Pay and Performance in Major League Baseball

By Gerald W. Scully*

The 1972 baseball season opened with the first players' strike in baseball history. The issues were economic, focusing primarily on the player pension fund. In recent years, there has been growing discontent among players over the provisions of the uniform contract in organized baseball, an issue which threatened a strike and a lockout prior to the 1973 season. The principal issues remain minimum salaries, maximum salary cuts, player benefits, and the reserve clause. The players support the recent Curt Flood claim that the reserve clause is illegal and severely reduces player economic benefits. Economic analysis confirms the latter view (see Simon Rottenberg). The owners contend that the clause is necessary for equalization of playing strength among teams. Economic analysis disputes such a contention (see Mohamed El Hodiri and James Quirk). Further, owners insist that player salary demands are unrealistically high. Fans, caught in the middle, seem persuaded that the players are overpaid. Somehow, a $150,000 a year ball player claiming exploitation is anti-heroic.

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The purpose of this paper is to crudely measure the economic loss to the players due to the restrictions of the reserve clause. Relationships between player performance and salary will be estimated and the predicted salary compared to predicted player marginal revenue product. Aside from providing insights into the operation of a particular labor market, the approach differs from other studies of the wage determination process in the following ways: 1) the individual player is the unit of observation; 2) salary functions are estimated within the framework of a labor market characterized by extensive bargaining; 3) marginal revenue products of the factors of production are estimated explicitly; and 4) rates of monopsonistic exploitation are found by comparing salary and marginal revenue product over various performance levels and career lengths.

The discussion will unfold as follows. First, the institutional characteristics of the baseball players labor market are briefly outlined. Next, with this institutional framework in mind, a model of marginal revenue product and salary determination is formulated. Then, the results of the empirical investigation into marginal revenue product and salary determination are presented. Finally, the rate of monopsonistic exploitation is calculated and policy implications discussed.

I. The Organization of the Baseball Players Labor Market

The institutional framework governing the organization of the labor market in baseball has been discussed in depth previously (see Rottenberg). We will deal only briefly with the topic. Currently, a player is a *free agent* until he signs a one-year, renewable, *uniform contract* with a major league team. The renewable feature of the contract is an option granted exclusively to the owner and is known more widely as the *reserve clause*. Simply stated, the reserve clause restricts the player's freedom of negotiation to the owner of the contract. Short of a constraint restricting the owner in the percent that he can cut a player's salary from the previous season, the contract grants a license to the owner to dispose of the player's services in the manner he sees fit. The owner's options at the expiration of the contract are wide. He can renew, sell, or terminate the contract. If he renews the contract, the player may be relegated to the team roster, transferred to a minor league team on the "protected" list, or left eligible for the *player's draft*. In selling the contract to another team, the owner transfers a property right—the exclusive control over the player's services. If sold, the player must report to his new owner within seventy-two hours.

The player's options are more limited. Upon being offered a contract, the player can accept the terms and sign or attempt to negotiate an improvement in the terms in his favor. The player may resort to a number of ploys, including the "holdout" tactic, to improve the terms. But once the owner has made his "final" offer, the player must capitulate or withdraw from organized baseball.

The reserve clause plays an important role in the determination of player salaries. If the labor market in organized baseball were perfectly competitive, player salaries would be equated with player marginal revenue products (*MRP*). The reserve clause prohibits the transfer of player services to teams where their *MRP* is higher. The reserve clause restricts player bargaining to one owner. The restriction grants some monopsony power to the owner and the exercise of that power results in a divergence between *MRP* and salary. The marginal revenue product continues to be an essential factor in player salary determination, but under the reserve clause, players and owners share the player's *MRP*.

The player's marginal revenue product in baseball is the ability or performance that he contributes to the team and the effect of that performance on gate receipts. The effect of player performance on revenue may be direct or indirect. Ability contributes to team performance and victories raise gate receipts—and broadcast revenues; this is the substantial effect of the individual's performance. Additionally, it is possible that some players may attract fans over and above their individual contribution through the team. Both players and owners understand the relationship, and the player's ability is the key issue in bargaining. But aside from the actual *MRP* of the player, the relative strength of the bargainers will also affect salary. It is true that the reserve clause grants more economic power to the owner. However, management is constrained by considerations of player and team morale. Certain factors, such as the number of close substitute players, affect the outcome of the negotiation. But the personalities of the bargainers must contribute to relative bargaining strength. Bargaining always has in it an element of poker and, as in poker, the player is at least as important as the cards.

II. A Simple Model of Marginal Revenue Product and Salary Determination in Major League Baseball[1]

A model which purports to reveal simply the formal process of *MRP* and salary determination should incorporate the two

[1] For an elegant treatment of the theory, see El Hodiri and Quirk.

major features of the ball players labor market discussed above: 1) Gross baseball revenues are related to individual performance primarily through their effect on team standing; and 2) the reserve clause reduces player salaries below player marginal revenue products.

Teams are engaged in the production of a constant number of games of a certain level of quality. The quality of the games is assumed to be measured by the team's percent wins W, which is related to two general categories of inputs: 1) a vector of player skills A_i; and 2) a vector of other nonplayer inputs I_j, such as managers, coaches, capital, etc., and more nebulous inputs such as team spirit. Thus,

$$W = W(A_1, A_2, \ldots, A_n; I_1, I_2, \ldots, I_m) \tag{1}$$

Teams derive revenue essentially from two main sources: gate receipts and the sale of radio and television rights. Fans purchase tickets or watch televised games because they derive utility from seeing the home team win. We assert that both gate receipts and broadcast revenue are directly related to the team's percent wins and the population in the area and indirectly related to player performance. That is, fans attend or watch games to see the team win, not to see player skills per se. It is well known that attendance varies with team performance and size of the metropolitan area (see Roger Noll), and undoubtedly so do broadcast revenues (see I. Horowitz). Accordingly, we state

$$\begin{aligned} R &= p \cdot T[W(A_i, I_j), P_g] \\ &\quad + B[W(A_i, I_j), P_b] \\ &\quad i = 1, \ldots, n; \quad j = 1, \ldots, m \end{aligned} \tag{2}$$

where R = team revenue, p = ticket price, T = number of tickets sold, W = team performance, P_g = population potentially attracted to the ballpark, P_b = potential broadcast households, and B = broadcast revenues.

