.389)***	1.783 (0.331)***	1.752 (0.324)***	1.768 (0.347)***	2.045 (0.382)***
Games played	0.002 (0.000)***	0.003 (0.000)***	0.005 (0.001)***	0.005 (0.001)***	0.005 (0.001)***	0.005 (0.001)***	0.004 (0.001)***	0.004 (0.001)***	0.003 (0.001)***
National League = 1	−0.214 (0.068)***	−0.344 (0.111)***	−0.500 (0.143)***	−0.367 (0.174)**	−0.463 (0.169)***	−0.373 (0.155)**	−0.312 (0.143)**	−0.278 (0.130)**	−0.126 (0.182)
Team winning percentage	−0.149 (0.124)	−0.187 (0.181)	−0.133 (0.342)	−0.527 (0.438)	−0.120 (0.420)	−0.404 (0.354)	−0.257 (0.319)	−0.393 (0.333)	−0.695 (0.371)*
Team revenue (US$1,000,000)	0.001 (0.001)	0.002 (0.001)	0.002 (0.002)	0.005 (0.003)*	0.001 (0.003)	0.000 (0.003)	−0.002 (0.002)	−0.002 (0.002)	0.000 (0.002)
Post-2006 = 1	0.077 (0.034)**	0.129 (0.048)***	0.205 (0.083)**	0.262 (0.093)***	0.259 (0.101)**	0.247 (0.088)***	0.177 (0.066)***	0.183 (0.075)**	0.107 (0.074)
Trend	0.005 (0.007)	−0.002 (0.009)	−0.007 (0.017)	−0.022 (0.020)	−0.011 (0.021)	−0.015 (0.019)	0.005 (0.015)	0.001 (0.017)	0.006 (0.016)
n	3,746	3,746	3,746	3,746	3,746	3,746	3,746	3,746	3,746

Note. Dependent variable is the log of real salary. Additional independent variables include team and position fixed effects. Bootstrapped standard errors are shown in parentheses. Bootstraps are calculated from 100 repetitions. Entries come from authors' calculations from the data.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table 5. Quantile Salary Regressions—Pitchers.

Percentile	10	20	30	40	50	60	70	80	90
Experience	0.070 (0.020)***	0.130 (0.022)***	0.237 (0.019)***	0.333 (0.017)***	0.386 (0.015)***	0.432 (0.016)***	0.490 (0.015)***	0.522 (0.016)***	0.516 (0.019)***
Experience^2	0.000 (0.002)	0.000 (0.001)	−0.005 (0.001)***	−0.010 (0.001)***	−0.012 (0.001)***	−0.014 (0.001)***	−0.018 (0.001)***	−0.020 (0.001)***	−0.020 (0.001)***
Earned run average	−0.003 (0.002)*	−0.005 (0.003)*	−0.008 (0.004)**	−0.007 (0.005)	−0.005 (0.005)	−0.006 (0.005)	−0.009 (0.006)	−0.016 (0.008)*	−0.007 (0.013)
Strikeout-to-walk ratio	0.015 (0.006)**	0.036 (0.014)***	0.068 (0.022)***	0.111 (0.022)***	0.131 (0.023)***	0.155 (0.026)***	0.137 (0.024)***	0.144 (0.021)***	0.132 (0.026)***
National League = 1	−0.007 (0.041)	−0.108 (0.070)	−0.191 (0.101)*	−0.304 (0.136)**	−0.590 (0.187)***	−0.722 (0.226)***	−0.580 (0.239)**	−0.338 (0.259)	−0.248 (0.139)*
Team winning percentage	0.030 (0.070)	0.067 (0.126)	0.327 (0.221)	0.081 (0.258)	−0.011 (0.301)	−0.409 (0.372)	−0.228 (0.388)	0.229 (0.396)	0.612 (0.369)*
Team revenue (US$1,000,000)	0.001 (0.001)	0.000 (0.001)	−0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	0.001 (0.003)	0.001 (0.003)	0.002 (0.003)	0.002 (0.003)
Post-2006 = 1	0.069 (0.020)***	0.067 (0.031)**	0.073 (0.043)*	0.083 (0.052)	0.094 (0.063)	0.066 (0.076)	0.046 (0.078)	−0.025 (0.082)	0.059 (0.090)
Trend	0.007 (0.004)**	0.010 (0.006)	0.011 (0.009)	0.009 (0.011)	0.007 (0.012)	0.012 (0.016)	0.016 (0.018)	0.026 (0.019)	0.014 (0.019)
n	3,430	3,430	3,430	3,430	3,430	3,430	3,430	3,430	3,430

Note. Dependent variable is the log of real salary. Additional independent variables include team fixed effects. Bootstrapped standard errors are shown in parentheses. Bootstraps are calculated from 100 repetitions. Entries come from authors' calculations from the data.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

