appears that Slovenia and Serbia Proper are more output efficient than Pannonia and that both regions are more efficient than the Poor region. These regional findings seem to concur with Milanovic's (1987) study of regional growth and development policy. Milanovic argues that less developed republics could not efficiently utilize the large volume of investment resources allocated from the more developed republics via the central government.

We next compare the mean output efficiencies of the three regions in both the private and social sectors. The Poor region is the least efficient in both sectors. Slovenia and Serbia Proper are more output efficient than Pannonia in the social sector. However, these two regions are equally efficient in the private sector.

These results give us insight into the overall regional efficiency differences. First, it seems that the Poor region is uniformly the least efficient region, regardless of sector. Second, the overall superiority of the Slovenia and Serbia Proper region is due primarily to its greater efficiency in the social sector.

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FREE AGENCY, LONG-TERM CONTRACTS AND COMPENSATION IN MAJOR LEAGUE BASEBALL: ESTIMATES FROM PANEL DATA

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Abstract—Using longitudinal data for Major League Baseball players, this paper estimates the effects of eligibility for free agency or arbitration on compensation and contract duration. Because eligibility is based on experience and better players are kept longer, a fixed effects approach is used. Arbitration and free agency eligibility both raised annual compensation; however, only free agency raised contract duration. The free agency findings are consistent with Nash bargaining; however, additionally considering the arbitration results suggests the "winner's curse": duration rises only when a team might lose a player. The auction market is thus avoided.

I. Introduction

Professional baseball is an excellent setting for studying labor market monopsony. First, players are subject to varying degrees of restrictions on their rights to free agency—the right to negotiate with any team of their choosing. Second, data on compensation and performance in professional sports are much more detailed than comparable information for workers in general.

This paper uses longitudinal data for Major League Baseball players to estimate the impact on compensation and contract duration of being eligible for free agency or for salary arbitration. Because eligibility is based on experience and because the better players are likely to be kept longer, we use a fixed effects approach, exploiting the longitudinal nature of the data file.

While players may desire the insurance value of long-term contracts, this value depends on the negotiating rules. Under the "reserve clause"—that is, the player is ineligible for free agency—the potential gains to the team in selling insurance to players are lower than under free agency. Further, the team avoids a potential bidding war by signing a long-term contract. Thus, under free agency, one would expect less owner

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resistance to long-term contracts than under the reserve clause.

II. Free Agency Rules, Arbitration and Salary Determination in Major League Baseball

Under current rules, major league baseball players become eligible for salary arbitration after 3 years of major league service and for free agency after 6 years.[1] Following the season during which a player becomes eligible for free agency, he may enter into contract negotiations with any other team(s) he designates. If he signs with another team, then that team will generally have to give compensation in the form of draft choices to the original team.[2] Players not eligible for free agency are said to be subject to the *reserve clause*, under which the team reserves the sole right to negotiate with the player (i.e., the team owns title to the player's contract) for the following year(s).[3]

We compare in a single year framework free agency with the reserve clause. Let M be the player's marginal revenue product, which we assume to be known with certainty.[4] Assume also for convenience that M is the same across teams. Then under free agency, the player's compensation W will equal M.[5]

Under the reserve clause, salary bargaining is a situation of bilateral monopoly. Without asymmetries in the bargaining procedure (e.g., time between offers) or in beliefs about the probability that negotiations will break down, Binmore, Rubinstein and Wolinsky's (1986) Nash bargaining model has a solution that maximizes (assuming team risk neutrality):

$$(M - W)(U(W) - U(W_0)), \tag{1}$$

where W_0 is the player's status quo income (i.e., the player's income in the event that he does not sign a contract).

In (1), $(M - W)$ is the difference between the team's total income and its status quo income (as is postulated in Nash bargaining models), assuming a contract at compensation W. Note that (1) assumes that the team's income from employing other players is not affected by this player's output. Under this assumption, the team's portion of the Nash maximand does not include income produced by other players. If players affect others' productivity, then one can redefine M accordingly.

Under these assumptions, the solution to (1) is

$$M = W + (U(W) - U(W_0))/U'(W). \tag{2}$$

The player earns less than his marginal revenue product.