Team costs C will be determined by the level of skills of the players and by the level of other nonplayer inputs. Since teams face a monopsonistic labor market, player costs are endogenously related to the level of skill. Other factor markets are assumed competitive. Therefore, we define team costs as

$$\begin{aligned} C &= \sum_i A_i S_i(A_i) + \sum_j r_j I_j \\ & i = 1, \ldots, n; \quad j = 1, \ldots, m \end{aligned} \tag{3}$$

where $S_i(A_i)$ are player supply functions and r_j nonplayer factor remunerations.

Team profits π are defined as

$$\pi = R - C \tag{4}$$

The first-order conditions for a maximum are obtained by differentiating with respect to A_i and I_j.

$$\begin{aligned} \frac{\partial \pi}{\partial A_i} &= p \frac{\partial T}{\partial W} \frac{\partial W}{\partial A_i} + \frac{\partial B}{\partial W} \frac{\partial W}{\partial A_i} \\ &\quad - A_i \frac{\partial S_i}{\partial A_i} - S_i, \\ & i = 1, \ldots, n \end{aligned} \tag{5}$$

$$\begin{aligned} \frac{\partial \pi}{\partial I_j} &= p \frac{\partial T}{\partial W} \frac{\partial W}{\partial I_j} + \frac{\partial B}{\partial W} \frac{\partial W}{\partial I_j} - r_j \\ & j = 1, \ldots, m \end{aligned} \tag{6}$$

The first-order conditions reveal that teams maximize profits by selecting a level of player skills and nonplayer inputs such that players receive a salary equal to their marginal revenue products less monopsony rents ($A_i S_i'$), and other factors are remunerated equal to their marginal revenue products. Owner accrued monopoly profits are also present in the model. The manifestation of monopoly profits may be considered by observing that

$$\frac{\partial \pi}{\partial P_g} = p \frac{\partial T}{\partial P_g} > 0 \tag{7}$$

$$\frac{\partial \pi}{\partial P_b} = \frac{\partial B}{\partial P_b} > 0 \tag{8}$$

III. Player Marginal Revenue Products

It is possible to crudely estimate player marginal revenue products in major league baseball. While the marginal revenue product of a particular player cannot be determined readily, the effect of player performance on team winning and the effect of team winning on team revenue can be ascertained. Making reasonable assumptions about how a player's performance alters team performance permits approximations of the player's marginal revenue product. It would be better if the relationship between marginal revenue product and player performance could be estimated using the player as the unit of measurement rather than the team, as can be done in the salary regressions. Such a procedure is impossible for the hitters and very difficult for the pitchers. Hitters in the regular lineup play virtually every home and away game during the season. Hence, fans cannot discriminate through attendance on the basis of player appearance. Pitchers do not start every game, so it is possible to evaluate their marginal revenue products individually. But this requires laboriously analyzing attendance for every team for every game during the season.

Player marginal revenue products are estimated in a two-equation model.[2] Equation (9) in essence is the production function which relates team output, the win-loss percent, to a number of team inputs. Equation (10) is the team revenue function which relates team revenues to the team win-loss record and the principal market characteristics of the area in which the team plays. The justification for estimating these relationships separately is derived from the fact that fans attend games principally to see the home team win, not to witness hitting and pitching performance per se.[3] Equation (9) specifies a linear relationship between team percent wins *PCTWIN*, expressed conventionally as games won divided by total games times 1,000, and a number of team performance variables. On the basis of previous research into the determinates of player salaries, it was found that hitter and pitcher performance were most suitably measured by the slugging average *SA* and the strikeout-to-walk ratio *SW*, respectively.[4] Therefore, the team win-loss percent is hypothesized to be related to the team slugging average *TSA* and the team strikeout-to-walk ratio *TSW* which are assumed to measure the offensive and defensive contributions to team victories. Winning, however, may be determined by more than team hitting and pitching performance. A large number of games in the majors during the season are won by one run. In these instances, player and hitting performance per se will make less difference in the outcome. It is here that team play, hustle, the quality of managerial and on the field decision making, all of which is determined by team morale, will substantially determine which team wins a higher share of these one-run games. To adjust for these factors, two dummy variables are specified: *CONT* which is equal to one for pennant or divisional winners

[2] Anthony Pascal and Leonard Rapping came close to estimating player marginal products in baseball. They specified a two-equation model, one relating team performance to team wins, the other between team wins and attendance but did not interpret their results as estimates of player marginal products.

[3] One must concede, however, that fans are drawn to see superstar players in action. The point, however, is that team revenue will be correlated principally with team win-loss records and less readily with team performance statistics. This is verified by empirical evidence, that the zero-order correlation coefficient between team revenue and team percent wins is much higher than the correlation coefficients between team revenue and team hitting and pitching measures.

[4] See the author (1974).

and their closest competitors at the end of the season, if the competition was five or fewer games out; and *OUT* which is equal to one for teams which at the end of the season were twenty or more games out of placing. Variable *CONT* should capture quality of play above and beyond hitting and pitching performance, inspired by the potential of a pennant or divisional title. Variable *OUT* should capture the demoralization that surrounds habitual losers. Finally, the absolute quality of play is generally regarded as being higher in the National League. Thus, equivalent team hitting and pitching performance would be expected to yield a lower win-loss percent in the National League. To compensate for this factor, a dummy variable *NL*, equal to one if the team is in the National League, is specified.

