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The Underpayment of Restricted Players In North American Sports Leagues

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Abstract

In this paper, we consider whether underpaying players restricted by the reserve clause is a common practice in the three largest sports leagues in North America—the NFL, NBA, and MLB. Our results are consistent with the hypothesis that owners of professional sports teams do exercise monopsony power whenever and wherever they can. Although differences exist across the three sports, our results indicate that in general: restricted players are underpaid; when the negotiating power of players rises, owners are less able to extract a surplus; and, the greatest surplus tends to be extracted from those who create the greatest amount of value.

Keywords: underpayment, reserve clause, surplus, free agent

Introduction

One of the most widely held notions in sports economics is that owners of professional sports teams exercise monopsony power whenever and wherever they can. To create countervailing power, players have responded by forming labor unions to bargain with owners on a more level plane. But most collective bargaining agreements favor veteran players, leaving younger players to the mercy of owners. In Major League Baseball (MLB), for example, most players with three or less years of experience are subject to the reserve clause which allows owners to unilaterally determine their salaries. Only with experience comes eligibility for arbitration, free agency, and a more equal bargaining relationship. While the particular rules pertaining to eligibility dif-

fer, similar bargaining rights exist in the National Football League (NFL) and the National Basketball Association (NBA).

In this paper, we survey the three largest sports leagues in North America to see the extent to which the underpayment of restricted players is common across these leagues. While a similar study was conducted on MLB (Krautmann et al., 2000), the other sports leagues have been largely ignored. As such, we hope to provide sports economists with evidence of how common such a practice is and to provide a comparison of the size of such underpayments across leagues.

Our results indicate that the underpayment of restricted players is a common practice among all three leagues. For those restricted players with the least degree of negotiating power, this underpayment (or surplus) ranges from about $492,000 for football players to more than $2.7 million for starting basketball players. As a player's negotiating power increases, the surplus extracted from him falls—in the case of baseball players, it falls from $1.2 million to less than $250,000. Finally, we find that the best players are underpaid the most—in the case of restricted baseball players, the surplus extracted from starters is more than five times that extracted from utility players.

Literature Background

It is not surprising that fans appear resentful toward professional athletes given that player salaries typically run into the millions of dollars. But regardless of how large salaries are in professional sports, economists tend to be more concerned with an athlete's salary in relation to the value he generates for his team. If a player generates $3 million for his team, yet is paid *only* $1 million, we would still consider him underpaid.

Most of the prior work on this topic has concentrated on MLB. Rottenberg (1956) was one of the first to discuss the monopsonization of baseball talent arising from the reserve clause. He reasoned that profit-maximizing owners would pay a salary somewhere between the player's Marginal Revenue Product (MRP) and his non-baseball salary. Scully (1974) devised a novel method for estimating a baseball player's MRP by separately estimating the player's Marginal Product (MP) and the team's Marginal Revenue (MR). By comparing this imputed MRP to the player's salary, Scully concluded that players from the pre-free agency era (i.e., prior to 1976) were paid only about 10 to 20 percent of their MRP. He later applied his methodology to the salary conspiracy of the mid-1980s and found that wages of free agents had fallen to about 30 percent of MRP (Scully, 1989). Subsequent studies applying the Scully method have come to a wide variety of conclusions regarding whether free-agent baseball players are paid their MRPs.[1]

In a paper addressing the role of training costs and player salaries, Krautmann et al. (2000) proposed a free-market approach to assess the MRP of baseball players restricted by the reserve clause. By assuming that a competitive labor market would result in free agents being paid their MRP, these authors substituted free-agent wages for MRP, then estimated the determinants of MRP in a standard wage regression model. Applying the estimated coefficients from this regression to the performance statistics of a restricted player gives this player's imputed MRP (or alternatively, what the restricted player would have been paid if he was a free agent). Comparing this estimate of MRP to the player's actual wage would yield an estimate of the amount by which he is underpaid. These authors found that the average "Journeyman" (i.e., an arbitration-

eligible player) is essentially paid his MRP, while the average "Apprentice" (i.e., an arbitration-ineligible player) is paid only about 25 percent of his MRP. These results parallel the conclusions reached in Zimbalist (1992a).

