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A Principal-Agent Model of Contracting in Major League Baseball

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Abstract

Traditional economic analyses of the reserve clause in major league baseball view it as having arisen from the superior bargaining of owners compared to players. This article interprets it instead as promoting efficient investment by teams in player development, given the transferability of player skills to other teams. Using a principal-agent framework, the article shows that limited player mobility emerges as part of the optimal contract between players (principals) and teams (agents).

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The traditional view of the reserve clause in major league baseball is that it was instituted by owners as a way of preventing rich teams from acquiring the best players, thereby maintaining competitive balance in the league.[1] Rottenberg (1956), however, proved this claim false when he argued that, as long as player trades (or sales) are allowed, the distribution of talent should be the same regardless of who holds the property rights to the players' labor services. In light of this "invariance proposition" (which is an illustration of the Coase Theorem (Coase, 1960)), the only effect of the reserve clause should be distributional: owners rather than players capture the return on the players' abilities.

This view of the reserve clause, however, is static in the sense that it takes the return to players' abilities as given, and interprets contracts between players and owners as a pure bargaining problem over that fixed value. In this context, the endurance of the reserve clause for nearly a century has been attributed to the players' inability to organize

[1] See, for example, Scully (1989, Ch. 1); Zimbalist (1992, Ch. 1); and Quirk and Fort (1992, Ch. 5). For an empirical analysis of the impact of the reserve clause on the distribution of player talent, see Depken (2002).

effectively. But what accounts for its continuing existence, albeit in limited form, in the current era of free agency and a strong players' union?

Daly (1992) has recently argued that there exists an efficiency rationale for the reserve clause due to the presence of contracting costs and the threat of player opportunism.[2] The argument is based on the idea that the economic return to a drafted player depends in part on a team's willingness to invest in training and development of that player. Such investments are especially important in professional baseball because, in contrast to football and basketball, college baseball ordinarily does not prepare a player to enter the major leagues directly. Instead, several years of minor league experience are usually needed (Shughart and Goff, 1992; Zimbalist, 1992, pp. 120, 171). The problem is that, once a player makes the majors, his skills are perfectly transferable to other teams, which, in a world of pure free agency, would be able to outbid the original team since they have not incurred the training costs.

In this setting, the reserve clause awards the original team exclusive rights to the player for some possibly limited period of time during which it can pay less than the market wage, thereby receiving a return on its initial investment. Moreover, rational players accept this limitation on their mobility for otherwise, teams will have no incentive to invest in training in the first place, thereby lessening the chances that they will make the majors. The reserve clause thus provides mutual benefits to players and owners (and hence social benefits) given that investment in player development is important.

The purpose of this paper is to formalize this argument using the apparatus of the principal-agent model, where the player is the principal and the team is the agent. We show that, even when players have the option to choose complete free agency, they do not find it in their interests to do so. Further, we show that in the optimal contract, players may not drive owners to their reservation profit level, even when they possess all of the bargaining power. Intuitively, players balance the benefits of a high wage (greater mobility) once they make the majors against the need to induce teams to invest in training, which increases players' chances of making it. Driving teams to zero profits may blunt this latter incentive, thus lowering player welfare. This suggests that team profitability should not necessarily be interpreted as a sign that teams are colluding or otherwise acting contrary to players' interests.

THE MODEL

The key element of the model is the function $p(x)$, which is defined to be the probability that a player makes the majors. It is assumed to be an increasing and concave function of x, the per-player investment by the team in training and development. Thus, $p'>0$ and $p''<0$. Let c be the per unit cost of x, which is assumed to be constant,[3] and let v be the lifetime value of the marginal product (VMP) of a player who makes the majors. (We assume players in the minors yield no return to the team.) From a social perspective, the expected return from a drafted players is therefore $p(x)v-cx$. A player who finances his own training would choose x to maximize this expression, yielding the first order condition

$$p'(x)v - c = 0. \tag{1}$$

Let x^* denote the solution to (1).

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[2] Also see Miceli and Scollo (1999).

[3] In reality, there are likely significant economies of scale in player training due to the high fixed costs of establishing a farm system. We ignore this issue here.

The problem is that players will generally not be willing or able to make the efficient investment on their own. Either they are risk averse, given the uncertainty of making the majors, or they are wealth constrained and unable to obtain a loan to cover the expense. This constraint is what leads to contracting between players and owners whereby the latter agree to finance the player's training in return for a share of the returns from those who make the majors.[4]

The terms of the contract are x, the level of investment the team promises to make, and w, the lifetime income of a major league player. Note that $w<v$ would represent a commitment by the player (enforceable by a court) to his original team for at least some part of his career (a reserve system), while $w=v$ represents complete free agency. The player's expected lifetime income under this contract is given by $p(x)w$.