The team percent win function *PCTWIN* was estimated with team data for 1968 and 1969.[5] The statistical results are:

$$(9)\quad PCTWIN_t = \underset{(.39)}{37.24} + \underset{(4.37)}{.92}\, TSA_t + \underset{(5.92)}{.90}\, TSW_t - \underset{(4.03)}{38.57}\, NL + \underset{(3.77)}{43.78}\, CONT_t - \underset{(6.17)}{75.64}\, OUT_t, \quad R^2 = .88, \; DF = 38$$

Interpretation of these coefficients is straightforward. Each one point increase in the team slugging average raises the team win percentage by .92 points. A one-hundredth point increase in *TSW* increases *PCTWIN* by .90 points. For equivalent player performance, National League teams will finish nearly 39 points lower in *PCTWIN*, reflecting a higher absolute quality of play. Contenders and cellar teams finish 44 and 76 points, respectively, above or below other teams with equivalent player performance. All of the coefficients are significant at better than the 1 percent level. With an R^2 of .88, the team *PCTWIN* function can be judged as rather completely specified. To the extent that *CONT* and *OUT* do not capture other dimensions of team quality, such as managerial and coaching inputs, the variance associated with omitted factor inputs appears to be quite small.

Team revenue (*REVENUE*) is estimated as a linear equation which specifies *PCTWIN* and market characteristics as the principal determinants.[6] *REVENUE* is defined as home attendance times average ticket price plus revenue from broadcasting rights.[7] The hypothesis is that fan attendance and hence, revenue, is positively affected by team wins. Fans respond to teams that win. When adjusted for differences in monopoly income among the teams, the partial coefficient of *REVENUE* with respect to *PCTWIN* is a measure of marginal revenue across teams. Franchises are granted as exclusive monopoly rights. The size of the geographical area will determine the magnitude of monopoly income. Accordingly, the 1970 population size of the Standard Metro-

[5] Data on *PCTWIN*, *TSA*, *TSW*, and the other variables were obtained from statistical baseball record books.

[6] The linear specification of the revenue function may be surprising, since one would normally expect diminishing returns to victories. However, estimated logarithmically, the coefficient between *REVENUE* and *PCTWIN* was 1.02, which was not significantly different from unity. The fact is that there is no nonlinearity present in the relationships. For computational simplicity in obtaining the player *MRP*, we chose to work with the linear specification. An intuitive justification for the existence of linear revenue functions in baseball is the age and stability of the industry. During the early period, perhaps, increasing returns were present. Currently, there is enough uncertainty of outcome that high win-loss records do not appear to be associated with declining marginal attendance.

[7] Noll kindly made the average ticket price data available. Broadcast revenues were obtained from *Sporting News*, p. 53. Note that the definition of team gross revenue employed here is incomplete. It does not include concession income, which amounts to about forty cents per fan, nor does it subtract the visiting team's share of the gate.

politan Statistical Area (*SMSA*) is included in the revenue function to adjust for the magnitude of monopoly income. Furthermore, interteam differences in *REVENUE* may exist due to interteam differences in the intensity of fan interest in various baseball cities. There is no reason to believe that the marginal revenues of all of the teams are the same. The demand for winning may be different from one baseball city to the next, and this phenomenon may be quite independent of the size of the *SMSA*. To adjust for interteam differences in the intensity of fan interest, the variable *MARGA* is included in the *REVENUE* equation. In the absence of time-series data on average ticket prices and broadcast revenues by team, *MARGA* is the coefficient obtained by estimating team specific attendance equations with time-series data covering the period 1957–71. These team attendance equations essentially estimated the relationship between team percent win and attendance over an extended period holding some other characteristics constant.[8] Wide differences in the slopes were observed, reflecting the phenomenon that teams obtained differential returns in raising their win-loss records. This finding supports Michael Canes' view that there are interteam differences in the elasticity of demand for winning. The partial coefficient of *REVENUE* with respect to *MARGA*, therefore, adjusts marginal revenue across teams for any interteam differences. Three other variables are included in the *REVENUE* function: the *NL* dummy which adjusts for returns due to a higher absolute quality of play in the National League; *STD* which is a dummy variable equal to one for the older stadiums located in poor neighborhoods with limited parking facilities; and *BBPCT*, the percentage of black players on the team. This last variable is included because previous studies have shown the existence of fan racial discrimination in baseball.[9]

The team *REVENUE* function was estimated with team data for 1968 and 1969. The statistical results are:

$$\text{(10)}\quad REVENUE_t = \underset{(1.69)}{-\ 1{,}735{,}890} + \underset{(6.64)}{10{,}330}\, PCTWIN_t + \underset{(4.61)}{494{,}585}\, SMSA_{70} + \underset{(4.28)}{512}\, MARGA + \underset{(1.84)}{580{,}913}\, NL - \underset{(2.42)}{762{,}248}\, STD_t - \underset{(3.13)}{58{,}523}\, BBPCT_t,$$

$$R^2 = .75,\ DF = 36$$

The empirical results indicate that raising the team win-loss record one point increases team revenue by $10,330. Since variables have been specified to control for monopoly effects in the industry, this coefficient can be interpreted as a marginal revenue product coefficient free of monopoly effects. For each 1 million *SMSA* population, revenues rise nearly one-half million dollars. For each one point increase in the fan interest coefficient *MARGA*, revenues rise $512. All of these coefficients are significant at better than the 1 percent level. Membership in the National League is worth nearly $581,000. The coefficient is significant at the 5 percent level. This income may be due to the higher absolute quality of play

[8] In the interest of conserving space, these equations are not presented here. The specification essentially consisted of a relationship between $Attendance_t$ and $PCTWIN_t$ and $PCTWIN_{t-1}$, plus several dummy variables to capture the effects of new stadiums, franchise shifts, and entry of new teams into the same geographical area. $PCTWIN_t$ was almost always highly significant with a coefficient range from 603 to 5,819; $PCTWIN_{t-1}$ was rarely significant. A time-series estimate of team attendance on *PCTWIN* for Seattle was not possible. Therefore, 43 observations were employed in equation (10).

