# Financial Restraint in the Free Agent Labor Market for Major League Baseball: Players Look at Strike Three*

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Professional baseball has provided economists with a wealth of issues and data over the years. Research in this area has been particularly productive because the pay and marginal revenue products of the players are easily measured. The principal issues have been salaries, the player pension fund, and the negotiating opportunities of players who are classified as free agents. In this study we examine the salary consequences of the baseball owners' boycott of the free agents market for players following the 1985 and 1986 seasons.

In 1987 baseball arbitrator Thomas Roberts ruled that baseball team owners had violated baseball's Basic Agreement by colluding in the free agent market for baseball players. The owners, in an effort to exercise financial restraint, did not bid on eligible free agents after the 1985 season (unless the former team was no longer interested in the player). In 1988 baseball arbitrator George Nicolau ruled that the owners once again boycotted the free agent market following the 1986 season.

These historic decisions raise more questions than they answer. What were the salary consequences for the involved players? What remedies should be forthcoming? What does this decision do to the status of owner-player negotiations in view of the fact that there have already been two player strikes in the past decade? This study will attempt to shed light on the first question. In particular, the salary consequences for affected free agents will be measured in an effort to estimate the economic consequences associated with the owners' financial restraint. The financial restraint hypothesis is that owners paid free agents lower salaries during the two collusion years than the players would have earned in the absence of collusion.

Following a very short discussion on the free agent market in section I, we introduce the Scully two equation model [14] in section II to measure marginal revenue products (MRP) of players. In section III we provide the regression results and the salary/MRP comparisons before and after the alleged collusion. Our conclusions are presented in section IV.

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## I. Background Issues

For decades major league baseball owner negotiations with their players were guided by the reserve clause. Under this clause in the Basic Agreement, players could not move freely from team to team. Movement of players occurred only if they were traded for one or more players from another team or their contracts were purchased by the receiving club. With players having very little bargaining power over their salaries, owners had a profit incentive to pay players less than their economic contributions to team revenue. This monopsonistic exploitation, statistically measured by several economists [14; 9; 13], was made possible by the exclusive rights that the teams had on their players.

In 1975 the reserve clause was overturned by a baseball arbitrator, and the era of free agency began with star players Andy Messersmith and Jim "Catfish" Hunter. A free agent is a player who has at least six years of experience and is not currently under contract with a team. He declares himself a free agent during the off-season and all teams may competitively bid for his services (including his old team). Free agents include premier players who feel they are being grossly underpaid, ordinary players hoping to enhance their salaries, and players in the twilight of their career who are resisting the lowering of their once lofty salaries.

As the result of the auction bidding mechanism used in the free agent market, the free agents were able to obtain salaries *in excess* of their marginal revenue products, [3; 12]. Furthermore, the players who were eligible for free agency but did not declare also saw their salaries go up because their bargaining positions were strengthened by the high salaries of comparable free agents [17; 12; 6]. However, the non-free agent players, even after the negotiating power provided indirectly by free agency and salary arbitration, still continued to receive less then their economic value to the team, although the rate of monopsonistic exploitation had decreased [8].

With the advent of free agency, salaries of *all* baseball players rose dramatically, from an average of $51,501 in 1976 to $143,765 in 1980, and up to $438,779 in 1988 according to Major League Baseball Player Association statistics [18]. As salaries were rising, the reported profits of the baseball clubs fell. A collective loss of $43 million was announced in 1983 [18]. In 1984, twenty-one of the twenty-six teams claimed they were losing money [6]. In an effort to improve the baseball clubs' financial conditions, Peter Uberroth, the newly appointed baseball commissioner, admonished the owners for participating in the free agent market and urged them to strengthen their teams by developing new players from the minor leagues.

In response, the owners largely abstained from the free agent market following the 1985 and 1986 seasons. This led to a grievance filing by the Major League Baseball Players Association. On September 21, 1987, arbitrator Thomas Roberts ruled that the major league owners had colluded in the free agent market by not bidding for the free agents. This violated Article XVIII of the Basic Agreements (negotiated by both parties in 1976), which prohibits clubs from acting in concert with other clubs.[1] A ruling on a similar grievance filed on behalf of the 1986 group was reached on August 31, 1988, also in favor of the players.

In summary, it is apparent that before free agency, players received salaries substantially

1. Article XVIII of the basic agreements establishes a system of free agency to eligible members of the bargaining unit. Paragraph H reads:

> The utilization or non-utilization of rights under this Article XVIII is an individual matter to be determined solely by each Player and each Club for his or its own benefit. Players shall not act in concert with other Players and Clubs shall not act in concert with other Clubs.

below their net contribution to team revenues. Since the advent of free agency, however, free agent players received salaries at or above their economic value while players not eligible for free agency continued to be exploited, albeit to a lesser degree. The remaining issue now is whether the recent efforts by team management to refrain from bidding for free agents has resulted in a lowering of free agents' salaries compared to their respective contribution to team revenues.

