THE EFFECT OF THE DESIGNATED HITTER RULE ON HIT BATSMEN: PITCHER'S MORAL HAZARD OR THE TEAM'S COST-BENEFIT CALCULATION? A COMMENT

GREGORY A. TRANDEL, LAWRENCE H. WHITE, and PETER G. KLEIN*

Goff, Shughart and Tollison [1997] attribute the American League's higher hit-batsman rate since 1973 to moral hazard: pitchers who no longer bat no longer face retaliation. We argue that retaliation is more efficiently directed at sluggers than at weak-hitting pitchers, and show that American League Designated Hitters (DHs) are plunked more frequently than are National League pitchers. We also offer a new estimating equation and update GST's sample. We show that the DH's effect on hit batsmen is no longer statistically significant. However, the point estimates are close to our prediction, which does not rely on moral hazard. (*JEL* D81, J28)

Since the Designated Hitter (DH) rule was introduced to the American League (AL) in 1973, American League pitchers have hit opposing batsmen more frequently than have National League (NL) pitchers. Goff, Shughart and Tollison [1997], hereafter GST, attribute this difference to moral hazard on the part of pitchers. Because American League pitchers no longer bat, they do not personally face retaliation in kind for hitting opposing batsmen, and hence "can throw at opposing batters with greater impunity" (p. 555). GST find that the introduction of the DH rule led to "a 10% to 15% increase in hit batters in the American League relative to the National League" (p. 558), and offer this increase as evidence consistent with the moral hazard story.

We question whether the DH rule has really made such a large difference, and whether pitchers' moral hazard is the best explanation for whatever difference it has made. We offer a different explanation: hit batsmen should occur more frequently in the AL because, from the team's point of view, the net benefits of "plunking" a designated hitter are higher than those of plunking a pitcher. Our empirical evidence, provided below, also casts doubt on the GST result.

We find the moral-hazard story questionable for the following reason. A National League team that plunked the opposing pitcher (in retaliation for his throwing at one of its players) would be putting the opposing team's weakest hitter on base, sacrificing a very likely out. A less costly form of retaliation is to plunk the opponent's best hitter, a batter far more likely to create runs for his team if pitched to normally. Retaliating against the big slugger is also likely to provide a greater benefit: threatening the opponents with injury to a top hitter should provide a greater deterrent than threatening them with injury to an average pitcher. If retaliation for a hit batsman is indeed directed at a team's big hitter, then the fact that AL pitchers no longer bat should have little (if any) effect on their willingness to hit opposing batters. We believe it is common knowledge among students of the game that plunking a big slugger is in fact the standard retaliatory strategy.[1]

* We thank Brian Goff for providing the hit batsmen data used in Goff, Shughart and Tollison [1997].

Trandel: Associate Professor, Department of Economics, University of Georgia, Athens, 1-706-542-3673
Fax 1-706-542-3376
E-mail trandel@rigel.econ.uga.edu
White: Professor, Department of Economics, University of Georgia, Athens, Phone 1-706-542-3696
Fax 1-706-542-3376
E-mail lwhite@rigel.econ.uga.edu
Klein: Assistant Professor, Department of Economics
University of Georgia, Athens, Phone 1-706-542-3697
Fax 1-706-542-3376
E-mail klein@rigel.econ.uga.edu

1. For evidence on where retaliation is directed, consider the following quote from Jim Riggleman, manager of the National League's Chicago Cubs. After stating that he did not want Cub pitchers to intentionally hit opposing batters, Riggleman explained: "I do not want anybody throwing at our people in retaliation. I do not want somebody hitting Sammy Sosa [Cub outfielder and home-run threat] in the ear or breaking his wrist so I can say 'Sammy, you took one for the team'" [*Chicago Tribune*, 1997].

Economic Inquiry
(ISSN 0095-2583)
Vol. XXXVI, October 1998, 679–684

Of course, our a priori argument and casual empiricism are not conclusive. In our explanation, the pitcher acts as an agent of his team's manager, so there is no particular deterrent value in plunking the pitcher. But hitting the pitcher might make sense as a retaliatory second-move strategy if instead, as GST explicitly assume, the pitcher himself can decide to throw at an opposing batter.

Our cost-benefit explanation for the interleague difference in hit batsmen implies that pitchers are plunked less often than are designated hitters,[2] whereas the GST moral-hazard explanation implies that pitchers who bat are objects of retaliation.[3] Support for the view that retaliation is seldom directed at pitchers is provided by James's [1987] annotated list of "significant injuries resulting from hit batsmen 1950–1984": only three of 48 cases (from regular-season games in which a pitcher batted) involved injury to a pitcher. Still, we need to take a more detailed look at the data to examine the question: when pitchers bat, is it pitchers or non-pitchers at whom retaliation is directed?