[9] See the author (1973, 1974).

in the *NL*. If the team plays in one of the older stadiums, it can expect a reduction in revenue of about $762,000. If this coefficient which is significant at the 1 percent level is reasonably accurate, then it would not appear profitable for the affected team to build privately financed ballparks, even if they serve as multiple sports arenas. Most of the stadiums built during the 1960's cost about $500 per seat or $25 million for a seating capacity of 50,000. The new Three Rivers Stadium in Pittsburgh cost about $700 per seat or $35 million. Thus, servicing the annual debt amounts to about $1.5 to $2 million annually. This factor may explain the domination of publicly owned or subsidized stadia. Finally, a 1 percent increase in the percentage of black players on the team reduces revenues by nearly $59,000. The coefficient is significant at better than the 1 percent level. Overall, 75 percent of the variance in team revenues is associated with the variance in the independent variables specified.

The coefficient of primary interest is *PCTWIN*. From equation (10) a one point increase in *PCTWIN* is estimated to raise *REVENUE* $10,330. From equation (9) a one point increase in *TSA* or *TSW* raises *PCTWIN* by .92 and .90, respectively. Therefore, the marginal revenue product of hitters and pitchers is

$$MRP \text{ hitters} = .92 \times \$10{,}330$$
$$= \$9{,}504 \text{ per point } TSA$$
$$MRP \text{ pitchers} = .90 \times \$10{,}330$$
$$= \$9{,}297 \text{ per } 1/100 \text{ point } TSW$$

However, there are several complications. Since the production function omits a number of inputs, the marginal revenue products of the players may be overstated. Several omitted factor inputs come readily to mind, such as managerial quality, entreprenurial player drafting and trading abilities, and stadium investment. In some crude tests to ascertain the impact of these omitted factors, I found little evidence to suggest any association with *PCTWIN*.[10] Furthermore, the high R^2 in the *PCTWIN* function indicates that the omitted factors do not play a very large role. Nonetheless, certain costs incurred in fielding teams ought to be subtracted from player *MRP* to obtain a measure of player net marginal revenue products. To be conservative, therefore, I will treat these estimates as *gross* marginal revenue products.

To obtain the individual player *MRP*, assumptions have to be made about how individual performance affects team averages. I will assume that individual performance carries with it no externalities, so that team performance is simply the linear summation of individual performance.[11] Most team rosters are divided into ten pitchers and fifteen nonpitchers. Eight of the pitchers will be regular starting or relief pitchers. Therefore, we can

[10] For example, the zero-order correlations between *PCTWIN* and *STD*, $SMSA_{70}$ and *MARGA* were .13, −.03, and −.09, respectively. Therefore, capital investment in stadia or franchise value (correlated with $SMSA_{70}$) has no discernible effect on *PCTWIN*. During the course of the investigation, an attempt was made to specify managerial quality into the *PCTWIN* function. This was approached by estimating the managers' *PCTWIN* record regressed on their teams' *TSA* and *TSW*. It was argued that differences in the slopes of these coefficients would serve as a managerial quality index. These coefficients, however, were not related to current team performance, and, hence, the results are not reported here.

[11] Both player and team externalities may be present in professional baseball. In view of the bitterly competitive environment in professional sports, it is likely that the magnitude of these externalities is small. One player's performance can affect another's, positively or negatively. But there seems no way of incorporating externalities explicitly into the revenue function. Therefore, possibly the estimates of *MRP* for above (below) average players could be biased downward (upward) to some small, unknown degree. For the problem of team externalities, see Canes. Furthermore, in the equation in fn. 14, where individual batting averages are regressed on a number of variables including the rank or order of finish of the team, the coefficient is insignificant. A reasonable interpretation of these results is that team performance does not affect the individual player's performance.

assume reasonably that an average pitcher with a *SW* ratio of about 2.00 will contribute 0.25 (=.125 x 2.00) points to *TSW*. Of the nonpitchers or hitters, about twelve will be regular players or substitutes. Thus, we assume that an average hitter with a *SA* of 340 will contribute 28.3 (=.08333 x 340) points to *TSA*.

Gross marginal revenue products were calculated for players of various talents and are presented in the first column of Table 1. The outstanding characteristics of these estimates are their sheer magnitude. Even mediocre players contribute in excess of $200,000 to team revenues, while star players have *MRP* several times that amount.

How realistic are these *MRP* estimates? Such a question is difficult to answer precisely, since these are the first set of systematically estimated *MRP* for any occupation. However, some comparisons can be made which suggest that these estimates are of the right order of magnitude. Noll recently estimated a statistical demand curve for baseball. In his analysis there are two variables which capture the player's contribution to team attendance. One variable is the team's number of games out of first place. This variable is akin to the *PCTWIN* variable in equation (9). The second variable is a superstar variable, which Noll interprets as capturing the effect of superstars on attendance independent of their contribution to team victories. Neither variable is statistically convincing.[12] Statistical significance aside, some useful comparisons can be made. Taking Hank Aaron, who in 1968 had a slugging average of 498 and 11 percent of the team at bats, arbitrarily as an example, I calculate Aaron to be worth $520,800. Using Noll's coefficients, in an average size baseball city, Aaron was worth $225,000 because he was one of two players with superstar status, plus $375,000, because he would be the difference between victory and defeat in about 20 games. Thus, by Noll's method, in 1971 Aaron was worth about $600,000. Noll's results would seem to confirm the order of magnitude of the *MRP* in Table 1.

As a second comparison, David Davenport by a crude procedure estimated Sandy Koufax's *MRP* at $617,554. Using equation (9), dividing the *PCTWIN* coefficient in equation (10) by the 1969 average ticket price to obtain marginal attendance, multiplying by the 1966 average ticket price, and noting that Koufax had a *SW* ratio of 4.12 in 1966, his last season, and pitched 22.2 percent of the team's innings, I estimate that Koufax was worth about $725,000.