On the whole, the literature seems fairly unanimous in its conclusion that restricted baseball players have been, and continue to be, underpaid. While the notion of underpaying restricted players is widely held, there has been very little analysis done on other sports leagues.[2] In this paper, we update the literature by looking at the underpayment of restricted players across the three largest sports leagues. In addition, we hope to explain the size of the underpayment by such things as characteristics of the player and his team, as well as the idiosyncrasies of the particular league.

Estimating the Surplus Using the Free-Market Approach

While the Scully approach to estimating MRP is quite innovative, it is limited when it comes to a cross-league comparison of salary determination. For one, some leagues share broadcast revenues equally across all teams, meaning that this important component of revenues is essentially fixed. Since fixed revenues are completely win-inelastic, this component of revenues should not enter into the computation of a team's MR. Yet studies suggest that teams do share some portion of these fixed revenues with players, which creates problems for defining and estimating the MR component of MRP.[3] A further problem can arise in identifying a particular player's MP. It is well-known that player-productivity in some sports is highly interdependent, making it nearly impossible to completely separate out the individual's contribution to team wins.

One advantage of using the free-market approach is that it does not entail the need to explicitly estimate a team's MR nor the player's MP. Given the intensity of the bidding process for free agents, this approach assumes that a free agent's wage reflects his marginal value to his team (regardless of whether this value comes from the gate, from broadcasting, or from concessions). As such, this approach skirts the need to explicitly compute the marginal revenue of a win. Furthermore, one would expect a team's bid to reflect a free agent's contribution to winning *in conjunction with the other players on the team.* For example, consider the bidding process for a free-agent NFL running back. A rational bid for a running back would surely internalize the particular characteristics of the team's offense. If a team's offensive line is geared for run blocking, then a running back with exceptional running skills will receive a high bid from this team's GM. But if the offensive line is geared for pass protection, then we would expect the GM to look for a running back that is able to take on a blitzing linebacker and/or is especially adept at receiving the dump-off pass. An explosive running back on a team set for pass protection is less valuable (hence, will be offered a lower wage) than a running back who is more proficient at blocking. Similar arguments can be made for baseball and basketball as well. The same type of allocative efficiency we traditionally ascribe to competitive markets applies here as well—that is, competitive bidding results in heterogeneous talent being allocated to its best-fit team. As such, the free-market approach should be impervious to the empirical limitations of fixed revenues and interdependency.

Because there are many characteristics that might make a player valuable to his team, this approach suggests that the analyst uses a sufficiently broad measure of the player's productivity, one which spans many facets of performance.[4] In MLB, a broad

and popular metric of a player's offensive productivity is his OPS (equal to the sum of his On-Base Percent and Slugging Average). In basketball, the NBA Efficiency metric has been shown to be a good representation of how player performance is compensated by decision makers. Because the NFL does not compute and publish a composite metric of productivity for offensive players (other than for quarterbacks), we use instead two independent measures designed to capture the offensive productivity of football players: total yards and touchdowns from passing, rushing, and receiving.

Economic theory suggests that a player's MRP is determined by his contribution to team success (i.e., his performance), as well as other factors affecting the team's marginal revenue:

$$MRP_i = f(Perf_i, Z_i) \tag{1}$$

The free-market approach begins by assuming that the competitive bidding process for a free agent ultimately aligns his wage to his MRP. Because our interest is in estimating the value of a player's productivity to his team, we substitute the free agent's wage for his MRP in (1) and run a standard regression of wages on expected performance, E(Perf), and other variables, Z:

$$wage_i = \alpha + \beta_1 E(Perf_i) + \beta_2 Z_i + \varepsilon_i \quad (\forall i \in \text{ free agents}) \tag{2}$$

Expected or *ex ante* performance is used in (2) because new free agent contracts are signed before the beginning of the season. Finally, the wage data used in this analysis includes a prorated value of all signing bonuses and other compensation components.