To examine issues of free agency and long-term contracts, suppose that the player and the team are uncertain about M. They may wait for a realization of M and negotiate a one-period contract; alternatively, the firm can sell insurance by offering a long-term contract, in advance of the realization of M.

If worker utility has the constant relative risk aversion (RRA) property, then it is shown in an appendix available upon request that the player's willingness to pay for insurance is higher under free agency than under the reserve clause. This result is due to the fact that there is a larger variance to insure against under free agency than under the reserve clause. Part of this variance may include the fear of a career-ending injury. If there is a cost associated with setting up a long-term contract, then a higher player demand for insurance will raise the likelihood of such contracts. However, under more general utility functions (e.g., declining RRA), player demand for long-term contracts may not be higher under free agency.

A commonly noted alternative explanation for the greater incidence of long-term contracts for free agents is that the team wants to avoid a bidding war. Under the reserve clause (which is a kind of one-way long-term contract), the team is under no threat of losing the player. Such an explanation is based on the irrationality of the winner's curse phenomenon (Cassing and Douglas, 1980). Finally, since free agents have more experience, teams may have a better estimate of their future M than that of noneligibles, facilitating long-term contracts.

Salary Arbitration

As noted, players with at least three years' major league service are eligible for salary arbitration. Under such a procedure, an arbitrator is agreed upon by the Players Association and the teams' Player Relations Committee.[6] The arbitrator is constrained to choose the final offer of either the player or the team, with no compromise. Arbitrators are directed to consider the following criteria in deciding salary cases: player performance during the past season, length and consistency of the player's career, comparative salaries, and the team's recent performance in the standings and at the gate. Further, the arbitrator is (except for players with 5 or more years of service) instructed to pay

[1] A year of service is defined as 172 days of being on the team roster or on injured reserve. See *Basic Agreement between The American League of Professional Baseball Clubs and The National League of Professional Baseball Clubs and Major League Baseball Players Association*, March 19, 1990, pp. 60–61.

[2] See *Basic Agreement* . . . , pp. 48–57.

[3] See *Basic Agreement* . . . , p. 48.

[4] Later we will consider the influence of uncertainty.

[5] The certainty assumption is obviously stylized. One might more reasonably view M as the player's expected productivity. Uncertainty about M increases with contract duration.

[6] This description of arbitration is based on *Basic Agreement* . . . , pp. 11–15.

special attention to comparison players with no more than one additional year of experience than the player in question. Arbitrators are free to weigh these criteria in any manner they deem appropriate. However, they are not allowed to consider evidence regarding the team's financial position, press comments about the player or team, offers made by the team or player during negotiations, the direct costs of arbitration (e.g., attorneys' fees) or salaries in other sports.

Players eligible for arbitration but not free agency include those with 3, 4 or 5 years of major league service.[7] Players with 5 years of service will become free agents in one year, unless they are signed now to long-term contracts. Thus, the insurance argument applies to this group, and the effects of free agency would be enjoyed by this group now even without arbitration. Arbitration for those with 5 years' service will involve some comparisons with free agents or with other 5 year players who have signed long-term, free agency-influenced contracts. For those with 4 years' service, arbitration will involve comparisons with some 5 year players; and arbitration for 3 year players will involve comparisons with some 4 year players.

According to the insurance argument, arbitration eligibility should lead to longer contracts than for those not eligible. This expectation is based on the possibly higher level of uncertainty about negotiated or arbitrated salaries under spot agreements. Both M and the potential behavior of the arbitrator are uncertain. For example, it has been argued that arbitrators attempt to balance their decisions over players and teams (Scully, 1989, p. 162).

III. Data and Empirical Procedures

To examine the impacts of free agency and arbitration eligibility on salaries and long-term contracts, a longitudinal data file on major league baseball players was constructed. Salary data, contract information, player performance data and local market data were collected for roughly all major league players for 1987–1990. In addition, the sample of long-term contracts was extended back to the 1983–86 period, with some contracts going back as far as 1979.[8] Compensation data include base salary, signing bonuses and the present value of deferred payments. We computed major league service to determine eligibility status.[9]

To estimate the impacts of free agency and arbitration eligibility, we note that eligibility is experience-related and that the better players are more likely to be kept longer. Further, the collective bargaining contract defines major league service as including bench time and time on injured reserve (as well as playing time). Thus, eligibility may be correlated with productivity, even controlling for playing experience.