## II. Methodology

This study will estimate the marginal revenue product of free agents in 1984, the last season before the owners' alleged collusion, and in 1985 and 1986, the two years in which the Major League Baseball Players Association filed grievances on behalf of the free agents. If the owners exercised financial restraint, the salary/MRP ratios for the 1985–86 groups will be lower than that of the 1984 group. A lower average ratio in 1985–86 is consistent with the financial restraint hypothesis and the charges of collusion.

Measurement of marginal revenue products for free agent players will be based on the standard work in this area: the Scully model. In his classic study on monopsony exploitation before the free agency era, Gerald Scully developed the first methodology that estimated marginal revenue products for various skill levels of players [14]. In particular, he formulated a two-equation regression model from which individual player MRP's can be derived.

The first equation related a team's winning percentage to a variety of hitting and pitching performance variables. The second equation relates team revenue to the team's winning percentage and to the specific characteristics of the team's market area. A player's estimated MRP is derived from the results of these two equations.

There are a few limitations to this model, however. First, the underlying assumption of this model is that fans go to baseball games to see *teams* play, not to see specific players play. Second, Scully's choice of player performance variables is somewhat arbitrary. Third, he assumes that team performance is merely the summation of individual performances. Despite these problems, his methodology nevertheless has become *the* standard model for all subsequent works on the measurement of MRP [19; 13; 3; 17; 12; 6].

The first equation is a team production function with its output being the team's winning percentage. This is regressed upon a number of different team inputs. The first set of inputs is hitting and pitching performance indicators. There are many measures of hitting and pitching performance that could have been used. For hitting, indicators that could have been used include batting average, slugging percentage (total bases divided by at bats), and total runs scored. For pitching, earned run average and the strikeout-to-walk ratio provide good measures of performance.[2] Following Scully's model, team slugging percentage and team strikeout-to-walk ratio were chosen as the performance indicators. Team slugging average is found by dividing the team's total bases for the season by the team at bats. The team strikeout-to-walk ratio is measured by dividing total

2. Team slugging percentage is chosen as the principal performance indicator for hitting and team strikeout to walk ratio is chosen as the principal performance indicator for pitching. Both are based on an earlier study [15] and affirmed by our own preliminary work. It is not surprising that these variables work well. Although team batting averages, doubles, triples, and homeruns are recorded weekly by the newspapers, the slugging average takes all of these into account with one statistic. With the strikeout to walk ratio the pitcher's ability to dominate the hitters is balanced against his control over the strike zone. The strikeout to walk ratio is therefore independent of the team's on-the-field performance, and thus it does the best in uniquely measuring pitching ability.

strikeouts by the pitching staff for the season by the number of walks. These team measures are divided by their respective league averages in order to yield a more relative measure of hitting and pitching performance for each team.

Performance variables measuring speed and defense have been found in other studies to be insignificant predictors of winning percentage [15]. Therefore, variables measuring these attributes will not be included in the first equation. On the other hand, measures of team intensity have been found to be instrumental in the determination of winning percentage. The variables *CONT* and *OUT* are used to capture the intensity or lack of intensity that would be expected at the end of the season when it is still in contention or out of the pennant race. The dummy variable *CONT* is equal to one of a team finishes the season as champion of its division or five or less games out of first place. *OUT* is equal to one if a team is twenty games or more out of first place at the end of the season.[3] Teams in contention would be expected to play with more intensity via greater baserunning and defensive efforts, and are more active in the acquisition of experienced players who can fill specialized roles such as pinchhitting or relief pitching. Teams in contention will acquire these players even if late season roster deadlines for playoff eligibility prevent these players from participating in the playoffs. Teams out of contention would be expected to play with lesser intensity when they bring up minor league players, give starts to inexperienced pitchers, and let players experiment at different field positions.

Therefore, the specification of the winning percentage equation is:

$$PCTWIN = a_1 + a_2 TSA + a_3 TSW + a_4 CONT + a_5 OUT + e_1 \tag{1}$$

where

$PCTWIN$ = Team winning percentage
$TSA$ = Team slugging average divided by league slugging average
$TSW$ = Team strikeout-to-walk ratio divided by league strikeout-to-walk ratio
$CONT$ = Contention dummy variable = 1 if team is less than 6 games out of 1st place; 0 otherwise
$OUT$ = Out of contention dummy variable = 1 if team is 20 or more out of 1st place; 0 otherwise
$e_1$ = random disturbance term.

