E C O N O M I C S B U L L E T I N

Team payroll and team performance in major league baseball: 1985−2002

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Abstract

This paper examines the relationship between team payroll and team performance in major league baseball from 1985 to 2002. The results indicate that the relationship has changed over time. Unlike the early years, there is now a much clearer relationship between payroll and performance. Specifically, in the latter part of the 1990s and continuing into the 21st century, the greater the team payroll and the more equally this payroll is distributed among team members, the better the on−field performance of the team. This is a problem of particular concern because of the growing disparity in team payrolls which, in turn, affects the competitive balance of the sport. This growing disparity was also at the heart of last year's contract negotiations between players and owners.

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1. Introduction

In recent years, there has been a large and growing disparity among the payrolls of Major League Baseball (MLB) teams. Not surprisingly, numerous investigations have been conducted which have examined the effects that this disparity has had on the competitive balance of the sport. The topic has been of interest not only to academic researchers and to the press, but also to MLB itself, which commissioned a study to assess the competitive structure of the sport [Levin, et. al., 2000].

The research investigation described in this note examines the relationship between team salary and team performance by focusing on three variables: (i) a team's won/loss percentage, (ii) a team's payroll and (iii) how the team decides to allocate its payroll among its players. The latter variable is one that has not been investigated in the literature and while the payroll variable has been extensively studied, the events of recent years in terms of salary escalation have suggested that a reexamination of the relationship is warranted. For the investigation, we look at an 18-year period of time from 1985 to 2002. The 1985 season was chosen as the starting point because individual salary data are available since that year and because this is a long enough time period to identify trends and changes that have taken place within the sport.

The individual salaries paid by each major league baseball team to its players during the 1985-2002 seasons were obtained from "Doug Pappas, SABR Business of Baseball Committee." Since there was some variability in the number of players listed for each team in a given year and since an active roster consists of 25 players on a team, only the salaries of the 25 highest paid players on each of the teams were used in these analyses.

2. Average Team Salaries of MLB Teams -- 1985-2002

Figure 1 presents multiple boxplots showing the yearly distribution of average team salaries for all MLB teams over the 18-year period. As shown in Figure 1, the distribution of average team salaries has changed dramatically over this period of time. The height of each box in Figure 1 represents the interquartile range (75^{th} percentile - 25^{th} percentile) and the horizontal line represents the median "average team salary" in a particular year. Asterisks denote teams that had an excessively large or small average salary compared to the other teams in that year.

As illustrated, from 1985 to 1990, the salary distributions were relatively compact, as the average salaries for MLB teams did not show much variability. That is, the differences among the average team salaries were relatively small and the year-to-year increases in average team salaries were minimal. It was during this period of time that MLB owners were found to be guilty of collusion in their restriction of free agents which, in turn, held down wages of baseball players, in general (Quirk and Fort, 1997).

During the 1991-1997 period, when there were two work stoppages (in 1994 and 1995), the average team salaries showed substantially more variability as indicated by increases in the interquartile range (IQR). In the most recent time period, 1998-2002, the IQRs were substantially larger than in previous years and the median average team salary increased in all years except in 2002, perhaps, in anticipation of a new collective bargaining agreement. These increases highlight the large differences

that now exist among MLB teams with respect to the average salary that they pay to their players.

This can also be seen in Table 1, which combines teams into four quartiles based upon their average team salary. The ratio between the average team salary of teams in the highest paying quartile and teams in the lowest paying quartile has increased from 1.94:1 in the 1985-1990 time period to 2.98:1 in the 1998-2002 time period. A ratio of 2:1 has been perceived to be one that is desirable to achieve a durable competitive balance in professional sports (Levin, et. al., 2000). Comparable figures in recent years for the National Football League and the National Basketball Association are 1.5:1 and 1.75:1, respectively.

3. Salary Inequality in MLB Teams -- 1985 to 2002

A team can decide to distribute its payroll among their players in numerous ways. For example, at the extreme, it could decide to fill its roster with players of approximately equal pay and ability with no superstars commanding a salary far greater than the other players. Alternatively, a team could decide to fill its roster with a few highly paid superstar players along with a large number of relatively lower paid players. What pattern of salary structure is most highly related to a team's winning performance? In order to answer this question, we need to have a measure of salary inequality.