We therefore take a fixed effects approach that in principle can eliminate the omitted variable problem:

$$\ln S_{it} = a_1 JARB_{it} + a_2 LAST_{it} + a_3 FREE_{it} + B'X_{it} + f_i + u_{it}, \tag{3}$$

where for each player i negotiating at time period t,

- S = average annual player compensation (salary, signing bonuses and the present value of deferred payments) over the life of the contract signed at time t
- $JARB$ = dummy variable indicating that the player is eligible for salary arbitration but not free agency and that the player is not currently in his last year of ineligibility for free agency
- $LAST$ = dummy variable indicating that the player is in his last year of ineligibility for free agency (and is therefore eligible for salary arbitration)
- $FREE$ = dummy variable indicating eligibility for free agency (and also arbitration)
- X = vector of performance and market variables to be discussed below
- f = fixed, unmeasured productivity effects
- u = serially and contemporaneously uncorrelated error term.

In (3) a contract for an individual player is the unit of observation. If f is correlated with the variables of interest, then ordinary least squares (OLS) applied to (3) will give a biased estimate of the impact of negotiating status on salaries. However, according to Hausman and Taylor (1981), the following fixed effects ("within group") estimator will give consistent estimates of the parameters on the time-varying variables in (3):

$$D \ln S_{it} = a_1 DJARB_{it} + a_2 DLAST_{it} + a_3 DFREE_{it} + B_z' DZ_{it} + Du_{it}, \tag{4}$$

where the D prefix indicates that the variable is measured as the deviation from its mean across observations for that individual, and Z is the subvector containing all of the elements of X that are time-varying. Note that (4) eliminates the fixed effect f, as it is time-invariant.

[7] Starting in 1991, 17% of those with at least two years' but less than three years' service became eligible for arbitration. See *Basic Agreement* ..., p. 11. Since our data end with 1990 contracts, this provision does not affect our findings.

[8] Data are taken from: Chass (1987 and 1990); *The Sporting News*, January 2, 1989, pp. 56–57; *The New York Times*, April 6, 1989, p. 48; *The Sporting News*, April 23, 1990, pp. 22–23; *The Sporting News*, weekly issues from 1983 through July 1990; *The Baseball Encyclopedia*, 8th edition; *The Sporting News Baseball Register*, 1987 through 1990 editions; *The Sporting News Baseball Guide*, 1990 edition; U.S. Department of Commerce (1987) and Statistics Canada (1987).

[9] See footnote 1.

The within group estimator can be compared to the following "between group" estimator of all of the parameters in (3):

$$M \ln S_i = a_1 MJARB_i + a_2 MLAST_i + a_3 MFREE_i + B'MX_i + f_i + Mu_i, \quad (5)$$

where an M prefix indicates that the variable is measured as the mean for all of the observations on individual i. If f is (partially) correlated with the variables of interest, then the between group estimator will give a biased estimate of the parameters. On the other hand, if f is uncorrelated with the arbitration or free agency eligibility variables *JARB*, *FREE* or *LAST*, then the between and within group estimators have the same expected value. We implement Hausman and Taylor's (1981) test for equality of the two estimates.

Turning to the actual specification of X, we note that performance criteria for pitchers differ radically from the criteria for position players. Hence, separate equations were estimated for these two groups.

Nonpitchers

For nonpitchers, the vector X of explanatory variables includes:

CONSTANT
BA = player's lifetime batting average as of the signing of the contract
EBA = lifetime (extra bases attained through extra base hits)/(at bats)
BBA = lifetime walks/at bats
SBG = lifetime stolen bases per game
CATCH = dummy variable for catchers
INF = dummy variable for non-first base infielders
ALL = percentage of seasons named to the all-star team
GOLD = percentage of seasons player won a Gold Glove award (for being the best fielder in the league at his position)
INC = 1985 per capita income in the team's Standard Metropolitan Statistical Area (SMSA)
POP = 1986 SMSA population
WHITE = dummy variable for whites
*Y*86, *Y*87, *Y*88, *Y*89, *Y*90 = dummy variables for contracts signed, respectively, in 1986, 1987, 1988, 1989, or 1990
*EX*1, *EX*2, *EX*3, *EX*4, *EX*5, *EX*6, *EX*7, *EX*8, *EX*9, *EX*10 = dummy variables for players who played major league baseball in, respectively, one, two, three, four, five, six, seven, eight, nine, or ten different seasons,

and the values of the variables *BA* through *GOLD* for the most recent season before the current contract.