The second equation relates team revenue to a number of market characteristics as well as the team's won-loss percentage. Revenue will be defined as attendance revenue (home attendance multiplied by the team's average ticket price, split 80%/20% between home and visiting teams), plus broadcasting revenue (local rights plus the national rights, which are divided equally among all 26 teams), plus concession revenue (home attendance multiplied by estimated per-capita concession sales).

Besides winning percentage, there are many other variables that can explain the magnitude of a team's revenue, namely those determining a team's attendance and consequently its revenue. Therefore, a variable is included that measures the population of each metropolitan statistical area

3. It has been observed by others using the Scully model that these two dummy variables appear to be disguised versions of the dependent variable [17]. However, the correlation coefficient between *PCTWIN* and *CONT* is .67 and between *PCTWIN* and *OUT* is −.65. These moderately sized correlations suggest that they are not exactly disguised versions of *PCTWIN* in this study.

(MSA) where a major league ball club is located. Because Scully argued that baseball fans would rather go to see a game in a new ball park than in an older stadium, a dummy variable for stadiums built before World War II and not renovated since then is also included. Scully also included a variable in his second equation that measured the difference in the intensity of fan interest. This variable had almost a negligible effect upon team revenue and will not be included in this regression. However, a dummy variable will be included that identifies the four metropolitan areas that have *two* major league teams. Having a second team present in the same metropolitan area will decrease the revenues of both teams, *ceteris paribus*.

Therefore, the specification of the revenue equation is:

$$REVENUE = b_1 + b_2PCTWIN + b_3SMSA + b_4STD + b_5TWOTM + e_2 \tag{2}$$

where

$REVENUE$ = Team revenue from attendance (attendance × average ticket price), broadcasting and concessions (attendance × per-capita concession revenue)
$PCTWIN$ = Team winning percentage
$SMSA$ = Size of the metropolitan area
$STD$ = Old stadium dummy variable
$TWOTM$ = Two teams in metropolitan area dummy variable
$e_2$ = Random disturbance term.

Estimation of an individual hitter's MRP is calculated by taking his own slugging average, multiplying it by his percentage of the team's at bats, dividing that product by the league average for team slugging, and then multiplying that result by the appropriate coefficients in equations (1) and (2). The individual hitter's MRP is:

$$MRP_{hitter} = (a_2 \times \text{Individual } SA \times \text{Individual \% of team at bats} \times b_2)/\text{league } TSA \tag{3}$$

where Individual $SA$ = slugging average (total bases/at bats) of a particular player, and at bats includes walks.

Estimation of an individual pitcher's MRP is calculated by multiplying his individual strikeout-to-walk ratio by his share of team innings pitched, dividing that total by the league $TSW$, and then multiplying that result by the appropriate coefficients in equations (1) and (2). The figures that are calculated are to be treated as gross MRP estimates. The individual pitcher's MRP is:

$$MRP_{pitcher} = (a_3 \times \text{Individual } SW \times \text{Individual \% of teams innings pitched} \times b_2)/\text{league } TSW \tag{4}$$

where Individual $SW$ = strikeout-to-walk ratio of a particular pitcher.

In order to estimate *net* MRP's for players, it would be necessary to subtract player development costs from the gross MRP players. However, player costs are difficult to obtain and in earlier studies were arbitrarily estimated as a *constant* for all players. Due to these data limitations, Somers and Quinton did not subtract player costs from their MRP estimates when they were studying the performance of the first group of free agents [17]. In this study, the financial

**Table I:** Winning Percentage Equation

$Y$ = *PCTWIN* = Team winning percentage (100% = 1000)
$X_2$ = *TSA* = Team slugging average divided by league slugging average
$X_3$ = *TSW* = Team strikeout-to-walk ratio divided by league strikeout-to-walk ratio
$X_4$ = *CONT* = In contention dummy variable
$X_5$ = *OUT* = Out of contention dummy variable
$e_1$ = Random disturbance term

($t$-ratios in parentheses)

$$\underset{}{PCTWIN} = \underset{(0.04)}{3.30} + \underset{(4.80)}{426.19TSA} + \underset{(2.20)}{72.47TSW} + \underset{(6.10)}{63.54CONT} - \underset{(-5.42)}{50.10OUT} + e_1$$

standard error = 34.04 (Mean of *PCTWIN* = 500)
Adjusted $R^2$ = 72.8%
$F$-statistic = 52.43
DF = 73

restraint hypothesis will be tested using gross MRP's since the test statistic relies on difference on the salary/MRP ratios, and not the magnitude of the MRP estimates.