To obtain player net marginal revenue products, the compensation to other inputs and firm specific training or player development costs need to be subtracted. Unfortunately, this cannot be done precisely because of data limitations. However, it is possible to crudely measure average costs in baseball and subtract them from player marginal revenue products. In view of the fact that little correlation was discovered between *PCTWIN* and a number of nonplayer inputs, this may be an appropriate procedure a priori. In undertaking this procedure, I have been guided by two principles. First, I chose to overstate other factor costs so that the net marginal revenue products may be viewed as a lower bound. Secondly, where stated costs, such as administrative expenses, appeared to reflect attempts to hide profits, I chose to work with the smaller cost figures. These factors will become clear in the discussion.

In the course of the Curt Flood litiga-

[12] The t-values for Noll's games behind variable was 1.36, while the t-value for the superstar variable was 1.8 (see equation (7)). Since there is a great affinity between the games behind variable and the *PCTWIN* variable, Noll's relatively poor results can be reasonably interpreted as caused by collinearity between team wins and the number of superstars.

tion, the industry presented testimony on some aspects of its costs. Noll utilized these data in his study on the profitability of sports franchises. Using Noll's data, four general categories of costs can be identified: 1) team costs, which include principally roster and team specific nonplayer salaries; 2) game costs, which include transportation costs for eighty-one away games, equipment, stadium rental, etc.; 3) general administrative costs, which are principally salaries of the front office personnel; and 4) sales costs. The average team in 1969 had team costs of $1,072 million. The average player salary in 1969 was $25,000 for a total average roster cost of $625,000. Distributed over the twenty-five-man roster, this yields nonplayer team costs of about $14,000 per player. Minimum game costs were $800,000. These costs ought to be spread over the principal team personnel, that is, players, coaches, and managers. Dividing conservatively by 30, per player game costs amount to $26,700. Similar procedures for administrative and sales costs yielded per player costs of $13,300 and $3,300, respectively. Total nonplayer costs per player amount to $57,300. This leaves two costs to be accounted for: capital and training. Capital investment in sports franchises is an elusive concept. Classically, we think of capital investment as plant and equipment necessary for the production process. Capital investment in sports franchises consists of the purchase of a monopoly right and player contracts—a monopsony right. In some cases, stadiums are owned but more frequently they are leased. Controversy aside as to what constitutes capital in the industry and whether this has anything to do with the productive process, the average value of a baseball franchise is $8.4 million. Figuring an opportunity cost of 10 percent, capital costs spread over the team amount to $28,000 per player. Finally, according to industry reports, the average cost of player development is about $300,000 per player. This estimate is derived by dividing the entire cost of minor league operations by the number of players promoted to the major leagues. Such an estimate of training costs is a gross overstatement. However, taking the figure at face value, this amounts to an average annual cost of about $43,000 per player (average player life is seven years). Therefore, figured in this way, the total annual cost of fielding an average career length player amounts to about $128,300 plus his salary.

Table 1—Estimated Marginal Revenue Products and Salaries of Average Career Length Baseball Players

Performance $\overline{SA}$ or $\overline{SW}$	Gross Marginal Revenue Product	Net Marginal Revenue Product	Salary
	Hitters		
270	213,800	85,500	31,700
290	230,000	101,700	34,200
310	245,200	116,900	36,800
330	261,400	133,100	39,300
350	277,500	149,200	41,900
370	292,700	164,400	44,400
390	308,900	180,600	47,000
410	325,000	196,700	49,600
430	340,200	211,900	52,200
450	356,400	228,100	54,800
470	372,600	244,300	57,400
490	387,800	259,500	60,000
510	403,900	275,600	62,700
530	420,100	291,800	65,300
550	435,300	307,000	67,900
570	451,400	323,100	70,600
	Pitchers		
1.60	185,900	57,600	31,100
1.80	209,200	80,900	34,200
2.00	232,400	104,100	37,200
2.20	255,700	127,400	40,200
2.40	278,900	150,600	43,100
2.60	302,200	173,900	46,000
2.80	325,400	197,100	48,800
3.00	348,600	220,300	51,600
3.20	371,900	243,600	54,400
3.40	395,100	266,800	57,100
3.60	418,400	290,100	59,800

The net marginal revenue products for players with an average career length are presented in the second column of Table 1. Subtracting such costs substantially reduces the gross marginal revenue products of the players. Note, however, that even mediocre players with an average career length have net marginal revenue products in excess of their estimated salaries. Clearly, if the per player training investment cost of $300,000 is accepted at face value, mediocre players at some point less than the average career length will have negative net marginal revenue products. Two final points are worth making. First, training investment may vary with the quality of the player. Second, pitchers may require a greater training investment than hitters. My suspicion is that mediocre players require more training than superior players. Thus, training costs may be understated for the below average and overstated for the above average players. I also suspect that training costs are overstated for the hitters and understated for the pitchers.

IV. Salary Determination

In order to test the salary model outlined, data are required on player salaries and performance. Baseball, unlike other sports where player salary information is guarded, publicizes the salaries of its ball players. Frequently, the press is used as a bargaining tool in salary negotiations by communicating inside information on player demands and owner contract offers. Thus, annually there is widespread public information on individual player salaries. Additionally, there is a wealth of performance data on teams and players. Baseball statistics on player and team performance are the best of any sport.