Since the coefficients in (2) are estimates of the marginal returns to the right-hand side variables (especially productivity) on MRP, we can apply these estimates to the restricted player's data to get his imputed MRP:

$$\widehat{MRP}_j = \alpha + \widehat{\beta_1} E(Perf_i) + \widehat{\beta_2} Z_j \quad (\forall j \in \text{ restricted players}) \tag{3}$$

Finally, to estimate the underpayment (SURPLUS), one simply compares the restricted player's imputed MRP to his actual wage:

$$\text{SURPLUSj} = (\widehat{MRP}_j - wage_j) \tag{4}$$

where SURPLUS > 0 implies that the restricted player is underpaid (relative to a comparable free agent) and SURPLUS < 0 implies that he is overpaid.[5]

We then examine whether the surplus extracted from restricted players varies systematically with characteristics of the player, team, or league. In MLB, for example, arbitration-ineligible Apprentices have less bargaining power than arbitration-eligible Journeymen. As such, one would expect Apprentices to be more susceptible to exploitation, thus generate a larger surplus. Further, starting (or full-time) players contribute more to team wins than utility (or part-time) players; thus the surplus extracted from starting restricted players may be larger than that extracted from utility players.[6]

In addition to these player characteristics, there are a number of differences between the leagues which could also have an impact on the size of the surplus. For example, owners may be more willing to exercise their monopsony power if they can justify extracting a surplus from their restricted players to help them recoup their player

development expenses associated with the minor-league system. In this regard, we would expect the surplus of restricted baseball players to be large given the degree to which MLB teams depend upon its minor leagues teams for developing players (Krautmann et al., 2000). The same possibility existed in the NFL during the years included in our sample. For example, in 2006, 226 players in the NFL had played in the NFL Europa League. That said, the league also acknowledged that NFL Europa was also designed to market American professional football in Europe.[7] As such, while attributing the recovery of training and development costs of NFL Europa may be legitimate in part, to attribute all costs associated with NFL Europa to player development ignores the marketing mission of that league. Given that NFL Europa was discontinued in 2007, we see the investigation of this question as a fruitful area for future research. While a development league does exist in the NBA (i.e., the D-League), teams in the NBA do not rely heavily upon (nor do they have much of a financial commitment to) this minor league. NBA teams typically only allocate one or two players to their affiliated D-League team.[8] In this regard, owners of NBA teams may not be able to justify recouping training expenses in the same manner as do owners of MLB (and possibly NFL) teams. Another reason to expect the surplus in MLB to be larger arises from the fact that there is a large supply of reserve players residing in the minor leagues. Such a large reserve of substitutable players yields MLB owners a credible alternative which may be used at the negotiating table. Finally, the surplus may vary across leagues simply because of differences in the degree of risk associated with highly paid draft picks that never end up producing for their team.

The manner in which initial salaries are determined also differs dramatically across the leagues. Though drafted baseball and football players can negotiate their salaries with the teams which drafted them, no such negotiating takes place for draftees in the NBA. The Collective Bargaining Agreement (CBA) in the NBA establishes fixed league-wide salaries for all first-round draft picks regardless of the particular player's value.

Finally, with the exception of place kickers, injuries would be expected to play a more critical role in terms of the expected careers of football players. If this greater propensity for injury leads to shorter expected careers, then one can hardly fault NFL players for getting as much money as they can early in their careers. As such, restricted NFL players may be less willing to be underpaid than players in the NBA and MLB.

Underpayment in Major League Baseball

Free Agent Wage Equation

We begin by gathering a sample of baseball players who were eligible for free agency during the 1997 to 2002 seasons; this sample consists of 308 potential free agents. Given the empirical problems incumbent with the specialization of pitchers, we focus our analysis on just free agent position players (i.e., hitters). The primary performance statistic used here is an ex ante estimate of the player's OPS, equal to the sum of on-base percent (OBP) and slugging average (SA).[9] This metric is preferred over either of the other two measures individually in that it recognizes the player's ability to get on base in any manner together with his ability to move around the base path. Forecasts of this performance statistic are calculated yearly in the "Projections for Batters" Appendix in Bill James' *Major League Handbook*. The vector of control variables, Z,

includes the player's primary position played, the population of the metropolitan area in which his team is located (POP), and a dummy variable which captures whether he is a starter or utility player (UTILITY).[10]