The next step will be to obtain salaries for all free agents in the year after their free agency. Salaries will be defined as including all incentive bonuses paid out to the free agents as well as their salaries. Free agents who participated in less than *one* percent of their team's at bats or innings pitched will be disqualified from their sample group (most of these players were injured for part of the season or were released from the team roster during the season), as well as those free agents who did not play at all in the year following their free agency. Individual salary/MRP ratios will then be calculated by dividing each free agent's salary by his MRP for the corresponding year he was a free agent.

For the purpose of measuring the effects of financial restraint, the free agents were divided into groups representing the 1984 free agents (the year before the collusion ruling) and the 1985–86 free agents (the two years of alleged collusion). An average salary/MRP ratio was calculated from the individual salary/MRP ratios of each group and a two-sample, one tail test was performed to test the statistical significance of the difference between the average salary/MRP ratios for the two groups.

## III. Data and Results

*Regression 1 (Winning Percentage Equation)*

Winning percentage (*PCTWIN*) is normally based on 1.000, but it was decided to use a base of 1000 instead for ease of interpretation. Team slugging average (*TSA*), as well as team strikeout-to-walk ratio (*TSW*), were gathered from various sources [18; 16]. Both the *TSA* and *TSW* variables are relative; they are based on league averages. If a team has a *TSA* of 1.05, it would mean that this team's slugging average is five percent better than the league average.

The regression results for the winning percentage equation are given in Table I. The signs on

all the coefficients met prior expectations and all were statistically significant at 1% levels except for *TSW*, whose coefficient is statistically significant at a 1.5% level. A correlation matrix and a test for heteroscedasticity are provided in Appendices I and II.

*Regression 2 (Revenue Equation)*

Attendance for each team during the season was obtained from that team's respective league [1; 17], while average ticket prices were obtained from the Commissioner's office [14]. Broadcasting revenues came from the annual baseball broadcasting issue of *Broadcasting* magazine [2].

Concession figures, the third element of team revenue, were the most difficult component of *REV* to obtain. Only three clubs were willing to give out per-capita concession sales figures. At the point, the concession component of revenue could have been dropped. However, it was felt that concessions were of too much importance in the measurement of revenue. Consequently, a method was developed to forecast concession sales figures for the other teams.

The first step in this method was to divide one of the three actual per-capita sales figures by that team's average ticket price to yield a "concession factor." This was done for each year in the study. Next, this concession factor was divided into all of the other teams' average ticket prices to give a per-capita concession sales figure for each team in each specific year.

Average ticket price was used as a proxy for per-capita concessions because average ticket price reflects many team-specific characteristics (such as cost-of-living in a specific metropolitan area, management decisions, etc.) that concession sales figures would also encompass.

After three sets of concession figures were calculated for each team, each set being based on one of the actual per-capita concession sales figures, one set was chosen to use in the measurement of the concession aspect of revenue. This set was chosen because its concession factor was in the middle of the concession factors of the other two scenarios. As with average ticket price, all concession figures for the Canadian baseball clubs (Toronto and Montreal) were converted to American dollars using exchange rates found in *International Financial Statistics* [7].

Data for the population variable (*SMSA*) were obtained from the *Statistical Abstract of the United States* [20]. The population used for each city was the largest metropolitan classification available that included the identified city: for example, Chicago was identified as being in a Consolidated Metropolitan Statistical Area (CMSA) while Kansas City was identified as being in a Metropolitan Statistical Area (MSA). The population figures for the Canadian teams were obtained via a telephone interview with Statistics Canada [19]. All population figures are estimates done after the last actual census in each country, which was 1980 in the U.S. and 1981 or 1986 in Canada. The *TWOTM* variable is self-explanatory; the criterion for a yes response was that two teams shared a CMSA. Finally, for the old stadium variable (*STD*), the only stadiums that fit the requirements were Wrigley Field and Comiskey Park in Chicago, Fenway Park in Boston, Tiger Stadium in Detroit, and Cleveland Municipal Stadium.

The regression results for the second equation are in Table II. If the winning percentage of a team increases by 1 unit (0.1%), its revenue will increase by $53,071 on average, holding all of the other variables constant. If a team's metropolitan area size grows by 1 million people, its revenue will increase by $1,469,440. A team that plays in an old stadium will make $1,322,698 more in revenue than a team that does not play in an old stadium. Finally, if there are two teams in one metropolitan area, each team's revenue will be lower by $7,376,298, on average.