Furthermore, baseball owners and players alike agree that salary and player performance are related and that playing performance is measurable. However, there is disagreement over which measures accurately reflect performance. Part of this controversy is due to the fact that baseball simultaneously is an offensive and defensive team sport. Disagreements about performance may partly depend on which aspect of the game is thought more important. The variables appearing in the regressions below are thought to be the best single, independent measures of offensive and defensive player performance available. The variables were not selected on entirely a priori grounds. Rather, experimentation with every known measure of performance was undertaken and then these performance measures were selected.[13]

Statistically, four factors seem important in the determination of major league

[13] I was guided initially in the specification of the player performance measures for the salary equations by the previous work of Pascal and Rapping. For hitters, they tried lifetime batting average, home runs, times at bat last season, age, and education. The performance measures for pitchers were games won per full season played, innings pitched per full major league season, total major league games won, total major league innings pitched, total seasons pitched, and differences between performance last year and lifetime performance. In one form or another, these variables explained a considerable portion of the variance in players' salaries (see their Table 3). Additionally, for nonpitchers, I calculated such measures as total bases, runs produced, extra base power, best at getting on base, base stealing, and fielding average. Such measures as pitching percentage, earned run average, hits divided by total batters faced, and games completed divided by games started were tried for pitchers. Furthermore, I considered certain factors not explicitly related to past performance. Since salary negotiations are based on expected performance, there is a certain risk associated with the prediction. Past deviations from average performance seemed like an appropriate way of incorporating expectations into the salary model. I also believed that required performance levels were likely to differ position by position, at least in the means, and attempted to take such differences into account along with the interclub average salary differentials. I believe no important factor was left uninvestigated. The fact that one performance measure or another or one plausible effect or another does not appear in the regression equations reported here does not mean that the measure or the effect was not associated with salary variations. Quite the contrary, most of the effects described above frequently were highly correlated with players' salaries, but their unique effects could not be isolated. For example, batting averages lagged one period and percentage deviation of the lifetime batting averages were significantly related to hitters' salaries but not independent of lifetime batting average.

ball player salaries. These factors are: hitting or pitching performance; the weight of the players' contributions to team performance; the number of years spent in the majors; and the greater bargaining power of "star" or "superstar" players.

One factor which governed the selection of the performance measures was that they be independent measures of the player's contribution to team performance. For hitters, the performance measure selected was lifetime slugging average, $\overline{SA}$. The lifetime batting average, which is a more popular measure of performance, does not take into account the number of bases advanced on a hit, although number of bases advanced is critical in scoring runs and hence winning games. Admittedly, some excellent hitters have low slugging averages. This difficulty was overcome by specifying a dummy variable $D_{\overline{BA}}$ in the hitter's salary equation which was equal to unity for those players with below average lifetime slugging averages but above average lifetime batting averages. The weight of the hitter's contribution $\overline{AB}$ is specified as his total lifetime at bats divided by his number of years in the majors times 5,500, the average season at bats for a major league team. The variable $\overline{AB}$ is a measure of the player's percentage contribution to team performance.

Pitching performance is more difficult to measure. The most common measure of pitching performance is the earned run average. However, the measure is virtually uncorrelated with salary. Pascal and Rapping found that the win-loss record was related to pitcher salary. However, neither measure of pitching performance is independent of team performance. Neither measure uniquely measures the pitcher's contribution to the team. In this study, the lifetime strikeout-to-walk ratio $\overline{SW}$ is employed as the single best measure of pitching performance. I also specify the lifetime average percentage of innings pitched out of total innings $\overline{IP}$ (approximately nine x games x years), as another important dimension of the pitcher's contribution.

Player salaries appear to rise automatically over time. Therefore, years spent in the majors M affect salary independently of average lifetime performance. This independent effect of time may be a pure seniority effect or it may measure the separate contribution of experience to playing ability. However, M seems to measure the phase in the career of the ballplayer and hence may adjust performance for trend.[14]

In view of the fact that size of $SMSA$, intensity of fan interest, and membership in the National League affect team revenues, one might suspect an influence of these variables on player salaries. It is a common notion that players are more highly paid in the National League and in the larger $SMSA$s. Economic theory cannot answer this question a priori. On the one hand, there is the view that the strong monopsony power of a monopolist located in a large market would yield lower salaries for such teams. Consistent with this view would be the greater demand of players for location in the large $SMSA$. Players derive nonbaseball income from

[14] This point is discussed in more detail in the author (1973). To determine whether the M coefficient largely reflected productivity increases over time, career batting averages for individual major league outfielders on teams in 1971 were estimated with the following statistical results:

$$BA_{it} = \underset{(.94)}{12.99} + \underset{(.63)}{1.483}\, NL - \underset{(.47)}{.1863}\, RANK + \underset{(17.45)}{.8850}\ \overline{BA} + \underset{(4.50)}{9.030}\ Log\ M,$$

$$R^2 = .42,\ DF = 725$$

The specification argues that the ith individual's batting average in season t is determined essentially by his lifetime career batting average or the mean batting average and the length of time in the majors. Neither NL nor the order of the finish of the team have an independent effect on BA_{it}. The results suggest about a 9 point increment in BA per season. Converted to an elasticity at the mean, productivity increases about 3.5 percent per season.

advertising firms and other sources which are located primarily in the large coastal population centers. On the other hand there is the view that within a bargaining framework, labor (players) would share in monopoly profits. Hence, this view would predict higher salaries where monopoly profits are large. As an interesting empirical test, $SMSA_{70}$, $MARGA$, and NL are included in the salary regressions.

Finally, players of rare talent, the stars and the superstars, command salaries apparently in excess of their relative contribution to the team. This introduces a nonlinearity into the salary equations. The nonlinearity may be explained by the greater bargaining strength of these players. There are very few substitutes for star players. Alternatively, the marginal revenue products of star players may be higher than their performance would strictly warrant. While I have not been able to confirm the fact empirically, fans may be drawn to the ballpark on the margin to see these players independent of their performance. To account for this effect, the salary regressions are estimated logarithmically.