As is standard procedure in this type of analysis, we estimated equation (2) in terms of the natural log of salary (where salaries have been measured in constant 2004 dollars). The Ordinary Least Squares (OLS) estimates of free agents' wages are presented in Table 1. According to Table 1, teams in larger cities pay higher wages, utility players get paid less, and those players who are generally valued for their defensive productivity get paid a higher salary.[11] A free agent's wage also rises with his performance—the coefficient on OPS is positive and significant. To get an idea of the economic significance of performance on salary, we evaluated (2) at the point of means and found that a starting second baseman whose OPS rises from the mean (i.e., 0.734) to two standard deviations above the mean (i.e., 0.896) would result in a threefold increase in his real salary—rising from $1.6 million to $4.6 million.

Surplus of Restricted Players in MLB

To calculate the underpayment of restricted baseball players, the estimates from Table 1 were applied to a sample of restricted baseball players in the 2002 and 2003 seasons. This sample consists of 165 Apprentices and 78 Journeymen. Table 4 contains the median values of the SURPLUS (in $2004), segmented into Apprentices and Journeymen, as well as starters versus utility players.[12]

Not surprisingly, Table 4 shows that bargaining power is a very important determinant of SURPLUS. Regardless of how one separates the data, the median surplus

Table 1: Free Agent Wages in MLB
($2004)
Dependent variable: ln(wages)

Variable	Coefficient	T-STAT
Constant	9.488***	19.91
OPS	6.428***	9.80
POP	0.000014*	1.72
CAT	0.287**	2.09
FIRST	0.121	0.71
SS	0.731***	4.45
THIRD	0.185	1.22
LF	-0.091	-0.51
CF	0.668***	3.54
RF	0.219	1.19
UTILITY	-0.524***	-3.73
R^2	0.48	
# observations	224	

*** significant at 1% level
** significant at 5% level
* significant at 10% level

Table 2: Free Agent Wages in the NFL
($2004)
Dependent variable: ln(wages)

Variable	Coefficient	T-STAT
Constant	13.55***	119.6
NONQBYD	0.001***	6.03
NONQBTD	0.014	0.90
QBYD	0.0001	0.63
QBTD	0.043**	2.20
POP	0.001	0.57
QB	0.22	1.30
RB	-0.27*	-1.90
WR	0.04	0.38
UTILITY	-0.02	-0.21
R^2	0.46	
# observations	308	

*** significant at 1% level
** significant at 5% level
* significant at 10% level

Table 3: Free Agent Wages in the NBA
($2004)
Dependent variable: ln(wages)

Variable	Coefficient	T-STAT
Constant	13.36***	75.33
NBAEFF	0.139***	15.39
POP	1.13×10^{-8}**	1.98
CENTER	0.624***	6.34
PWFORWARD	0.323***	3.17
SMFORWARD	0.210**	2.00
PTGUARD	0.166	1.64
UTILITY	-0.071	-0.713
R^2	0.64	
# observations	378	

*** significant at 1% level
** significant at 5% level
* significant at 10% level

Table 4: Median Values of Surplus (in $2004)
Restricted Players
(Number of observations in each cell)

		All Players		Starters	Utility
		SURPLUS	Wages as a % of MRP	SURPLUS	SURPLUS
MLB	Apprentices[1]	$1,217,000 (165)	19%	$1,676,000 (114)	$311,000 (51)
	Journeymen[2]	$221,000 (78)	86%	$304,000 (64)	-$158,000 (14)
NFL	Apprentices[3]	$492,000 (198)	50%	$575,000 (71)	$482,000 (127)
	Journeymen[4]	$264,000 (86)	77%	$551,000 (59)	$178,000 (27)
NBA	Apprentices[5]	$732,000 (272)	66%	$2,700,000 (83)	$564,000 (189)