The positive sign of the stadium coefficient can perhaps be explained by looking at the fact that three of the teams that play in old stadiums (the Chicago Cubs, the Boston Red Sox, and the

**Table II:** Revenue Regression

$Y$ = *REV* = Team revenue from attendance, broadcasting and concessions ($)
$X_2$ = *PCTWIN* = Team winning percentage; based on 1000
$X_3$ = *SMSA* = Size of the metropolitan area (millions)
$X_4$ = *STD* = Old stadium dummy variable
$X_5$ = *TWOTM* = Two teams in metropolitan area dummy variable
$e_2$ = Random disturbance term

($t$-ratios in parentheses)

$$REV = \underset{(-1.17)}{-1{,}522{,}481.5} + \underset{(5.84)}{53070.5(PCTWIN)} + \underset{(6.29)}{1469440.2(SMSA)}$$
$$+ \underset{(0.97)}{1322698.6(STD)} - \underset{(-3.27)}{7376297.6(TWOTM)} + e_2$$

standard error = 4,712,291 (mean of *REV* is 30,935,231)
Adjusted $R^2$ = 68.2%
$F$-statistic = 42.2
DF = 73

Detroit Tigers) won divisional titles during the three year period of this study. No team playing in an old stadium won a divisional crown during the years studied by previous authors. (The coefficient was negative in those studies). Another explanation is that fans actually prefer the friendly confines of old stadiums.[4] However, the coefficient is not statistically significant.

All other coefficients were of the correct sign and were statistically significant at the 1% level. A correlation matrix and a test for heteroscedasticity are provided in Appendices I and II.

### *Salary/MRP Ratios*

All salary data were obtained from *USA Today* and its annual baseball salary issues [21]. Salary data are available from other sources, but for the sake of consistency, this was the only source of salary data used (the data only went back to 1984). If the salary for a free agent could not be found in the year after his free agency, he was disqualified from the sample group, even if he did play in that year.

The total number of players who filed for free agency after each of the three years was 79 in 1986, 62 in 1985, and 58 in 1984. By removing all of the free agents who did not meet the criteria specified and whose salaries were not obtainable, the size of the 1984 sample group was reduced to 34. For the 1985–86 combined sample group, there were 69 free agents who met all of the requirements and whose salaries were obtainable.

The test of the difference between the two sample groups involves the computation of the ratio of each free agent's salary to his MRP (MRP and salary figures for each player are given in Appendix III). As discussed earlier, the salary/MRP ratios use gross MRP figures because the costs of player development are not subtracted from the measured MRPs. The reported salary/MRP ratios are thus lower than what they would be if net MRP values were used. These ratios

4. The authors wish to thank the referee for this observation.

**Table III:** Mean Ratios of Salaries to Gross Marginal Revenue Products (Standard Errors in Parentheses)

| | Salary/MRP 1984 | Salary/MRP 1985–6 | Difference |
|---|---|---|---|
| Unweighted Average | 0.961 | (0.693) | 0.268 |
| | (0.204) | (0.110) | |
| Weighted Average | 1.217 | 0.750 | 0.467 |
| | (0.327) | (0.110) | |
| Sample size | 34 | 69 | |

are then averaged for each group of free agents: 1984 (year before the collusion ruling) and 1985–86 (the two years of alleged collusion). These averages are then compared to each other, and the difference is determined. For the 1984 sample group, the average ratio of salary to gross MRP was 0.961. (All figures are in Table III). For the 1985–86 agent group, the average ratio of salary to gross MRP was only .693. This yields a fairly large difference of 0.268, which is a 28% drop in the mean salary/MRP during the two years of alleged collusion. This is consistent with the hypothesis that baseball owners exercised financial restraint in bidding for the available free agents in the 1985 and 1986 seasons.

The second ratio calculated was a weighted average ratio. Each free agent's salary was divided by mean salary of his sample group to obtain a weight for this player. This quotient was then used to weight this player's ratio. This procedure gives more weight to the salary/MRP ratios of high-salaried players. The mean salary/MRP for the weighted ratios is 1.217 in 1984, while the weighted ratio for the 1985–86 group of free agents is 0.750, which gives a difference of 0.467. This difference is a 38% drop in the mean salary/MRP ratios for free agents during the two years of alleged collusion.

The standard hypothesis tests on the difference between two population means can be performed to establish whether the observed differences in the sample means reflect true differences. The standard test requires an assumption that the unknown population variances are equal. When a pooled variance is used, the $t$-ratios for the difference between the mean salary/MRP ratios are 1.58 for the unweighted means and 1.69 for the weighted means. The probability-values are 6% and 5% respectively. The support for the hypothesis of no difference in the mean ratios is small, and the hypothesis can be rejected at the 10% level (one-tail) for both tests.