Results in Table 4 for position players suggest that the 2007 CBA's effect on salaries is not uniform throughout the distribution. The parameter estimate associated with the post-2006 variable grows when moving from the tails to the center of the distribution, with the largest estimate occurring for those players in the 40th percentile. In fact, the coefficient associated with the 90th percentile is not statistically significant. Tests were conducted to see whether each coefficient for the other percentiles is statistically different from that for the 40th percentile. Results indicate that the coefficient associated with the post-2006 variable for the 10th percentile is statistically different at the 5% level, and the coefficients associated with the 20th and 90th percentiles are different at the 10% level. This provides statistical evidence that the 2007 CBA had a larger effect on position player salaries in the middle of the distribution when compared to those in the tails. Given that owners and union representatives must agree on changes made to a CBA, these results lend support to the median voter model, suggesting that modifications made to the 2007 CBA were designed to aid those position players in the middle of the distribution.

Results in Table 5 suggest a different story for pitchers. As before, the parameter estimates associated with the post-2006 dummy variable are relatively smaller at each percentile for pitchers than for position players. Additionally, it seems as though the 2007 CBA's effect on pitcher salaries is concentrated at the bottom of the distribution. The coefficient is statistically significant only at the 10th, 20th, and 30th percentiles, and it is only significant at the 10% level at the 30th percentile. To maintain consistency with the analysis for position players, tests were conducted again to see whether each coefficient for the other percentiles is statistically different from that for the 40th percentile. Again, the results for pitchers are different from those for position players. None of the coefficients associated with the post-2006 dummy variable are statistically different from the coefficients for those pitchers at the 40th percentile. This suggests that while the parameter estimate is statistically significant at the 10th, 20th, and 30th percentiles, there is no differential effect of the 2007 CBA on pitcher salaries throughout the distribution.

Using the tax rates referenced by Zimbalist (2003) and Maxcy (2009), Equation 2 predicts a player's salary should increase between 15% and 30%. Equation 2 inherently assumes that a player's quality (or relative league quality) remains unchanged between the pre- and post-2006 period. Almost all of the results in Tables 2 and 4 for position players lie within the bounds provided by Equation 2. The only result that falls outside the bounds occurs in Model 5 of Table 2. However, the sample used in that analysis was very restricted (only two observations per player, one before 2007 and one after 2006). The results for pitchers, however, do not fall in line with the predictions from Equation 2. Only Models 2 and

5 in Table 3 show coefficients associated with the post-2006 variable that lie within the predicted bounds.

In MLB, there are clear distinctions between pitchers and position players. The above results suggest that uniform regulations within bargaining agreements can have different effects on each group. When compared to pitchers, particularly those on a team's starting rotation, position players generally play in significantly more games. Differences in the amount of playing time may lead to differences in the MRP between the two types of players. This is not the first article to suggest differential impacts of MLB policies on pitchers versus position players. Hill and Spellman (1983) find significantly higher estimated increases in compensation for position players versus pitchers due to the introduction of free agency in 1977. Hill and Jolly (2014) find that position players who file for final offer salary arbitration experience a larger increase in salary when compared to pitchers. Furthermore, those position players who exchange offers with their teams experience a salary premium, whereas no premium exists for pitchers who exchange salary offers with their teams.

Even though revenue sharing's effect on salaries is larger, generally, for position players than for pitchers, the results in Tables 4 and 5 do suggest a common theme—changes to the revenue sharing plan enacted by MLB in the 2007 CBA benefitted mostly players in the middle to lower half of the salary distribution in both cases. The 2007 CBAs effect is largest for position players in the 30th–60th percentiles, which lends support for the median voter model. For pitchers, the coefficients associated with the post-2006 dummy variable are statistically insignificant for the 40th–90th percentiles. As mentioned above, there is little evidence of statistically significant differences between the coefficients associated with the post-2006 variable across the pitcher quantile regressions. However, these results are, qualitatively speaking, in line with the predictions from Equation 2. In other words, those playing for smaller revenue/market teams (which typically pay lower salaries, on average) tend to receive larger pay increases than those

Conclusions

The purpose of this article is to analyze the effect of changes made to the 2007 CBA on player salaries. The key change made to the operation of MLB from the 2003 to the 2007 CBAs occurred with the revenue sharing agreement. Specifically, the 2007 CBA reduced the marginal tax rate associated with revenue sharing and eliminated its regressive nature. Theoretically, these changes should increase players' MRP and, therefore, salary.

Using a similar methodology to Jewell, McPherson, and Molina (2004), results suggest that the 2007 CBA increased position player salaries by 19.7%, on average. The result was relatively robust to various sample selection criteria. The 2007 CBA had differential effects on players throughout the distribution, however, with the largest impact occurring in the center of the distribution. The impact of the 2007 CBA on pitcher salaries is somewhat lower, 8.7% on average. Furthermore, there is little evidence suggesting that the effect differs throughout the pitcher salary distribution.