Notes:

[1] For MLB, Apprentices refers to arbitration-ineligible players (mostly those with less than four years of experience)

[2] For MLB, Journeymen refers to arbitration-eligible players (those with between four and six years of experience)

[3] For the NFL, Apprentices refers to reserve players (those with less than three years experience and playing under the reserve clause)

[4] For the NFL, Journeymen refers to restricted free agents (those with three years of experience, and whose team can match any free-agent offer)

[5] For the NBA, Apprentice refers to players with less than four years of experience

extracted from Apprentices is positive and many magnitudes larger than that extracted from Journeymen. Table 4 shows that the median surplus extracted from Apprentices is $1.2 million, more than five times larger than that extracted from the typical Journeyman. On a relative basis, this means that the wage paid to a typical Apprentice is less than 20 percent of his MRP, while the typical Journeyman is paid over 85 percent of his MRP. Not only do owners extract the greatest surplus from those with the least bargaining power, but they also extract the greatest surplus from the best players. In the case of Apprentices, the surplus extracted from starters is over five times larger than that extracted from utility players.

Underpayment in the National Football League

Free Agent Wage Equation

For football players, equation (2) was estimated using salary data based on a sample of 308 free agents from the 2004 and 2005 seasons. Due to rules restrictions pertaining to which players can legally advance the ball during a typical play, our sample contains only offensive players at the quarterback, tight end, wide receiver, and running back positions. For purposes of identifying the productivity metrics associated with salary, we tested a variety of common measures including total yards, touchdowns scored, fumbles, and interceptions. While we did not find any significant relationship between salaries and either type of turnover, we did find that total yardage and touchdowns were significantly related to salary. We also found that the quarterback position is fundamentally different from any of the other offensive positions considered (perhaps due to the fact that quarterbacks are involved in every offensive play). As a result, our final set of productivity measures separate out the quarterback from the other offensive positions. In particular, the productivity metrics used here include: rushing and passing touchdowns for quarterbacks (QBTD); rushing and receiving touchdowns for non-quarterbacks (NONQBTD); total yards from rushing and passing for quarterbacks (QBYD); total yards from rushing and receiving for non-quarterback (NONQBYD).[13] We also included dummy variables for the quarterback (QB), wide receiver (WR), and running back (RB) positions.

To estimate the wage equation, the *ex ante* measure of a player's productivity is based on his performance in the prior season (i.e., $E(Perf_t) = Perf_{t-1}$). The primary reason for using the prior season is that player contracts in the NFL are rarely guaranteed for more than one year; as such, we would expect a player's salary to be closely aligned with his performance from the year before. Salary data are the official cap values (salary plus any prorated signing and other bonuses), obtained from *USA Today*'s online database.[14] We recognize that the inclusion of amortized signing bonuses mean that annual cap values are based in part on a team's forecasted valuation at the time of the signing as opposed to spot wages for current productivity. However, to include *only* the non-guaranteed portion of a player's salary would significantly underestimate payments to players for the productivity they provide. While the use of non-guaranteed payments could constitute a test of some form of reservation payment (wage), it would be a strongly inferior choice in our effort to estimate the relationship between total payments to labor and productivity. As was the case for MLB, equation (2) was estimated in terms of the natural log of salary, where the salary variable was measured in constant 2004 dollars.

One feature of football that makes it particularly difficult to determine which players should be considered "starters" versus "utility players" is that players are often substituted on a play-by-play basis (depending on the situation; e.g., short yardage, third down and long, etc.). If we had data which measured the number (or percentage) of plays the player was involved in, then we could potentially use this to delineate starters from utility players. But absent such information, we are left to separate these two types of players using a more generic measure of participation. In this study, the criteria we used to identify starters are: quarterbacks with more than 100 passes; running back with more than 75 rushes; wide receivers with more than 35 receptions; and, tight

ends with more than 25 receptions. In each case, players with less than the threshold were considered utility players. We acknowledge that any division of this type is at some level arbitrary. Yet, absent data at the individual play level, we lack a continuous measure of participation.