As for the team, it expects a per-player return of

$$\pi = p(x)(v-w) - cx. \tag{2}$$

Suppose that, in order for the team to make the investment, it must receive a sufficient return to cover its opportunity cost, denoted $\overline{\pi}$ (that is, $\pi \geq \overline{\pi}$). This is referred to as the *participation constraint* in the agency literature. In addition, suppose that the player cannot observe, or cannot verify in court, the team's choice of x. This is the source of the agency problem. Formally, it is captured by the *incentive compatibility constraint*, which says that the team's choice of x must maximize its expected return in (2).

Given these constraints, we write the player's problem as

$$\max_{w,x} p(x)w \tag{3}$$

subject to:

[4] The idea is similar to a contingent fee for lawyers, whereby lawyers retain a share of the proceeds from a

$$p(x)(v-w)-cx \geq \overline{\pi} \qquad (3.1)$$

$$x = \arg\max\, p(x)(v-w)-cx \qquad (3.2)$$

Consider first constraint (3.2). The resulting first-order condition is given by

$$p'(x)(v-w) - c = 0, \qquad (4)$$

where the second-order condition is satisfied given $p''<0$. Let $\hat{x}(w)$ denote the solution to (4), where $\hat{x}(0) = x^*$ and $\partial\hat{x}/\partial w = p'/p''(v-w) < 0$. Thus, $\hat{x} < x^*$ for $w>0$. This implies the following trade-off for players. By seeking a higher *w* (greater mobility), they increase their lifetime income upon making the majors but lower their chances of making it by reducing the incentives of teams to invest in player development. The optimal contract balances these effects while ensuring the willingness of teams to participate.

The optimal contract can be derived graphically as follows.[5] First consider the incentive compatibility constraint. This is shown in Figure 1, which graphs $\hat{x}(w)$ in (x,w) space. Any contract must lie on this locus.

Next consider the participation constraint. Evaluating the left-hand side of (3.1) at $\hat{x}(w)$ and differentiating with respect to *w* yields

$$\begin{aligned}\frac{\partial\pi}{\partial w} &= [p'(v-w)-c]\left(\frac{\partial\hat{x}}{\partial w}\right) - p \\ &= -p < 0 \qquad (5)\end{aligned}$$

where the second line follows from (4). This implies that, along the $\hat{x}(w)$ locus, profits are decreasing in *w*. Thus, there is a critical value of *w*, denoted $\overline{w}$, below which the

lawsuit only if the plaintiff wins.

[5] See the Appendix for a formal derivation.

team earns expected profits above $\overline{\pi}$ and are therefore willing to participate in the contract. This range is shown by the darkened segment of $\hat{x}(w)$ in Figure 1.[6]

Having characterized the set of feasible contracts (i.e., those satisfying the constraints in (3)), we now turn to the player's optimal choice from this set. To proceed, note that the indifference curves for the player's objective function, *p(x)w*, are negatively sloped since

$$\frac{dx}{dw} = \frac{-p}{p'w} < 0 . \tag{6}$$

Further, they are convex to the origin given $p''<0$. The optimal contract is thus found by locating the highest indifference curve that just touches the feasible set.

Two types of optima are possible. The first is shown in Figure 1. In this case, both constraints are binding. Thus, teams are driven to their opportunity level of profit ($w = \overline{w}$), and they invest $\hat{x}(\overline{w})$ in player development. The second type of optimum is shown in Figure 2. In this case, the participation constraint is not binding, so teams actually earn more than their opportunity level of profit ($w = \widetilde{w} < \overline{w}$), and they invest $\hat{x}(\widetilde{w})$ in player development. In this second optimum, players place a high value on *x* relative to *w*, and so are willing to accept a lower lifetime income upon making the majors (a stricter reserve system) in order to induce teams to spend more on player development.

CONCLUSION

Two implications follow from these results. First, the interests of players and owners are not in opposition to the degree that the static bargaining approach to contracting implies. In particular, if the optimal contract is of the second type, owners

[6] We assume that $p(x^*)(v-w)-c^* > \overline{\pi}$ so that a contract with $w>0$ is feasible.

actually expect to make above normal profits in the *players'* optimal contract. As a result, owner profits are not necessarily a sign that they are exercising disproportionate bargaining power (for example, through collusion), or are acting contrary to the players' interests.

Second, as the importance of team investments in player development decline, the player's indifference curves steepen (i.e., players are willing to accept a smaller decrease in w to obtain a given increment in x). This suggests that the first type of optimum is more likely to arise. As this happens, contracting will more closely resemble a pure bargaining problem. Thus, for example, if teams begin to rely more on colleges as a source of player development in baseball--meaning that they transfer player development costs to colleges and/or players--we would expect conflicts between players and owners to escalate.