There are a variety of statistics that can be used to measure the diversity (disparity) of income or salary distributions. Economists have a long tradition of measuring income inequality with the Gini coefficient and it is this measure that we use to determine the degree of inequality of a particular team's salary distribution. The Gini coefficient for the salaries of players on a particular team in a given year t is computed as:

$$G_t = \Delta_t / 2\ \mu_t$$

where Δ_t is the Gini mean difference for the team in year t and μ_t is the population mean salary for the team in year t. The value of Δ_t for a particular year t is given by:

$$\frac{\sum_j \sum_i |Si - Sj|}{n(n-1)}$$

where n is the number of players on a team and S_i and S_j are the salaries of the team's i^{th} and j^{th} players for year t. The Gini coefficient approaches 0 as income equality increases and approaches 1 as income equality decreases.

The boxplots in Figure 2 show the distribution of team Gini coefficients for particular years. In general, there has been an upward movement in salary disparity since 1985 both within and among teams with the high point occurring in 1995. Since that time, there have been small fluctuations, on a year-to-year basis. It has been speculated that the overall increased inequality over time has been the direct result of the demise of the reserve clause. In comparison to other professional sports, MLB has, by far, the most unequal team salary distributions (Quirk and Fort, 1997).

Another way to look at the salary disparity is to compare the amount of money paid to the most highly paid players compared to the amount of money paid to those of lower-paid players. As indicated in Table 2, the top 10% of players in terms of salary received just 25% of the total salary pool in 1985 compared to 40% of the total salary

pool in 2002. Further, the bottom 70% of the players in terms of salary received 44% of the total salary pool in 1985 compared to only 23% in 1985. As a result, fewer and fewer players are commanding a higher percentage of the total salary pool.

3. Relationship between Team Performance, Average Team Salary and the Distribution of Salaries

As noted above, there is a growing disparity among the average salaries paid by MLB teams to its players and that within many teams there is a growing disparity with respect to the salaries paid to team players. Further, in recent years, numerous researchers have concluded that there has been a reduction in the level of competitive balance within MLB (Butler, 1995; Horowitz, 1997; Chatterjee and Yilmaz,1991; and Schmidt and Berri, 2001). We now look at the interrelationships between the two payroll measures and team performance.

As indicated in Table 3, there is a strong relationship between how well a team performs on the field and the average salary that the team pays to its players. This is especially true in recent years. The difference in the average number of games won in a 162 game season between those teams whose average salary was among the highest 25% of all team salaries and those teams whose average team salary was among the lowest 25% of all team salaries was 14.7 games during the 1998-2002 time period. For the 1991-1997 time period, the differential was 10.9 games and for the 1985-1990 time period, the differential was just 5.5 games.

For the first two times periods, the number of games won between those teams in the second and third quartiles was almost identical, but in the most recent time period, teams in the third quartile of average salaries won approximately 7 more games, on average, than those in the second quartile. The data show the increasing disparity since 1997 in the number of games won among teams based only upon their average team salary.

A relationship also exists, though not quite as strong, between a team's performance and its Gini coefficient. It is a negative relationship indicating that the lower the Gini coefficient (the greater the equality of individual salaries of a team), the greater the number of games won. Table 3 shows that while there was no relationship between the Gini coefficient and team performance from 1985-1990, a relationship has existed since 1990. This relationship was strongest in the 1991-1997 time period when teams that had the greatest degree of equality of salaries won, on average, 9.3 more games than those teams whose individual salary distribution had the greatest amount of inequality.

Regression analyses were also conducted for the three time periods. Here, the dependent variable was the percentage of wins for a given team and the independent variables were a team's average salary and its Gini coefficient. Over time, the percentage of variability that could be explained by the two payroll variables has increased. For the initial time period, 1985-1990, the percentage of variability in team performance that could be explained was just R^2=.02. This value increased to R^2 =.16 for the 1991 to 1997 time period and to R^2 =.19 for the 1998 to 2002 time period.