Because the NFL has no local television revenues, and because gate revenues are shared extensively, one would not expect market size to have the same impact on NFL salaries as it does in MLB.[15] To allow for this possibility, however, we include the population (POP) of the metropolitan area, as measured in hundreds of thousands. Finally, we have included positional dummy variables to control for quarterback (QB), running backs (RB), wide receivers (WR), and tight ends. The omitted dummy variable in our estimation is the tight-end position.

The results of running OLS on equation (2) are reported in Table 2. Not surprisingly, we found that market size is not an important determinant of players' salaries. The point estimate on UTILITY is negative, but insignificant, meaning that utility players are not paid less for the productivity that they generate than starters. Although we find this result a little surprising, it may be due to the criterion used to delineate starters from utility players.

Of particular interest are the coefficients on the productivity measures. Table 2 shows that the coefficients on NONQBYD and QBTD are both significant and positive, suggesting that more productive players receive higher salaries. Though the coefficients on NONQBTD and QBYD are both insignificant, this is likely due to the high correlation between touchdowns scored and total yards gained.[16]

Surplus of Restricted Players in the NFL

Applying the results of the estimation in Table 2 to the 198 Apprentices (reserved players) and 86 Journeymen (restricted free agents) in 2004 and 2005 allows us to examine the underpayment of restricted players in the NFL. These results appear in Table 4. While not as dramatic as was the case in MLB, we find that the surplus extracted from restricted players again varies by the degree of negotiating power. Table 4 shows the median surplus for Apprentices is over $492,000, while the median surplus for Journeymen is only $264,000. These results imply that the typical Apprentice in the NFL receives about 50% of his MRP, while the typical Journeyman is paid over 75% of his MRP. Consistent with our expectations, those players who generate the largest productivity tend to have the greatest surplus extracted from them. In Table 4, starters generate a larger surplus than that generated by utility players (although the difference is not as severe as that seen in MLB).

Underpayment in the National Basketball Association

Free Agent Wage Equation

For basketball players, equation (2) was estimated using a sample of free agents who signed multi-year contracts from the 2000-01 through 2005-06 seasons. This sample consists of 378 player-observations. We estimate free agent salaries in the NBA as a function of three key factors—player performance, market size, and position played. The key variable, player performance, is measured by the official NBA Efficiency metric (NBAEFF) because this appears to be the primary statistic used in the salary deter-

mination decision.[17] Because a player's contribution to the team varies across position played (i.e., big men tend to get rebounds and not commit turnovers, guards do the opposite), this performance measure is calculated relative to the average performance at each position. This relative performance measure is then adjusted to reflect the NBA Efficiency on a per-game basis.[18]

In addition to this performance metric, we included the population (POP) of the metropolitan area of the player's team to control for possible market-size effects. To control for position-related effects on salary, we included dummy variables for the center position (CENTER), power forward (PWFORWARD), small forward (SMFORWARD), and point guard (PTGUARD). The omitted dummy variable in our estimation is the shooting-guard position. Finally, we included dummy variables to control for bench player (UTILITY), here defined as those who averaged less than 24 minutes per game. The dependent variable used is the log of the average salary on the newly signed contract, measured in constant 2004 dollars.

The OLS estimates of equation (2) are reported in Table 3. Table 3 also shows that neither market size nor bench players are related to free agent salaries. Our results also suggest that teams pay a premium for centers and forwards (relative to shooting guards). In regards to performance, our results are not surprising. We find that a player's productivity has a significantly positive impact on his salary. To get the economic impact of this effect, consider a shooting guard whose productivity rises from the mean (10.4) to two standard deviations above the mean (20.8).[19] The estimates in Table 3 predict that such a player would see over a 300 percent rise in his salary—going from $3.1 million to $13.8 million.

Surplus of Restricted Players in the NBA

The results reported in Table 3 were applied to a collection of restricted NBA players. Given that NBA rosters contain only 12 players, for the most part, only first-round draft picks make the team that drafted them. Furthermore, the collective bargaining agreement (CBA) during the sample period specified the salaries for these draftees and locks in those players for the first three years of their career.[20] As such, those players on NBA rosters with less than four years experience are almost entirely composed of players whose salaries were determined by the terms of the CBA. For this reason, we defined the set of restricted players as those with less than four years of NBA experience. Our sample contains all such players during the 2005-06 and 2006-07 seasons.