Sampling of a number of years (since introduction of the DH) shows a pattern consistent with our cost-benefit argument. Designated hitters (typically good hitters, because fielding skills are not required for their job) are hit by pitches somewhat more frequently than are other batters, while pitchers (typically poor hitters, because pitching skills are much more important to their job) are hit much less frequently (see Appendix). On average, DHs in the AL have been hit at about 110% the rate of other AL batters. Since DHs get about 1/9 of AL at bats, this factor suggests that the total hit batsmen rate in the AL should exceed the rate in the NL by about 1%. Pitchers in the NL are hit about 40% as frequently as other batters. Because pitchers get 6%–7% of NL at bats, this factor suggests that the AL hit batsmen rate should exceed the NL rate by 3%–4%. Combining these two factors implies that having a DH bat rather than a pitcher (independent of any moral hazard effect) should cause the AL hit batsmen rate to exceed the NL rate by 4%–5%.

How large is the actual change in the rate differential since the DH rule was introduced? The data in Table I reveal that over the pre-DH period (1947–1972), the mean difference between the AL and NL hit batsmen rates (hit batsmen/10,000 batters) was 2.7 (with a standard deviation of 8.2). Over the DH era (1973–1997), the mean difference was 8.1 (standard deviation of 7.5). By this measure the DH rule appears to have raised the plunking rate by 5.4. Since the average hit batsmen rate over the 51-year period is about 60, this represents a 9% increase in hit batsmen. This increase exceeds our predicted effect,[4] but is this difference statistically significant?

To answer this question, we turn to a regression analysis. We offer two amendments to the empirical work of Goff, Shughart and Tollison. First, we introduce a new estimating equation. The GST results were derived from the following:

$$(1) \qquad HB_t^A - HB_t^N = \beta_0 + \beta_1 DH + \beta_2 (AB_t^A - AB_t^N) + \varepsilon_t ,$$

where HB is hit batsmen, AB is at bats, DH is a dummy variable indicating the existence of a designated hitter (equal to unity for 1973 and after), t represents years, and A and N represent the American and National Leagues. This equation can presumably be justified as a reduced form of

$$(2) \qquad HB_t^A = \beta_0^A + \beta_1 DH + \beta_2 AB_t^A + \varepsilon_t^A$$

$$HB_t^N = \beta_0^N + \beta_2 AB_t^N + \varepsilon_t^N,$$

2. Of course, even when retaliation is not an issue, a weak batter should be less likely to be hit by a pitch than is a strong batter. A pitcher can generally retire a weak batter without throwing "inside" and taking the chance of hitting the batter and putting him on base. Like GST, we have no way to sort the data on hit batsmen into retaliatory and other cases.

3. It is possible that, under the GST explanation, pitchers are rarely hit in equilibrium, because the threat of retaliation deters them from plunking an opposing batter in the first place. The fact that pitchers are generally weak hitters, however, suggests that this equilibrium is not subgame perfect. The threat of retaliating by plunking the pitcher (and putting him on base) is not credible. A referee points out an argument that reinforces this conclusion: a pitcher who anticipated retaliation could avoid it by adopting a defensive batting style (not "digging in," standing far from the plate). Such a strategy would be low-cost for a weak-hitting pitcher, but not for a big slugger.

4. However, if the 1994–1997 trend (see Table I) continues, this difference will soon be much smaller.

TABLE I
Hit Batsmen (per 10,000 At Bats)

Year	American League	National League	Difference
1947	31.4	42.9	−11.5
1948	42.5	38.6	3.9
1949	42.2	46.6	−4.4
1950	50.9	51.9	−0.9
1951	53.6	52.0	1.6
1952	58.4	56.4	2.0
1953	62.1	52.5	9.6
1954	50.6	54.5	−3.9
1955	64.6	56.5	8.1
1956	66.9	47.8	19.1
1957	65.3	55.2	10.0
1958	60.4	58.6	1.8
1959	62.9	54.8	8.1
1960	64.1	52.2	11.9
1961	58.1	60.3	−2.2
1962	60.8	67.3	−6.4
1963	62.2	67.9	−5.7
1964	66.5	59.1	7.4
1965	58.1	73.0	−14.8
1966	59.0	65.5	−6.6
1967	73.3	64.3	8.9
1968	79.3	64.1	15.2
1969	67.0	67.4	−0.4
1970	65.8	59.1	6.6
1971	65.9	59.9	6.0
1972	63.7	56.7	7.0
1973	59.9	54.2	5.7
1974	62.7	54.4	8.3
1975	60.3	55.5	4.8
1976	56.9	47.1	9.8
1977	59.7	49.5	10.2
1978	57.8	50.6	7.2
1979	55.0	50.2	4.8
1980	51.4	38.8	12.6
1981	54.9	42.4	12.5
1982	47.8	46.0	1.7
1983	54.6	44.4	10.2
1984	53.8	37.8	16.0
1985	54.2	42.5	11.7
1986	64.6	47.5	17.2
1987	63.4	52.7	10.7
1988	71.4	56.1	15.3
1989	62.7	48.3	14.4
1990	66.3	53.4	12.9
1991	69.3	56.1	13.2
1992	75.8	60.1	15.8
1993	81.7	73.2	8.5
1994	76.3	81.7	−5.4
1995	85.6	90.4	−4.8
1996	91.2	87.9	3.3
1997	85.5	100.0	−14.5