The change to the revenue sharing agreement in the 2007 CBA represented a dramatic attempt to improve competitive balance in MLB. Between 1998 and 1999, the NBA and the National Basketball Players Association agreed to similarly large changes to their CBA. Specifically, the NBA and players' union agreed to a cap on individual player salaries, a new exception to the team salary cap, an extension of the rookie scale agreement from 3 to 4 years, lower rookie scale salaries, and minimum pay scales

based upon years of experience.[15] Changes to the NBA CBA altered player pay by institutionalizing it through maximum payouts and minimum increases. The MLB CBA changed revenue sharing between franchises in the hopes of incentivizing teams to invest in players and, therefore, change salaries. The MLBPA has steadfastly resisted any owner overtures for team- or individual-level salary caps. Because of this resistance, baseball has the most market-driven salaries of the four major professional team-based sports in the United States. Comparing MLB to the NBA allows for an understanding as to how different unions trying to reach a compromise in collective bargaining negotiations can affect salaries.

Acknowledgments

Declaration of Conflicting Interests

Funding

Notes

1. The panel's independent members included Paul Volcker, George Will, Richard Levin, and George J. Mitchell. The Panel's report can be found at http://www.mlb.com/mlb/downloads/blue_ribbon.pdf.
2. For an example focusing on final offer salary arbitration, see Hill and Jolly (2014).
3. See Basic Agreement (2002), Zimbalist (2003, 2006), and Maxcy (2009) for more specific details.
4. See "Pirates' books reveal flaw in revenue-sharing" by Rob Biertempfel and Bob Cohn (2010) or "MLBs Revenue-Sharing Formula" by David Jacobson (2008).
5. See Basic Agreement (2006) and Zimbalist (2006) for more detail.
6. This result assumes that the relative quality of the player is the same in the period before and after the change in the tax rate.
7. The Uniform Resource Locator (URL) for the USA Today Web site is http://usatoday30.usatoday.com/sports/salaries/index.htm. The URL for Doug's statistics is http://www.dougstats.com. The URL for Rodney Fort's database is https://sites.google.com/site/rodswebpages/codes.
8. Jewell, McPherson, and Molina (2004) use a similar estimated equation. The authors estimate the determinants of within-team Gini coefficients throughout the 1990s. Since this article is interested in salaries throughout the league, instead of at the team level, the analysis uses a similar estimated equation for individual player salaries.
9. The salary figures do not include any incentive bonuses earned.
10. The exact percentage change comes from $e^{\hat{\beta}} - 1$.
11. It is worth noting that the standard errors in Models 1—3 are robust and clustered at the player level. This should account for some of this nonindependence.

12. The parameter estimate associated with the National League (NL) dummy variable warrants some discussion. For position players, the results of Model 1 in Table 2 suggest that NL position players earn approximately 15% less than comparable American League (AL) position players do. Simple averages from the data support this claim. Position players in the AL earned, on average, US$1,744,779. Players in the NL earned US$1,480,632, which is approximately 15% less. The coefficient associated with the NL dummy variable in the pitcher regression (Model 1 in Table 3), however, is misleading. The coefficient indicates that NL pitchers earn 36% less than AL pitchers do. This is due to multicollinearity in the pitcher regressions. The NL dummy variable is highly correlated with the team fixed effects. When removing the team dummies and reestimating Equation 3 for pitchers, the coefficient associated with the NL dummy variable equals −0.034, and it is statistically insignificant. This implies that NL pitchers earn approximately 3.3% less than AL pitchers do, on average. Simple averages from the data set support this number. The average AL pitcher salary equals US$1,288,251, and the average NL pitcher salary is US$1,270,779, which is 1.4% lower.

13. It is possible that changes to the revenue sharing plan in the 2007 CBA affected not only pay on average but also the return to various performance metrics, such as slugging percentage for position players or earned run average for pitchers. To investigate this, interaction terms between the post-2006 dummy variable and each variable in x_{it} were created. These interactions were then used in Equation 3 for both position players and pitchers. Results from these regressions show that the coefficients associated with the post-2006 dummy variable and each of the interaction terms are statistically insignificant. Therefore, it appears that the revenue sharing agreement in the 2007 CBA had only a level effect on log salary and did not affect the returns to each of the performance metrics used here.