There were two primary sources for the data used in the salary equations. All of the values of the independent variables were obtained or calculated from or based on *The Baseball Encyclopedia*. The salary data were made available to me by Pascal and Rapping and hence is the same salary sample as used in their study. Their data were obtained from reported salaries in twenty local newspapers and *The Sporting News*. There is reason to believe that the data are fairly accurate, but, equally important, there is no a priori reason to think that reporting errors, if any, are systematically related to any of the variables used in the analysis.[15]

The salary sample is nonrandom and biased toward the upper tail of the salary distribution. There are 148 observations, 87 of which are for 1968 salaries and the remainder for 1969. Of the 61 observations for 1969, 41 of the players also appear in the 1968 sample. Therefore, there are 107 nonrepeat observations. The salary range in the observations is from \$10,000 to \$125,000 with 34 observations below \$25,000. Thus, about 25 percent of the sample is in the lower end of the salary observations. In our judgment, enough observations over the whole salary range are present to make inferences about the populations. The mean salary of all the players in the sample was \$48,100. This figure may appear high, but it does not compare unfavorably to the reported average salary of \$42,200 in 1970 of 209 veterans on the major league teams.[16]

The player salary regressions are as follows:[17]

$$
\begin{aligned}
(11)\quad Log\, S_{hitters} = {} & \underset{(.82)}{.6699} + \underset{(4.76)}{1.0716}\, Log\,\overline{SA} \\
& + \underset{(7.53)}{.5220}\, Log\, M + \underset{(1.61)}{.0579}\, Log\, D_{\overline{BA}} \\
& + \underset{(3.10)}{.2746}\, Log\,\overline{AB} \\
& - \underset{(.78)}{.0621}\, Log\, SMSA_{70} \\
& + \underset{(2.81)}{.2645}\, Log\, MARGA \\
& + \underset{(.62)}{.0194}\, Log\, NL, \\
& R^2 = .81,\ DF = 85
\end{aligned}
$$

[15] Pascal and Rapping verified the salary data with Marvin Miller, head of the Major League Baseball Player's Association. For further discussion of the various data, see Pascal and Rapping and the author (1974).

[16] See the testimony of John Clark, Jr., Curt Flood Court Transcript, p. 1660.

[17] Since current salary depends on last year's lifetime performance, all of the independent variables were lagged one year. The t-values appear under the regression coefficients and *log* values are to the base 10.

$$(12)\quad Log\, S_{pitchers} = \underset{(4.16)}{3.3845} + \underset{(4.00)}{.8076}\, Log\, \overline{SW} + \underset{(7.70)}{.5015}\, Log\, M + \underset{(4.22)}{.9698}\, Log\, \overline{IP} - \underset{(.53)}{.0534}\, Log\, SMSA_{70} - \underset{(.61)}{.0619}\, Log\, MARGA - \underset{(.20)}{.0070}\, Log\, NL,$$

$$R^2 = .78,\ DF = 48$$

The main determinants of player salaries are, except for one case, $D_{\overline{BA}}$, which is significant at the 10 percent level, all significant at the 1 percent level or better. Overall, 78 to 81 percent of the variation in ballplayer salaries is accounted for. The remaining variance may reasonably be attributed to the vagaries of the bargaining process. However, as can be readily seen, the salary process in major league baseball is quite deterministic. The concept that ballplayer salaries are related to performance seems reasonably well confirmed.

With regard to the effect of $SMSA_{70}$, $MARGA$, and NL, it can readily be ascertained from the equations that while these variables play a substantial role in revenue determination for teams, they have virtually no effect on player salaries. Particularly noteworthy is that the $SMSA_{70}$ coefficient is in fact negative but in both cases insignificant. The $SMSA$ size has no effect on player salaries. While the absolute quality of play is higher in the National League, this effect does not raise player salaries. Finally, intensity of fan interest, $MARGA$, does not affect pitchers' salaries, but does contribute positively and significantly to hitters' salaries.

In the fourth column of Table 1 the predicted salaries of the ballplayers are reported. In determining the predicted salary, the variables other than the performance measures were set equal to their respective population means. For hitters, M was equal to 8 in the sample, while pitchers spent about six years in the majors. The shorter playing careers of pitchers is well known. On the average, pitchers have about 14 percent of the total innings pitched during a regular season. This is equivalent to about 207 innings or 23 game equivalents. Average hitters have about 7 percent of the at bats. Above average hitters are paid somewhat more for their performance, *ceteris paribus*, than above average pitchers. Undoubtedly, this reflects the effect of a two year average difference in time spent in the majors. However, below average hitters appear to earn less than below average pitchers. In part, this may be due to the fact that as good starting pitchers age, they can be used effectively by starting them less frequently and using their skills in relief. On the other hand, effective hitting cannot be improved by resting the batter.

V. The Degree of Monopsonistic Exploitation of Professional Ball Players

Once knowledge of player marginal revenue product and salary is obtained, it is a relatively simple matter to obtain estimates of the degree of monopsonistic exploitation. In Table 2, gross and net marginal revenue products, salary, and rates of monopsonistic exploitation are presented for three categories of players. Mediocre players are assumed to have career lengths of four years, with hitters having 5.0 percent of the team at bats, AB, and pitchers having 10.0 percent of the innings pitched, IP. Average players are assumed to have career lengths of seven years, with $AB = 8.0$ percent and $IP = 14.0$ percent assumed. Star players are assumed to have career lengths of ten years, with $AB = 10.0$ percent and $IP = 18.0$ percent. On the basis of an analysis of hitters'