4. Summary

Overall, the results of these analyses suggest that the large disparity in team payrolls is having an effect on the competitive balance of the sport. Further, the results indicate that owners with a fixed payroll who build a more evenly balanced team as

measured by the individual salaries of its players do better than owners who spend a large percentage of its payroll on only a few highly paid superstar players. Perhaps, the best illustration of this is the Seattle Mariners team of 2001, which had the highest winning percentage (71.6%) of any team in the 18-year period, while at the same time having the lowest Gini value for of any team in that season.

What effect the recently signed collective bargaining agreement between owners and players will have on salary disparity and competitive balance can only be speculated. Preliminary indications, based upon 2003 payroll data, suggest a reduction in the IQR of the average team salaries, but still a large disparity between some teams. For example, the New York Yankees have an average salary of approximately $6 million dollars, which is $2 million dollars more than the average salary of the Boston Red Sox, the next highest paying team in the American League.

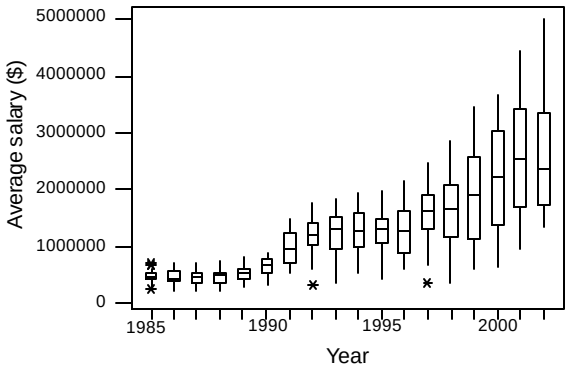

Figure 1: Boxplot of Average Team Salaries – 1985-2002

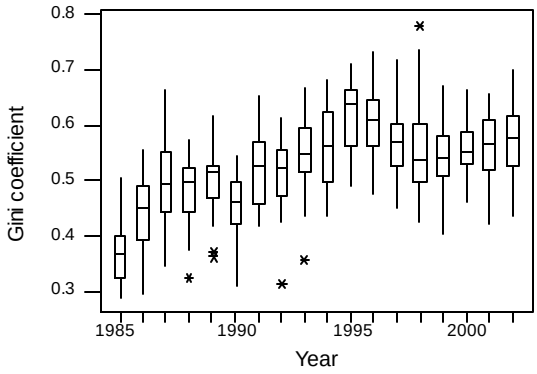

Figure 2. Boxplot of the Gini Coefficients -- 1985-2002

Table 1
Average Team Salary in Thousands by Quartile

Quartile	1985-1990	1991-1997	1998-2002
Q1*	$350	$ 782	$1,125
Q2	$465	$1,152	$1,821
Q3	$562	$1,422	$2,510
Q4	$678	$1,761	$3,357
Ratio: (Q4/Q1)	1.94:1	2.25:1	2.98:1

*This category contains those teams whose average team salary was among the lowest 25% of all team salaries. Other categories have a similar meaning with Q4 representing those teams whose average team salary was among the highest 25% of all team salaries.

Table 2
Cumulative Salary Distributions

Percentile	1985 Cumulative salary	2002 Cumulative salary
Highest 10% of players	25%*	40%
Second highest 10%	17	23
Third highest 10%	14	14
Lowest 70%	44	23

*Read, in 1985, the highest paid 10% of the players received a total of 25% of the total salary pool. In 2002, this percentage increased to 40%.

Table 3
Team Performance, Average Team Salary and Gini Coefficient

Measure	Average Number of Games Won Assuming a 162 Game Schedule 1985-1990	1991-1997	1998-2002
Average team salary			
Q1*	77.9	75.0	75.6
Q2	81.6	81.0	75.2
Q3	81.2	81.8	83.9
Q4	83.4	85.9	89.7
Gini coefficient**			
Q1 (relative equality)	81.7	85.7	85.2
Q2	80.1	82.5	80.6
Q3	81.0	79.5	79.5
Q4 (relative inequality)	81.5	76.4	79.1

*This category contains those teams whose average team salary was among the lowest 25% of all team salaries. Other categories have a similar meaning with Q4 representing those teams whose average team salary was among the highest 25% of all team salaries.
**The Gini coefficient categories have a similar interpretation as the average team salary categories.

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