TABLE II

Estimates of Hit-Batsmen Differences Between American and National Leagues

Years	1947–1990		1947–1997	
Equation	**(1)**	**(4)**	**(1)**	**(4)**
Intercept	12.83	2.68	12.35	2.61
	(9.01)	(1.62)	(11.29)	(2.24)
DH Dummy	45.11	7.55	14.44	4.80
	(19.71)	(2.52)	(19.68)	(3.18)
AB Diff	.0068		.0093	
	(.0017)		(.0017)	
ρ	0.208	0.182	0.274	0.357
	(0.157)	(0.154)	(0.159)	(0.1551)
R^2	.73	.26	.68	.20

Notes: Standard errors in parentheses; ρ is the estimated first-order autocorrelation coefficient. Dependent variable is difference between leagues in hit-by-pitch counts (for equation (1)) and hit-by-pitch rates (for equation (4)).

where $\beta_0 = \beta_0^A - \beta_0^N$ and $\varepsilon_t = \varepsilon_t^A - \varepsilon_t^N$. Equations (2) have two possible flaws. First, when estimated over a multi-year panel of data, they imply that Hit Batsmen is a constant function of At Bats. As Table I indicates, however, there have been substantial changes over time in the *HB/AB* ratio. Second, equation (2) assumes that the effect of the Designed Hitter is independent of the number of At Bats in the American League. This restriction is particularly important because the numbers of teams in the National and American Leagues both changed during the relevant period.[5] An alternative to the GST specification is

$$(3) \quad HB_t^A = (\beta_0^A + \beta_t + \beta_1 DH + \varepsilon_t^A)\, AB_t^A$$

$$HB_t^N = (\beta_0^N + \beta_t + \varepsilon_t^N)\, AB_t^N,$$

which assumes that all effects are proportional to At Bats and that a time-varying effect is common to both leagues. Equations (3) can be estimated as

$$(4) \quad (HB_t^A / AB_t^A) - (HB_t^N / AB_t^N) = \beta_0 + \beta_1 DH + \varepsilon_t.$$

Results for both equations (1) and (4) are reported below.

Our second amendment is to introduce additional data. The GST analysis used data through 1990; we have added data through 1997.[6] As Table I shows, adding post-1990 data is important because the pattern of interleague differences in hit batsmen rates changed markedly after 1992.

Table II presents our OLS regression results. While GST considered a number of time periods, we focus on GST's most recent sample period. Following GST (and the implications of the Durbin-Watson statistic), we include a correction for first-order serial correlation (results without this correction are presented in footnote 8). The first two columns of Table II cover the same period as GST, 1947–1990. While the DH Dummy is statisti-

5. Changes in the number of teams have occurred at different times in the two leagues. In 1961, the AL had ten teams while the NL had eight, and from 1977 to 1993, the AL had 14 teams while the NL had 12.

6. The 1997 data came from the ESPN SportsZone webpage (http://espnet.sportszone.com/). For the first time in baseball history, regular-season interleague games were played in 1997. All results of interleague games have been removed from our data. In other words, the figure given for 1997 American League in Table I includes only intraleague games played between two AL teams (using a DH), and that for National League games includes only games played between two NL teams (not using a DH). Removing the interleague data, however, has little effect on our results.

cally significantly different from zero in both specifications in equations (1) and (4), the significance is stronger in equation (4).[7] The result in the first column essentially reproduces the GST result. In the second column, the coefficient estimate on the DH variable means that the AL hit batsman rate exceeds the NL rate by 7.5 per 10,000 at bats. Given the average (over the whole period) of about 60 plunks per 10,000 at bats, this indicates that the DH rule led the AL hit batsmen rate to exceed the NL rate by about 12%, consistent with GST's estimate.

However, we argued above that one should not expect a zero difference in hit batsmen between leagues. Rather, we predict that simply having a DH batting rather than a pitcher will produce a 4%–5% difference in hit batsmen independent of moral hazard.