The $t$-test permits the assumption of equal population variances to be violated somewhat without invalidating the $t$-test. However, because of the large differences in the sample variances in this case, the assumption of equal population variances is doubtful. If the sample variances are not pooled, the distribution of the test statistic is uncertain [8]. In such cases the $t$-distribution is used as an approximation provided the sample sizes are large. With this change, the $t$-ratios for the difference between the mean salary/MRP ratios are 1.25 for the unweighted means and 1.35 for the weighted means. The probability-values are 11% and 9%, respectively. The support for the hypothesis of no difference is still small, but the hypothesis can be rejected at the 10% level only for the weighted means.[5]

5. What is not reflected in these tests is the high proportion of the population that is included in each sample. All free agents were included for the three years except those players who were disqualified because they had less than 1% of the team at bats or innings pitched, were not signed by any team, or did not have their salaries published in *USA Today* [21]. The samples were roughly half of the size of the population. Sample differences thus reflect true differences more strongly than what is indicated by the usual $t$-tests.

In conclusion, the mean salary/MRP ratios for free agents in 1985–6 were 28% smaller for unweighted means and 38% smaller for weighted means than those found in 1984. This is consistent with the hypothesis of financial restraint in the free agent market by club owners. Free agent players received lower salaries in 1985–6 than what they would have received if competitive bidding took place as it did in 1984 and earlier years. There is little reason to doubt that this group of free agents suffered the economic consequences associated with the club owners' nonparticipation in the bidding process.

When free agents receive less in salary than their economic worth to the club, this does not mean that their salaries are necessarily lower in the "collusion years" than they were earlier. A player whose performance is improving can find his salary going up as well as the gap between his salary and his worth to the team. But by limiting the salary increases paid to free agents (who are forced to resign with their old team), club owners save on salary expenditures not only for the free agents but for all players on the team as non-free agents compare their performances and salary with those of free agents.

It is interesting to note that the average salary for baseball players in 1987 declined slightly. The player association reported an average salary of $412,454, down from $412,520 in 1986 (the owners reported an average salary of $402,579 [11]). This is the first decline since the player association started keeping records in 1967. Financial restraint in the free agent market appears to have set the tone for salaries generally.

## IV. Conclusion

Two baseball arbitrators have recently ruled that the club owners colluded after the 1985 and 1986 baseball seasons by not bidding on the available free agents. This study suggests that a testable hypothesis is whether there were salary consequences associated with the owners' alleged collusion in 1985–86. The results showed that there is a large difference between the salary/MRP ratios of the 1984 free agent group and those of the 1985–86 free agent group. The mean ratios were 28% lower for the unweighted ratios and 38% lower for the weighted ratios. This outcome suggests that the free agents in 1985 and 1986 did suffer economic consequences compared to the 1984 group. This finding is consistent with the financial restraint hypothesis. Although financial restraint is the natural economic consequence of collusion, these results do not empirically establish that collusion occurred, since financial restraint could have been due to the independent decisions of the 26 baseball clubs.

The nonparticipation by club owners in the 1985 and 1986 free agent markets did result in collusion rulings. In 1989, baseball arbitrator Thomas Roberts assessed a $10 million penalty on the owners. Additional rulings on the appropriate remedies are still forthcoming. Suggested remedies by the players association have included new free agency opportunities for the affected players as well as punitive damages from the owners [11]. Our results suggest that the salary consequences of financial restraint can be estimated, at least on the average, for the affected players. A remedy to the players in the form of lost compensation can be based on the estimated net MRP compared to the actual salaries received. The difference between the estimated market value and the actual salary would be the economic damage deserving compensation. This gap could be increased by a factor of 3 to reflect the type of punitive damages that are awarded for violating in this nation's antitrust laws. Although baseball is exempt from our antitrust laws, there is no reason why an arbitrator should avoid use of the treble damage remedy.

Punitive damages are difficult to determine and pose problems in assigning the guilty parties. If a claim of $10 million is awarded to the free agents, not only does this sum have to be allocated in an equitable fashion, it must also be collected equitably. It is not clear whether all teams should contribute, or contribute equally, to pay for any assessed fine.

Although bringing the 1985–86 free agent players up to market value may not be sufficient to deter owners from further nonparticipation, in the short run, it may not be necessary to worry about future collusion. Industrial organization theory suggests that the large number of baseball clubs will make it nearly impossible for the owners to resist the temptation to cheat on any agreement to refrain from bidding for free agents. This is especially likely in baseball because of the considerable overcapacity in most baseball stadiums and the widely varying population markets. A "star" player can fill many of those empty seats. Since the owners have no mechanism to punish those who sign free agents, competitive bidding will most likely re-emerge over time.

Such a long term solution is not likely to placate the players. The present Basic Agreement expires on December 31, 1989. Before then, the owners and players must work out some compromises on the free agency system to prevent a third strike by the players.