APPENDIX

This appendix provides a formal solution to the constrained optimization problem in (3). The Lagrangian for the problem is given by

$$L = p(x)w + \lambda[p(x)(v-w) - cx - \bar{\pi}] + \mu[p'(v-w) - c] \tag{A1}$$

where λ and μ are the multipliers on the participation and incentive compatibility constraints, respectively. The first-order conditions for w and x are given by

$$\frac{\partial L}{\partial w} = p - \lambda p - \mu p' = 0 \tag{A2}$$

$$\frac{\partial L}{\partial x} = p'w + \lambda[p'(v-w) - c] + \mu p''(v-w) = 0 \tag{A3}$$

Using (4), we can solve (A3) for μ to get

$$\mu = \frac{-p'w}{p''(v-w)} \tag{A4}$$

which is positive given $v>w$ (which must be true by (3.1)). Thus, the incentive compatibility constraint is binding. Now, solving (A2) for λ yields

$$\lambda = 1 - \mu p' \tag{A5}$$

which may be positive or zero. Thus, the participation constraint may or may not be binding.

Together, (A2) and (A3) imply

$$\frac{-p}{p'w} + \frac{\lambda p}{p'w} = \frac{p'}{p''(v-w)} \tag{A6}$$

Note that the first term on the left-hand side is the slope of the player's indifference curve (see (6)), while the term on the right-hand side is $\partial\hat{x}/\partial w$, the slope of the incentive compatibility constraint. Thus, if the participation constraint is binding, $\lambda>0$ and the player's indifference curve is steeper than the $\hat{x}(w)$ locus at the optimum. This is the case in Figure 1. In contrast, if the participation constraint is not binding, λ=0 and the player's indifference curve is tangent to the $\hat{x}(w)$ locus at the optimum, as in Figure 2.

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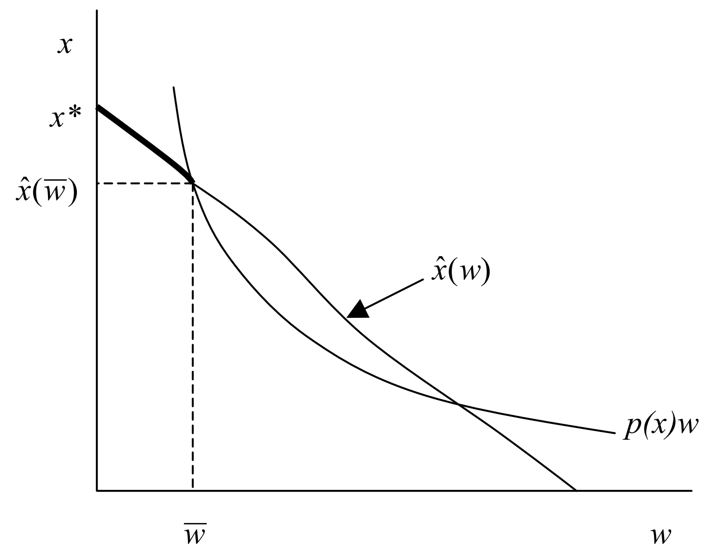

Figure 1: Optimal contract when incentive compatibility and participation constraints are both binding.

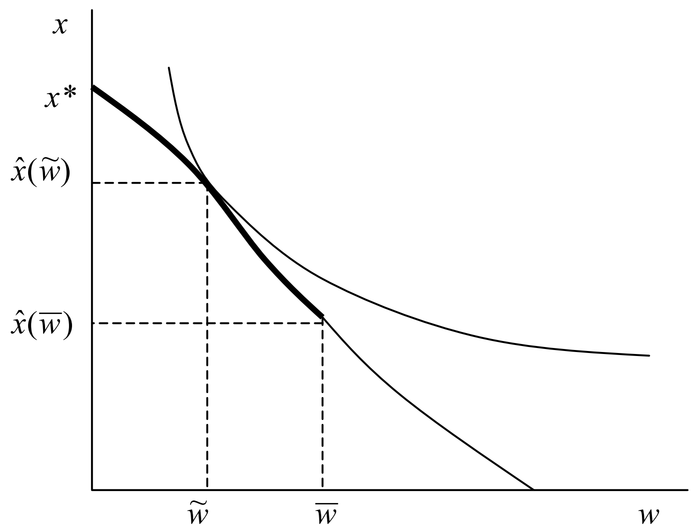

Figure 2: Optimal contract when only incentive compatibility constraint is binding.