The third and fourth columns of Table II cover the period 1947–1997. When the recent data are added, both specifications in equations (1) and (4) produce results consistent with our predicted effect. The dependent variable in specification of equation (1) is the interleague difference in total hit batsmen; the point estimate of 14 is less than 4% of the average number of plunked batters during the DH era. The point estimate in column four (when compared to the average rate of 60) indicates that the DH rule led the hit batsmen rate in the AL to exceed that in the NL by just over 8%. While these results are consistent with our predictions, the coefficients on DH in both specifications are not statistically significantly different from zero. These results are thus also consistent with the hypothesis that the DH caused no difference in hit batsmen between leagues. Although insignificant, the two point estimates do sandwich our 4%–5% prediction.[8]

Our empirical results for the 1947–1997 period thus do not support GST's view that the DH rule has caused an interleague difference in hit batsmen needing to be explained by moral hazard. This conclusion is reinforced by two factors. First, there are a priori doubts about GST's story, since retaliation for a hit batter is more efficiently directed at the opposing team's star batter than at a pitcher. Second, (weak-hitting) pitchers are plunked less often than are other players, which by itself should reduce the NL hit batsmen rate. We suggest that the evidence supports the following statement. To the extent that American League batters are (on average) more likely to be hit by pitches than are National League batters, the difference is largely because the AL batters are (on average) better hitters, and are thus less costly and more beneficial to hit.

7. The higher R^2 value for equation (1) does not imply that the GST specification is better. Much of its explanatory power derives from the fact that the absolute interleague difference in numbers of hit batsmen is highly correlated with the interleague difference in numbers of at bats, which differ for the reason given in footnote 6. Because equation (4) estimates the difference in hit batsmen *rates* (per at bat), its R^2 receives no such boost.

8. When estimated over the 1947–1997 period without correcting for serial correlation, the coefficient (and standard error) estimates on the DH dummy are 11.96 (16.01) and 5.38 (2.20). The estimate for equation (4), which suggests about an 9% increase in hit batters in the AL, is statistically significantly different from zero, and not far from our prediction.

REFERENCES

Goff, Brian L., William F. Shughart II and Robert D. Tollison. "Batter Up! Moral Hazard and the Effects of the Designated Hitter Rule on Hit Batsmen." *Economic Inquiry*, July 1997, 555–61.

James, Bill. "A History of the Beanball," in *Baseball Abstract 1987*. New York: Ballantine Books, 1987, 131–40.

Chicago Tribune. "Riggleman Backs Away from any Part of Beanballs." 14 July 1997, Sec. 3, p. 3.

APPENDIX

A. *Comparing the rate at which American League DHs are hit by pitches to that of other players in the American League*

	Total		DH only		NonDH	
Year	At bats	Hit by pitch	At bats	Hit by pitch	At bats	Hit by pitch
1974	66044	414	7432	52	58612	362
1975	65371	394	7356	39	58015	355
1977	77274	461	8651	52	68623	409
1982	77886	372	8631	45	69255	327
1983	77821	425	8552	73	69269	352
1984	77910	419	8661	72	69249	347
1985	77257	419	8532	63	68725	356
1986	77376	500	8601	67	68775	433
1987	77819	493	8605	98	69214	395
1988	77005	550	8448	74	68557	476
1989	77004	483	8564	46	68440	437
1990	76800	509	8533	67	68267	442
1991	77603	538	8621	50	68982	488
1992	77147	585	8697	64	68450	521
1993	77506	633	8784	55	68722	578
1994	55198	425	6177	35	49021	390
1995	69522	595	7684	63	61838	532
1996	79090	721	8720	75	70370	646
Totals for 1974–1975, 1977, 1982–1996:						
	1341633	8936	149249	1090	1192384	7846

Designated hitter hit-by-pitch rate: 73.03 (1)

Non-designated hitter hit-by-pitch rate: 65.80 (2)

(1)/(2) = 1.11

Designated hitter at bats as percentage of total at bats: 11.12%

B. *Comparing the rate at which National League pitchers are hit by pitches to that of other players in the National League* (Data collected by hand; therefore a sample of years was used)

	Total		Pitchers			Non-pitchers			Pitcher at bats / total at bats	Pitcher rate / non-pitcher rate
Year	At bats	Hit by pitch	At bats	Hit by pitch	Rate	At bats	Hit by pitch	Rate		
1974	66212	360	4702	8	17.0	61510	352	57.2	.071	.297
1977	66700	330	4503	12	26.6	62197	318	51.1	.068	.521
1982	66263	305	4495	7	15.6	61768	298	48.2	.068	.324
1986	65730	312	4267	10	23.4	61463	302	49.1	.065	.477
1990	65968	352	4126	16	38.8	61842	336	54.3	.063	.715
1994	55068	451	3381	12	35.5	51687	439	84.9	.061	.418
1996	77711	683	4692	12	25.6	73019	671	91.9	.060	.279
Totals for these seven years:										
	463652	2793	30166	77	25.5	433486	2716	62.7	.065	.407