**Appendix I.**

| | Simple Correlation Matrix for Equation (1) | | | | |
|---|---|---|---|---|---|
| | *PCTWIN* | *TSA* | *TSW* | *CONT* | *OUT* |
| *PCTWIN* | 1.00 | 0.48 | 0.38 | 0.67 | −0.65 |
| *TSA* | — | 1.00 | 0.14 | 0.26 | −0.38 |
| *TSW* | — | — | 1.00 | 0.38 | −0.22 |
| *CONT* | — | — | — | 1.00 | −0.39 |
| *OUT* | — | — | — | — | 1.00 |
| | Simple Correlation Matrix for Equation (2) | | | | |
| | *REV* | *PCTWIN* | *SMSA* | *STAD* | *TWOTM* |
| *REV* | 1.00 | 0.69 | 0.65 | 0.06 | 0.33 |
| *PCTWIN* | — | 1.00 | 0.39 | 0.06 | 0.14 |
| *SMSA* | — | — | 1.00 | 0.01 | 0.81 |
| *STAD* | — | — | — | 1.00 | 0.10 |
| *TWOTM* | — | — | — | — | 1.00 |

## Appendix II

### *Park Test for Heteroscedasticity*

A Park test was used to test for heteroscedasticity in each of the regressions. It is performed by regressing the logarithm of the squared residual error terms of the regression on the logarithm of each of the explanatory variables. This test is only performed on the quantitative variables in each regression.

The results of Park tests performed on both of the regression show that there was no heteroscedasticity present in either equation.

### *Park Tests for Equation (1): (t-ratios in parentheses)*

*LE2* = Logarithm of squared residual errors in equation (1)
*LPCYWIN* = Logarithm of winning percentage

$LSMSA$ = Logarithm of the size of the metropolitan area

$$LE2 = \underset{(1.80)}{24.73} + \underset{(0.34)}{0.75}(LPCTWI)$$

$$LE2 = \underset{(46.24)}{28.70} + \underset{(1.22)}{0.48}(LSMSA)$$

*Park Tests for Equation (2): (t-ratios on parentheses)*

$LE2$ = Logarithm of squared residual errors in equation 2

$LTSA$ = Logarithm of team slugging average

$LTSW$ = Logarithm of team strikeout-to-walk ratio

$$LE2 = \underset{(27.41)}{6.11} - \underset{(-0.32)}{1.62}(LTSW)$$

$$LE2 = \underset{(27.41)}{6.11} - \underset{(-0.34)}{0.61}(LTSW)$$

**Appendix III**

The following list shows: 1) the players in each of the three years, 2) their salary, and 3) their gross marginal revenue product, as estimated by the two-step statistical procedure used on this paper. It is important to remember that the MRP's are overstated because the costs of player development have not been subtracted out.

| Player | Pitcher/Batter | Salary ($) | Gross MRP ($) |
|---|---|---|---|
| | | 1984 | |
| Sutter, B. | P | 1,354,167 | 642,031 |
| Sutcliffe, R. | P | 1,260,000 | 1,007,038 |
| Thornton, A. | B | 1,100,000 | 2,867,745 |
| Lynn, F. | B | 1,090,000 | 2,551,949 |
| Kingman, D. | B | 1,087,500 | 2,894,351 |
| Fingers, R. | P | 1,065,000 | 236,913 |
| Whitson, E. | P | 800,000 | 683,937 |
| Eckersley, D. | P | 750,000 | 610,118 |
| Lacy, L. | B | 725,000 | 2,262,839 |
| Gantner, J. | B | 687,500 | 2,179,340 |
| Johnson, C. | B | 683,333 | 1,822,633 |
| Trout, S. | P | 640,000 | 439,280 |
| Hooton, B. | P | 565,000 | 234,285 |
| Stoddard, T. | P | 556,250 | 237,358 |
| Aase, D. | P | 525,000 | 94,812 |
| Russell, B. | B | 450,000 | 951,694 |
| Lezcano, S. | B | 425,000 | 1,338,002 |
| Jones, R. | B | 390,000 | 1,120,048 |
| Kison, B. | P | 320,000 | 255,947 |
| Royster, J. | B | 325,000 | 755,591 |
| Pryor, G. | B | 316,667 | 987,736 |
| Rozema, D. | P | 310,000 | 458,587 |
| Wohlford, J. | B | 308,333 | 1,080,720 |
| Ayala, B. | B | 303,333 | 447,937 |
| Ruhle, V. | P | 295,000 | 278,641 |
| Wilfong, P. | B | 266,667 | 1,157,000 |
| Almon, B. | B | 255,000 | 824,602 |
| Grubb, J. | B | 250,000 | 767,892 |