Pitchers

The vector of explanatory variables for pitchers includes:

CONSTANT
WPCT = career winning percentage
ERA = career earned run average
PS = percentage of a pitcher's games which he has started
PSV = percentage of appearances resulting in a save
STWPCT = *PS* * *WPCT*
STPSV = *PS* * *PSV*
STERA = *PS* * *ERA*
ALL, *INC*, *POP*, *Y*86, *Y*87, *Y*88, *Y*89, *Y*90, *EX*1, *EX*2, *EX*3, *EX*4, *EX*5, *EX*6, *EX*7, *EX*8, *EX*9, *EX*10, *WHITE*, and the values of *WPCT* through *ALL* for the most recent season before the current contract.

The model for pitchers distinguishes between statistics for relief pitchers and starters. In addition, the inclusion of ten experience dummies allows for a more detailed profile than the usual quadratic term.[10] Further, note that in the within group regressions, *WHITE* drops out. However, where appropriate, we tested for race differences in the other coefficients, although recent research has not found salary discrimination in baseball (Kahn, 1991). Finally, we restrict the analysis to players with multiple contract negotiations, as necessitated by the fixed effects model.

IV. Results

Table 1 provides descriptive statistics. Salary and contract duration are highest for free agents (*FREE* = 1) and for those in the year prior to free agency eligibility (*LAST* = 1). Tables 2–4 show selected within group and between group regression results. For the nonpitchers within group model, Chow tests rejected, for each dependent variable, coefficient equality between whites and nonwhites, necessitating the use of separate regressions. However, the effects of being eligible for arbitration but more than one year away from free agency (*JARB*), free agency (*FREE*) and being in one's last year before free agency (*LAST*)

[10] Jiobu (1988) finds that hazard rates (exit from baseball) rise with experience from about 5% at 1–2 years to 70% at 10 years.

TABLE 1.—MEAN VALUES FOR COMPENSATION AND CONTRACT DURATION BY ELIGIBILITY STATUS

Eligibility Status	Number of Cases	Annual Compensation	Contract Duration	Total Compensation
		Nonpitchers		
Reserve Clause Only	491	$153,497	1.01 yrs.	$160,539
JARB = 1	281	618,067	1.37 yrs.	974,449
LAST = 1	78	825,636	1.76 yrs.	1,843,018
FREE = 1	294	766,571	1.62 yrs.	1,538,547
Total	1144	470,993	1.31 yrs.	829,312
		Pitchers		
Reserve Clause Only	331	$149,388	1.02 yrs.	$151,971
JARB = 1	234	529,316	1.26 yrs.	732,114
LAST = 1	69	870,709	1.58 yrs.	1,694,246
FREE = 1	197	806,610	1.59 yrs.	1,475,003
Total	831	472,068	1.27 yrs.	757,035