14. Team owners and MLBPA representatives did agree to other changes between the 2003 and 2007 CBAs, and these may have affected players' salaries. It is important to note that the post-2006 variable may pick up these other changes. However, most of the alterations to the 2007 CBA were minor when compared to the changes made to revenue sharing. One potential example is the change made to the competitive balance tax. The competitive balance tax rates did not change from the 2003 to the 2007 CBAs. However, the 2003 CBA provided some exceptions allowing teams to have payrolls exceed the payroll threshold and pay no tax. The 2007 CBA eliminated these tax loopholes. All teams are affected by changes made to the revenue sharing agreement, while only four teams were subject to the competitive balance tax during the sample period here. Therefore, it is reasonable to conclude that the revenue sharing agreement had a larger effect on teams than did the changes to the competitive balance tax. Arguably, while only four teams explicitly paid the competitive balance tax, removing tax loopholes could raise the implicit competitive balance tax rate. Theoretical models developed by Fort and Quirk (1995) and Marburger (1997) show that increases in the implicit tax rate associated with the competitive balance tax should reduce players' MRP and, therefore, salaries. The post-2006 variable would pick up this effect. The results presented here generally show an increase in salary associated with the 2007 CBA. This provides evidence that the changes made to the revenue sharing agreement had a relatively larger effect on salaries when compared to the competitive balance tax.

15. For a detailed discussion of the various changes made to the NBA CBA, see Hill and Jolly (2012).

References

Basic Agreement Between the 30 Major League Clubs and Major League Baseball Players Association , Effective September 30, 2002.

Basic Agreement Between the 30 Major League Clubs and Major League Baseball Players Association , Effective December 20, 2006.

Biertempfel, R., Cohn, B. (2010, August 24). Pirates' books reveal flaw in revenue-sharing. TribLive Sports. Retrieved from http://triblive.com/x/pittsburghtrib/sports/pirates/s_696195.html#axzz3dM52xe1x

Brown, M. (2009, 11 20). Revenue-sharing figures ('02,'03,'05,'07,'08,'09). The Biz of Baseball. Retrieved from http://www.bizofbaseball.com/index.php?option=com_content&view=article&id=3760&Itemid=178

Brown, M. (2010, 3 2). Revenue sharing is making an impact: Common fund is spreading MLB's money around. Baseball America. Retrieved from http://www.baseballamerica.com/today/majors/season-preview/2010/269597.html

Cavagnac, M. (2009). Revenue sharing and competitive balance when teams are not wage takers. Review of Industrial Organization, 35, 299–313.

Dietl, H., Grossman, M., Lang, M. (2011). Competitive balance and revenue sharing in sports leagues with utility-maximizing teams. Journal of Sports Economics, 12, 284–308

Fort, R., Quirk, J. (1995). Cross subsidization, incentives, and outcomes in professional team sports leagues. Journal of Economic Literature, 33, 1265–1299.

Hill, J. R., Jolly, N. A. (2012). Salary distribution and collective bargaining: A case study of the NBA. Industrial Relations, 51, 342–363.

Hill, J. R., Jolly, N. A. (2014). Negotiated settlement under MLB final offer salary Arbitration system. Contemporary Economic Policy, 32, 533–543.

Hill, J. R., Spellman, W. (1983). Professional baseball: The reserve clause and salary structure. Industrial Relations, 22, 1–19.

Jacobson, D. (2008, 7 14). MLBs revenue-sharing formula. CBS Money Watch. Retrieved from http://www.cbsnews.com/news/mlbs-revenue-sharing-formula/

Jewell, R. T., McPherson, M. A., Molina, D. (2004). Testing the determinants of income distribution in major league baseball. Economic Inquiry, 42, 469–482.

Levin, R. C., Mitchell, G. J., Volcker, P. A., Will, G. F. (2000). The report of the independent members of the commissioner's blue ribbon panel on baseball economics. New York, NY: Major League Baseball.

Marburger, D. R. (1997). Gate revenue sharing and luxury taxes in professional sports. Contemporary Economic Policy, 15, 114–123.

Maxcy, J. G. (2009). Progressive revenue sharing in major league baseball: The effect on player transfers and talent distribution. Review of Industrial Organization, 35, 275–297.

Major League Baseball . (2006). MLB, MLBPA reach five-year labor accord [Press Release]. Retrieved from http://www.mlb.com/news/press_releases/press_release.jsp?ymd=20061024&content_id=1722380&vkey=pr_mlb&fext=.jsp&c_id=mlb Google Scholar

Rascher, D. A. (1997, 6). A model of a professional sports league. In Hendricks, W. (Ed.), Advances in the economics of sport (Vol. 2, pp. 27–76). Greenwich, CT: JAI Press.

Vrooman, J. (2009). Theory of the perfect game: Competitive balance in monopoly sports leagues. Review of Industrial Organization, 34, 5–44.

Zimbalist, A. (2003). Labor relations in major league baseball. Journal of Sports Economics, 4, 332–355.

Zimbalist, A. (2006). New MLB labor deal corrects earlier flaws, lays foundation for growth. Street & Smith's Sports Business Journal, 9, 27.

Zimbalist, A. (2010). Reflections on salary shares and salary caps. Journal of Sports Economics, 11, 17–28.