TABLE 2—MARGINAL REVENUE PRODUCT, SALARY AND RATES OF MONOPSONISTIC EXPLOITATION FOR THREE QUALITY CATEGORIES OF PLAYERS

Career Performance $\overline{SA}$ or $\overline{SW}$	Gross Marginal Revenue Product	Net Marginal Revenue Product	Salary	Rate of Monopsonistic Exploitation $(GMRP-S)/GMRP$ Columns (2–4)/2	Rate of Monopsonistic Exploitation $(NMRP-S)/NMRP$ Columns (3–4)/3
Mediocre Hitter ($M=4$, $AB=5.0$ percent)					
255	121,200	−39,100	9,700		
264	125,500	−34,800	13,900		
273	130,200	−30,100	17,200		
283	135,000	−25,300	20,000		
Total	511,900	−129,300	60,800	.88	1.47
Mediocre Pitcher ($M=4$, $IP=10.0$ percent)					
1.50	139,500	−20,800	9,000		
1.55	144,100	−16,200	12,800		
1.61	149,700	−10,600	15,700		
1.66	154,300	−6,000	18,100		
Total	587,600	−53,600	54,800	.91	2.02
Average Hitter ($M=7$, $AB=8.0$ percent)					
305	231,900	103,600	14,100		
316	240,500	112,200	20,300		
327	249,000	120,700	25,000		
338	256,600	128,300	29,100		
350	266,100	137,800	32,700		
362	275,600	147,300	36,000		
375	285,100	156,800	39,000		
Total	1,804,800	906,700	196,200	.89	.79
Average Pitcher ($M=7$, $IP=14.0$ percent)					
2.00	260,300	132,000	16,500		
2.07	269,600	141,300	23,300		
2.14	278,900	150,600	28,600		
2.22	288,200	159,900	33,000		
2.30	297,500	169,200	36,900		
2.38	306,800	178,500	40,500		
2.46	316,000	187,700	43,700		
Total	2,017,300	1,119,200	222,500	.89	.80
Star Hitter ($M=10$, $AB=10.0$ percent)					
385	365,900	250,600	20,400		
398	378,300	263,000	29,400		
412	391,600	276,300	36,300		
427	405,800	290,500	42,200		
442	420,100	304,800	47,400		
457	434,300	319,000	52,100		
473	449,500	334,200	56,500		
490	465,700	350,400	60,500		
507	481,900	366,600	64,400		
525	499,000	383,700	68,000		
Total	4,292,100	3,139,100	477,200	.89	.85
Star Pitcher ($M=10$, $IP=18.0$ percent)					
2.60	437,000	321,700	27,200		
2.69	446,300	331,000	38,500		
2.79	464,900	349,600	47,200		
2.88	483,400	368,100	54,500		
2.98	502,000	387,500	61,000		
3.09	520,600	405,300	66,800		
3.20	539,200	423,900	72,100		
3.31	557,800	442,500	77,100		
3.42	576,400	461,100	81,800		
3.54	595,000	479,700	86,300		
Total	5,122,600	3,969,600	612,500	.88	.85

career performance, all players were assumed to increment their performance at the rate of 3.5 percent per season.[18] The principal difference in the marginal revenue products of the categories of players is due to higher lifetime performance levels and greater utilization of the better players. The principal difference in the net marginal revenue products arises from the higher gross marginal revenue products of the better, more intensively used players and the longer career length over which training costs are recovered. The rate of monopsonistic exploitation in the fifth column, which relates salary to the gross marginal revenue product, may be viewed as the upper bound of player exploitation, while the sixth column, which relates salary to the net marginal revenue product, may be viewed as the lower bound.

As examination of Table 2 reveals, players are generally exploited to a large degree in major league baseball. The exploitation index is bounded between 0 and 1 when $MRP > 0$. A value of 1.0 indicates complete exploitation and zero indicates no exploitation. Considered over career length, average players receive salaries equal to about 11 percent of their gross and about 20 percent of their net marginal revenue products. Star players receive about 15 percent of their net marginal revenue products. Only mediocre players have salaries in excess of their net marginal revenue products. On the whole, therefore, it seems that the economic loss to professional ballplayers under the reserve clause is of a considerable magnitude.

VI. Policy Implications

Economic analysis points to the exploitation of the professional baseball player under the reserve clause through the introduction of monopsony power. Empirical analysis confirms the existence of this exploitation and suggests that it is of considerable magnitude. The exemption of organized baseball from the antitrust laws has created such player economic rents. The decision of the Supreme Court against Curt Flood by no means removes the issue. The players are increasingly militant over the reserve clause and have made known their desire for modification of the clause in their collective bargaining negotiations. In the last round of negotiation, players obtained a concession of binding arbitration of salary disputes, but player-initiated transfers still are not possible. Furthermore, Congress is currently studying the problem and some alternatives may emerge. I can only mention and comment on the implications of some of the major suggestions.

One proposal would place baseball players under a contractual arrangement like pro football. Under this system, known as the "Rozelle Rule," a player can play out his option and become a free agent, but since the team purchasing the player must come to terms with the team for whom the player previously played, player-initiated transfers are an illusion. A similar idea in the proposed *NBA-ABA* merger agreement would produce similar consequences. Under their proposal a player can submit a salary dispute to nonbinding arbitration. If still dissatisfied, the player can switch to another team only if the two teams agree on a transfer price.

A second popular proposal revolves around a system of long-term contracts. Here players would be free agents until they sign a contract for five years or so. Their free agent status would revert at the expiration of the contract. Such a system would partially redistribute economic rents, would recover team player development costs, and would have minimal effect

[18] See fn. 14. Treating all players, both hitters and pitchers, over the quality range of performance as incrementing their performance at the rate of 3.5 percent per season is arbitrary.

on the equalization of team playing strengths.

The most radical proposal is a completely free labor market with all contracts for a full season being negotiated off-season. This proposal would eliminate player economic rents. Organized baseball argues that such a scheme would destroy the game. They point to the rich owner, who could not be prevented from buying all of the good players. They argue that investments in teams would be unattractive. Teams would fold and no buyers would be found. They also forecast the end of player development and minor league subsidies and hence long-term damage to the sport. None of these objections has more than superficial merit. As El Hodiri and Quirk have proved, the distribution of playing talent would be the same with or without the reserve clause; since the *MRP*s of players vary by city size, only equal distribution of revenues among the teams would effectively bring about equalization of play. Profitable investments in teams are still possible in the absence of monopsony rents, since monopoly profits remain. It is possible that reorganized with the league as the basic economic decision unit, instead of the team, baseball could operate as an efficient monopoly or duopoly rather than as an inefficient cartel. Finally, if players were to receive their *MRP*s, the players as in the Professional Golf Association would fully absorb their training costs. Baseball schools could develop players with the potential major leaguer paying tuition. These schools could be within organized baseball or independent of it. Or, perhaps, colleges will subsidize player development costs in baseball as they do in football and basketball. With modification in the reserve clause, the players could benefit and the game need not suffer.

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