| | | | |
|---|---|---|---|
| Perez, T. | B | 225,000 | 522,088 |
| Reuschel, B. | P | 200,000 | 291,316 |
| Dilone, M. | B | 175,000 | 697,713 |
| Bumbry, A. | B | 160,000 | 1,209,574 |
| Henderson, S. | B | 150,000 | 1,470,329 |
| Nicosia, S. | B | 105,000 | 660,858 |
| | 1985 | | |
| Gibson, K. | B | 1,200,000 | 2,992,193 |
| Moore, D. | P | 1,000,000 | 590,288 |
| Sutton, D. | P | 890,000 | 683,346 |
| Fisk, C. | B | 875,000 | 2,706,241 |
| Wynegar, B. | B | 733,333 | 1,011,495 |
| McRae H. | B | 650,000 | 1,462,624 |
| Darwin, D. | P | 610,000 | 708,050 |
| Thon, D. | B | 600,000 | 964,037 |
| Bernazard T. | B | 580,000 | 2,041,866 |
| Bochte, B. | B | 572,500 | 1,311,503 |
| Grich, B. | B | 500,000 | 1,828,197 |
| Beniquez, J. | B | 450,000 | 1,762,465 |
| Blue, V. | P | 450,000 | 252,247 |
| Yeager, S. | B | 412,809 | 340,599 |
| Dwyer, J. | B | 400,000 | 940,335 |
| Easterly, J. | P | 350,000 | 184,135 |
| Brookens, T. | B | 325,000 | 1,821,998 |
| Niekro, P. | P | 300,000 | 460,905 |
| Perez, T. | B | 275,000 | 957,874 |
| Lopez, A. | P | 223,272 | 190,603 |
| Iorg, D. | B | 210,000 | 436,252 |
| Jones, Lynn | B | 185,000 | 396,132 |
| Washington, U.L. | B | 180,000 | 755,704 |
| Quirk, J. | B | 150,000 | 808,147 |
| Sakata, L. | B | 75,000 | 344,998 |
| Ruhle V. | P | 60,000 | 385,572 |
| Spilman, H. | B | 60,000 | 140,582 |
| | 1986 | | |
| Morris, J. | P | 1,850,000 | 1,137,796 |
| Raines, T. | B | 1,666,333 | 2,983,349 |
| DeCinces, D. | B | 1,050,000 | 2,193,271 |
| Parrish, L. | B | 1,000,000 | 1,587,793 |
| Downing, B. | B | 900,000 | 2,365,389 |
| Randolph, W. | B | 900,000 | 1,693,671 |
| Boone, B. | B | 883,000 | 1,376,311 |
| Guidry, R. | P | 850,000 | 1,109,779 |
| Clancy, J. | P | 850,000 | 672,368 |
| Gedman, R. | B | 772,504 | 1,653,103 |
| Whitt, E. | B | 750,000 | 1,716,122 |
| Forsch, B. | P | 750,000 | 518,683 |
| Palmer, D. | P | 725,000 | 531,143 |
| Alexander, D. | P | 650,000 | 774,469 |
| Ward, G. | B | 633,000 | 1,542,425 |
| Knight, R. | B | 600,000 | 2,205,698 |
| Jackson, R. | B | 525,000 | 1,743,840 |

| | | | |
|---|---|---|---|
| Smith, L. | B | 500,000 | 2,082,477 |
| Washington, C. | B | 480,000 | 546,012 |
| Garner, P. | B | 450,000 | 1,420,315 |
| Lopes, D. | B | 450,000 | 1,172,441 |
| Dempsey, R. | B | 400,000 | 1,243,807 |
| Roenicke, G. | B | 380,000 | 497,771 |
| Sambito, J. | P | 360,000 | 132,700 |
| John, T. | P | 350,000 | 207,298 |
| Concepcion, D. | B | 320,000 | 1,150,704 |
| Dwyer, J. | B | 307,500 | 784,531 |
| Heep, D. | B | 300,000 | 879,545 |
| LaCoss, M. | P | 300,000 | 371,801 |
| Andersen, L. | P | 300,000 | 185,865 |
| Speier, C. | B | 275,000 | 758,676 |
| Royster, J. | B | 260,000 | 1,004,068 |
| Porter, D. | B | 260,000 | 830,432 |
| Moore, C. | B | 256,000 | 891,522 |
| Cerone, R. | B | 250,000 | 834,201 |
| Herndon, L. | B | 225,000 | 1,094,889 |
| Quirk, J. | B | 200,000 | 193,408 |
| Spilman, H. | B | 175,000 | 433,585 |
| Stewart, S. | P | 175,000 | 98,661 |
| Martinez, T. | P | 162,500 | 324,748 |
| Price, J. | P | 100,000 | 82,866 |
| Noles, D. | P | 75,000 | 91,503 |

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