TABLE 2.—SELECTED WITHIN GROUP RESULTS FOR NONPITCHERS

	Dependent Variable					
	LSAL		*DUR*		ln(*SAL* * *DUR*)	
	Whites	Nonwhites	Whites	Nonwhites	Whites	Nonwhites
LAST	0.4821	0.4373	0.3043	0.1754	0.6211	0.5591
	(0.0914)	(0.1045)	(0.1339)	(0.1579)	(0.1344)	(0.1593)
JARB	0.3617	0.4344	0.0226	−0.1292	0.3637	0.3648
	(0.0510)	(0.0605)	(0.0747)	(0.0914)	(0.0750)	(0.0922)
FREE	0.4433	.03469	0.4622	0.4318	0.6780	0.5900
	(0.1108)	(0.1475)	(0.1623)	(0.2228)	(0.1630)	(0.2247)
BA	−2.2332	−3.2691	−0.1637	−1.6638	−2.3553	−4.173
	(0.7807)	(0.9412)	(1.1439)	(1.4218)	(1.1486)	(1.4341)
EBA	−0.8742	4.3004	−1.2014	2.1399	−1.6048	5.8216
	(0.8203)	(1.1098)	(1.2019)	(1.6766)	(1.2069)	(1.6911)
BBA	2.4422	0.9629	1.2831	0.4441	3.2271	1.1798
	(1.0566)	(1.0141)	(1.5482)	(1.5319)	(1.5546)	(1.5451)
SBG	1.9724	0.217	0.5426	0.2914	2.1827	0.1909
	(0.7236)	(0.5362)	(1.0603)	(0.8100)	(1.0647)	(0.8170)
ALL	0.6622	0.7104	−0.3531	1.8133	0.667	1.3694
	(0.2187)	(0.3356)	(0.3204)	(0.5069)	(0.3217)	(0.5113)
GOLD	1.1514	0.7786	−1.8416	0.8173	0.9658	1.2473
	(0.5890)	(0.3881)	(0.8631)	(0.5863)	(0.8666)	(0.5913)
BAL	2.0084	2.5443	0.7955	1.2553	2.4591	3.3129
	(0.4778)	(0.4156)	(0.7001)	(0.6278)	(0.7029)	(0.6332)
EBAL	0.7254	−0.3874	0.4898	−1.0229	0.9976	−1.2654
	(0.4204)	(0.5237)	(0.6161)	(0.7912)	(0.6186)	(0.7980)
BBAL	−0.1248	−0.0677	−0.0336	−0.3373	−0.1786	−0.2322
	(0.1443)	(0.2041)	(0.2114)	(0.3083)	(0.2123)	(0.3109)
SBGL	0.1215	0.0503	−0.0267	0.202	0.1659	0.1397
	(0.1944)	(0.1342)	(0.2848)	(0.2027)	(0.2860)	(0.2045)
ALLL	0.1078	0.0293	0.3949	−0.4304	0.2658	−0.1261
	(0.0640)	(0.0712)	(0.0937)	(0.1075)	(0.0941)	(0.1084)
GOLDL	0.0605	0.2854	0.6492	0.0889	0.1895	0.3461
	(0.1301)	(0.1092)	(0.1907)	(0.1650)	(0.1915)	(0.1664)
Sample size	670	474	670	474	670	474

Notes: Standard errors are in parentheses. *SAL* (*LSAL*) is (ln) annual compensation. *DUR* is contract duration in years. For other explanatory variables, see text. An *L* suffix signifies the last season's value for the variable. Results for other variables are available upon request.

TABLE 3.—SELECTED WITHIN GROUP RESULTS FOR PITCHERS

	LSAL		*DUR*		L = ln(*SAL* * *DUR*)	
	Whites	Nonwhites	Whites	Nonwhites	Whites	Nonwhites
LAST	0.2788	0.5322	0.4552	0.4009	0.5350	0.7640
	(0.0863)	(0.1553)	(0.1187)	(0.2135)	(0.1231)	(0.2214)
JARB	0.3593	0.2757	−0.0644	−0.0203	0.3360	0.2688
	(0.0509)	(0.1022)	(0.0701)	(0.1405)	(0.0726)	(0.1457)
FREE	0.0447	0.3057	0.9155	0.5264	0.5100	0.6600
	(0.1146)	(0.1973)	(0.1576)	(0.2713)	(0.1634)	(0.2813)
WPCT	−0.6983		−0.4483		−0.9779	
	(0.2606)		(0.3584)		(0.3716)	
ERA	−0.1945		−0.0176		−0.2017	
	(0.0522)		(0.0718)		(0.0745)	
PS	−1.0784		0.3778		−0.8857	
	(0.5406)		(0.7434)		(0.7709)	
PSV	−0.1143		−1.907		−0.8803	
	(0.6177)		(0.8495)		(0.8808)	
STWPCT	0.5992		−0.4547		0.3877	
	(0.5251)		(0.7222)		(0.7488)	
STPSV	−4.048		2.0538		−3.226	
	(2.0489)		(2.8177)		(2.9217)	
STERA	0.1953		−0.0574		0.1684	
	(0.0688)		(0.0947)		(0.0982)	
ALL	0.6554		0.7341		1.1033	
	(0.2998)		(0.4122)		(0.4274)	
WPCTL	0.3408		0.298		0.5262	
	(0.0948)		(0.1304)		(0.1352)	
ERAL	−0.0153		0.0011		−0.017	
	(0.0138)		(0.0189)		(0.0196)	
PSL	0.322		0.2986		0.4627	
	(0.1673)		(0.2300)		(0.0239)	
PSVL	1.2584		1.4785		1.9004	
	(0.2780)		(0.3824)		(0.3965)	
STWPCTL	0.1582		−0.0102		0.1525	
	(0.2020)		(0.2777)		(0.2880)	
STPSVL	−0.0246		−0.502		−0.3537	
	(1.3933)		(1.9162)		(1.9869)	
STERAL	−0.0275		0.033		−0.0465	
	(0.0181)		(0.0250)		(0.0259)	
ALLL	0.0382		−0.1925		−0.0691	
	(0.0689)		(0.0947)		(0.0982)	
Sample size (pooled)	831		831		831	