Our results indicate a substantial level of underpayment of restricted NBA players. Table 4 shows that the median surplus extracted from all restricted basketball players was $732,000, implying that the typical player received only about two-thirds of his MRP. Furthermore, in comparing restricted starters to restricted utility players (where a starter is defined as a player who averaged at least 24 minutes per game), we find that starters generate nearly five times the surplus generated by utility players.

Cross-League Comparisons and Concluding Observations

Altogether, our results are consistent with the hypothesis that owners of professional sports teams exercise monopsony power whenever and wherever they can. Although the absolute size of the surplus, and the potential justification for doing so, may differ across the three sports, the following similarities are more striking:

- restricted players are significantly underpaid,
- the surplus falls with the negotiating power of the player,
- and the largest surpluses are extracted from those players who create the greatest value.

We entered this research project expecting Apprentices in MLB to generate the largest surplus of all three sports. For one, owners spend a much greater amount on their minor leagues, and thus need to use this surplus to recoup as much of their training expenses as possible. While development leagues do exist in the NFL and NBA, the commitment to these minor leagues is inconsequential compared to that seen in MLB. In addition, the large supply of replacement players residing in baseball's minor leagues give MLB owners many more options than in the NFL or NBA, thus yielding owners even more negotiating power.

Indeed, we found that the average Apprentice in MLB is paid only about 19% of his MRP—the smallest percent across all three sports. But in an absolute sense, the size of the surplus extracted from starting NBA Apprentices was the largest of all three sports. This might be explained in large part by the wage-determination process in the NBA. Apprentices in MLB and the NFL are free to negotiate their initial salaries when they are first drafted (although, most Apprentices in MLB are paid the Major League minimum salary). But the salary of a first-round draft choice in the NBA (who is often a starter) is completely determined by the terms specified in the CBA. This is consistent with the major conclusion we find across all three sports—owners extract surplus wherever and whenever they can. Since the greatest value is generated by starters, and these players have the least amount of countervailing power, it is not surprising to find that the largest surplus is extracted from the young restricted superstars.

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Endnotes

[1] See Cassing and Douglas (1980), Sommers and Quinton (1982), Hill (1985), Zimbalist (1992a, 1992b), Blass (1992), Oorlog (1995), and Bradbury (2007).

[2] A recent working paper by von Allmen et al. (2006) did look at the underpayment in the NFL, although the issue has not been applied to the NBA in over two decades (see Scott, Long, and Sompii, 1985).

[3] Berri, Brook, and Schmidt (2004) introduced a model of gate revenue for the NBA, a model that was expanded for Berri, Schmidt, and Brook (2006). When total revenue is used as the dependent variable, each win was found to be worth (i.e., MR) about $540,000. Yet NBA teams paid out a total of $1.8 billion to their players in 2006-07, which works out to about $1.5 million per victory. The reason the value per victory is so much higher than the MR is that the Collective Bargaining Agreement specifies that players receive a share of the national broadcasting revenues. As such, sharing these fixed revenues makes deriving an estimate of a team's MR very difficult.

[4] In labor economics, tenure is an important control variable used to impute a worker's MRP primarily because analysts typically do not have direct measures of productivity. In sports economics, on the other hand, the analyst is able to directly measure the player's performance, as long as the analysis proxies MP using reasonable and sufficient statistics. As such, we do not need to include experience (and possibly, its square) as we are directly measuring this component of productivity.

[5] Note that our use of the variable SURPLUS is a measure of what the restricted player would have received *if* he were a member of the free agent class (instead of the disadvantaged class). Whether this underpayment arises from the monopsonistic exploitation of owners, or is directly a result of terms specified in the CBA (which allows for such exploitation), our measure of SURPLUS is simply a proxy for the difference between what such a player is worth and what he is paid.

[6] This may be particularly likely given that most Apprentices (especially in MLB and the NBA) are paid the minimum salary stipulated in the Collective Bargaining Agreement.

[7] Data on NFL Europa alumni are from Brian Baldinger, "The Passing of NFL Europa Shouldn't be taken Lightly." At http://www.nfl.com/nflnetwork/story?id=09000d5d8014a7d4&template=with-vi. In this article, Baldinger argues strongly for the development role of the league. The marketing function of the league is acknowledged in the announcement of the league's closure in "NFL Europa Closes" at http://www.nfl.com/news/story?id=09000d5d801308ec&template=without-video&confirm=true.

[8] An owner of a local D-League team told one of the co-authors that the primary function of the D-league was to create a supply of non-playing labor (e.g., referees, sports marketing, etc.).

[9] When it comes to the production of team wins, the OPS metric does a reasonable job in predicting wins as any other metric or set of metrics. In an auxiliary regression of team wins on ERA and OPS, we found that the adjusted R-square was 0.86. When we ran the regression of wins on ERA and SA and OBP, the adjusted R-square remained at 0.86. Furthermore, by summing SA and OBP together, this metric implicitly weighs each productivity component equally. This is particularly appealing given that a simple regression of free-agent salaries on SA and OBP revealed that the regression coefficients on these two productivity measures were not significantly different from each other. Thus, since both measures are equally valued when it comes to compensation, and OPS weighs the two measures equally, we believe OPS provides a reasonable productivity measure to determine salaries.

[10] A utility player is defined as one who is expected to appear in fewer than half of the games played over the entire season (i.e., less than 81 games).

[11] The defensive positions refer to the catcher, shortstop, and centerfielder positions. In Table 1, all three positions are paid significantly more than the default position (i.e., second base).

[12] Median, rather than mean, values are reported given the typically skewed nature of income-related data. We would like to thank Michael Leeds for making this suggestion to us.

[13] In some way, our measures of productivity appears to double count the yards produced by players on the field. That is, yards passing by a QB must be equal to the yards receiving by a receiver. This is not, however, a problem in the analysis because yards produced by QB and receivers is a joint product which necessitates both sides of the pass. If a pass is thrown, but no player receives it, it does not produce wins. Clearly, general managers understand this joint production aspect of NFL players, and their wage bids for players should be an efficient reflection of this recognition. As such, there should be no problem of "doubling counting" when it comes to the determination of salaries.

[14] The USA Today database cap value for each player "represents the player's pro-rated signing bonus, plus salary and other bonuses for the season…[O]ther Bonuses includes roster, report, workout and other bonuses, plus any likely-to-be-earned bonuses." Source: "USA Today Salaries Databases: Football." http://content.usatoday.com/sports/football/nfl/salaries/default.aspx

[15] In the NFL, the home team keeps 60% of the gate, while the remaining 40% goes into a pool shared by all teams.

[16] In our sample, the correlation coefficient between NONQBYD and NONQBTD was greater than 0.80, while the correlation between QBTD and QBYD was greater than 0.90.

[17] The NBA Efficiency metric is given by: (Points + Rebounds + Steals + Assists + Blocked Shots – All Missed Shots – Turnovers). Although the work of Berri et al. (2006) offered evidence that this measure is not the best metric of a player's impact on wins, it is a very good measure of how player performance is evaluated by coaches and general managers (hence closely related to a teams' salary bids). A similar story was told in Berri and Krautmann (2006).

[18] Specifically we determined each free agent's per-minute NBA Efficiency value. We then subtracted the average at each position, and then added back the average value for NBA Efficiency

across all positions, or 0.45. Once we took these steps, we then multiplied what we had by the number of minutes a player played.

[19] To give an example of a shooting guard performing around the mean NBA Efficiency per game is Bryant Stith in the 2001-02 season. A player performing around two standard deviations above the mean is Allen Iverson in the 2003-04 season.

[20] The CBA was updated in 2005 so that first-round draft picks were automatically signed to a two-year contract, with the team having an option for the third and fourth years.

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