Note: Based on regressions pooled by race with different race effects for *LAST*, *JARB*, and *FREE*. For other variables, see text. Results for other variables are available upon request.

TABLE 4.—SELECTED BETWEEN GROUP REGRESSION RESULTS FOR LOG ANNUAL COMPENSATION

Explanatory Variable	Nonpitchers		Pitchers	
	Whites	Nonwhites	Whites	Nonwhites
JARB	0.6749	1.0474	1.0673	1.2036
	(0.1131)	(0.1383)	(0.1512)	(0.3580)
FREE	0.8218	1.1279	1.0825	1.2108
	(0.1418)	(0.2284)	(0.1720)	(0.2821)
LAST	1.1207	1.1446	1.2467	1.5126
	(0.1914)	(0.2018)	(0.2216)	(0.5721)
Chi-square (within vs. between)	174.35	144.20	163.34 (pooled)	
d.f.	36	36	39	
rho	< .005	< .005	< .005	
Sample size	218	163	278	

Note: Results for other variables are available upon request.

were not significantly different by race.[11] For pitchers, there were only 85 nonwhite player-years; we thus pooled by race and interacted *WHITE* with the eligibility variables. *F*-tests showed that such interactions were significant as a group only for log annual compensation (*LSAL*). However, for pitchers, none of these interactions was significant in any individual case.

Hausman-Taylor (1981) tests for the presence of fixed effects (table 4) all decisively reject the null hypothesis that the within and between group coefficients for the time-varying variables are the same. The eligibility coefficients for the between group regressions are much larger than those for the within group regressions, suggesting that eligibility status is correlated with unmeasured productivity variables. We therefore concentrate on the within group results (tables 2 and 3).

The findings for nonpitchers' annual compensation show similar effects for *JARB*, *FREE* and *LAST* that are highly significant and about 35%–50% in magnitude. Further, for pitchers, free agency eligibility (*FREE*) has significantly *smaller* effects than arbitration eligibility more than a year away from free agency (*JARB*) or one year from free agency (*LAST*) for whites and roughly similar effects as *JARB* for nonwhites.

While the *LSAL* results suggest that actual eligibility for free agency does not have an incremental effect on annual salaries, the results in tables 2 and 3 for contract duration and total compensation show the advantages of free agency for players.

The contract duration results are very similar for pitchers and nonpitchers.[12] Being eligible for arbitration and more than one year from free agency (*JARB*) has small and statistically insignificant effects on *DUR* in all cases. *FREE* and *LAST* usually have significantly positive effects on duration, in each case with a (sometimes significantly) larger effect for actual free agency (*FREE*) than for being one year away from free agency (*LAST*). Further, the impact of *FREE* or *LAST* is always significantly different from that for *JARB* at better than the 5% level on two-tailed tests. Since the mean of *DUR* for those ineligible for arbitration or free agency (i.e., *JARB*, *LAST* and *FREE* are 0) is 1.01–1.02 years (table 1), the eligibility variables' point estimates for *DUR* in tables 2–3 are roughly percentage effects.

These findings indicate that eligibility status has intuitively reasonable effects on contract-wide compensation. Those who are eligible for arbitration but are more than one year away from free agency do better than those under the reserve clause. However, players in their last year before free agency are treated similarly to free agents, and both of these groups sign more lucrative contracts than the newly arbitration eligible (*JARB* = 1). Further, actual or near free agents (especially white pitchers) appear to "spend" their greater bargaining power in longer, guaranteed contracts rather than in higher per unit payments, compared to the newly arbitration-eligible.[13]

Tables 2 and 3 also show within group results for productivity variables for nonpitchers and pitchers, respectively. For both pitchers and nonpitchers, several lifetime as well as previous season performance indicators affect salaries (*LSAL*) or contract duration (*DUR*). However, no strong pattern that would allow us to determine whether current or lifetime statistics are the more important emerges. Further, instances of reversals of sign for career and previous season performance levels indicate that it is difficult to disentangle the effects of these highly correlated measures.

V. Conclusions

This paper has used longitudinal data and fixed effects methods to estimate the impact of salary arbitration and free agency eligibility on compensation and contract duration of major league baseball players. Arbitration and free agency eligibility had similar salary effects; however, free agency raised contract duration, while arbitration had no effect on duration. The findings for free agency are consistent with the Nash bargaining model with constant relative risk aversion. However, these duration results in conjunction with those for the effects of arbitration eligibility (*JARB*) also support models of the winner's curse. Only when a team faces the loss of a player to free agency is there a positive duration effect. The long-term contract postpones (perhaps forever) the need to participate in the auction market.

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[11] While the productivity effects were significantly different by race as a group, no strong patterns were evident. Further, the between group regressions showed small and insignificant racial differences in salary, *ceteris paribus*.

[12] For any single cross-section, contract duration is a noncontinuous variable with considerable mass at one year. However, the within group regressions use the deviation of current contract duration from its mean over the observations on the player, which takes on a wider possible set of values than the raw contract duration variable.

[13] To determine the "price" players are willing to pay for long-term contracts, we regressed *LSAL* on the full set of variables and *DUR*. We obtained, counterintuitively, *positive*, significant coefficients, suggesting that *DUR* is correlated with time-varying productivity effects. Such findings limit us to saying that free agency eligibility appears to have greater effects on duration than on salary, relative to arbitration eligibility.

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PRIVATE SECTOR TRAINING AND GRADUATE EARNINGS

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Abstract—The paper uses a survey of British graduates to estimate the impact of employer-provided training on the earnings of men and women graduates. The results indicate that, although the training impact is reduced after controlling for endogeneity, some forms of training have a considerable impact. However, there are substantial gender differences in the earnings impact of various types of training. Moreover, men graduates are more likely to receive training than otherwise identical women.

I. Introduction

Private sector training and its impact on earnings is becoming of increasing policy relevance in the United States and Britain, with governments in both countries emphasising the importance of employer-provided training in the development of the skilled workforce necessary for growth in the 1990s. But does private sector training affect workers' productivity and earnings? What type of workers are offered private sector training? Are there gender differences in its provision and impact? Some of these issues have been addressed in recent studies using actual measures of private sector training to estimate the impact of training on earnings (see, for example, Duncan and Hoffman (1979), Mincer (1984), Lillard and Tan (1986), Brown (1988), Lynch (1989), Barron et al. (1989), Booth (1991) and Tan et al. (1992)). The present paper represents an addition to this literature, since it uses the 1986 British National Survey of 1980 Graduates to focus on gender differences in the provision and impact of private sector training. The advantages of this survey are first, that it contains information on three categories of employer-provided training in the present job and in previous jobs since graduation. It is therefore possible to examine the impact of training in the current job on wages and wage growth, and also the portability of previous training across jobs. Second, the survey contains information about worker ability, proxied by the class of degree obtained and by the individual's point score in public examinations at the end of secondary school (the "A" levels). Third, since the data derive from a specific cohort, problems of unobserved heterogeneity are reduced. Although this cohort is representative, for the age group 25–34 years, of only 9.5% of the British workforce (Creigh and Rees, 1989) the graduate labour market is of far greater importance to the economy than is indicated by its numerical size.

Section II of the paper outlines the econometric methodology adopted to deal with potential training endogeneity, and also discusses the data source. Estimates of the determinants of the training probability are reported in section III, and section IV presents the estimates of the earnings and earnings growth models. Some conclusions are drawn in the final section.

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II. The Model and the Data

Suppose the logarithm of individual earnings are represented by the model below, where y_i denotes the