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# By the Numbers

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*Review*

## Academic Research: Recent Studies

Charlie Pavitt and Ken Ross

*Charlie Pavitt reviews more recent studies from the academic literature, with an additional review by Ken Ross.*

**Zhang, Xing, Tat Y. Chan, and William P. Bottom (2022), Relational aspects of vicarious retribution: Evidence from professional baseball, Journal of Applied Psychology, Vol. 107 No. 6, pp. 917-931.**

There have been several psychological studies of strategic (rather than accidental) hit-by-pitches as indicators of aggression, and a few specifically directed toward studying pairs of initiating HBPs followed by retaliatory HBPs as a cycle of provocation and score-settling retribution. This one is a sophisticated example of the latter.

The authors' work is based on a sample of about 20,000 HBPs from 1991-2010 games, as collected by Retrosheet. The data generally shows evidence for retribution: the occurrence of an initiating HBP increased the odds of a retaliatory HBP, on average an inning later, after which the odds of additional HBPs decreased (two retaliatory hit batters in response to the initial one were relatively rare).

The authors also looked at other variables. Retaliation was more likely if the hit batter and teammate-pitcher were both from outside the USA, and less likely if the teammate-pitcher and initiating team batter were both from outside the USA, or had been teammates in the past.

In addition, retaliation was less likely if both had not attended college, while college attendance for both increased retaliation. These two findings make no sense to me.

Some results for control variables are also of interest. Retaliation was more likely: the greater the score difference; the better the

retaliatory team's winning percentage; the retaliatory team being at home; with either team having a more diverse mixture of US and non-US players; with both teams in the American League.

Perhaps unknown to these authors, some of these latter findings replicate earlier work; in particular, the AL result appears to be due to the presence of the DH, where pitchers know they will not bat and so won't be direct victims of retaliation. -- *Charlie Pavitt*

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*The previous issue of this publication was November, 2021 (Volume 30, Number 2).*

**Biolsi, Christopher, Brian Goff, and Dennis Wilson (2022), Task-level match effects and**

**work productivity: Evidence from pitchers and catchers, Applied Economics, Vol. 54 No. 25, pp. 2888-2899.**

For several years now, there has been an accumulation of evidence that the quality of infield fielding is more critical for ground ball pitchers, and outfield fielding for fly balls pitchers. Biolsi, Goff and Wilson used Retrosheet data from 2000 to 2017 to examine another possible defensive interdependence, that between pitchers and catchers regarding getting outs of all types and strikeouts.

There were a total of 5,519 pitcher-catcher matches between 2000 and 2017; the authors used the 75 percent most active of those for each analysis. There was a lot of variation across seasons, but in general for individual seasons, pitchers had the most impact on both outs and strikeouts, then catchers, and

finally the specific pitcher-catcher match the least. However, when combined across seasons, the match had more impact than the catcher and, in the case of outs, almost as much as the pitchers.

The authors' proposed explanations for the difference between within and across season findings were that (1) the increase in sample size obtained from combining seasons reduced noise that appeared in the yearly individual pitcher and catcher coefficients, and that (2) good pitcher-catcher matches take time to develop and the development time was reflected in the single season data; this latter proposal was supported when examining factors potentially affecting the overall results. In addition, pitcher-catcher matches were slightly more influential when the two came from the same country and, more strongly, spoke the same first language, and when their MLB debuts had been closer together in time. -- *Charlie Pavitt*

**York, Kenneth and Cynthia Miree (2020), Achieving competitive balance in the face of resource uncertainty: A resource dependence perspective on the Negro leagues, Management and Organizational History, Vol. 15 No. 1, pp. 22-31.**

An older one that I just discovered, but fitting to report given the recent official recognition of the Negro Leagues' major league status.

For the Eastern Colored League (ECL; 1920-1948), the Negro American League (NAL; 1937-1962), and the Negro National League (NNL; 1920-1948), within-season competitive balance (as measured by the standard deviation of W-L record, as well as the Gini coefficient) indicate less competitive balance than the [White] American and National Leagues in the corresponding seasons. The average SD was about 0.16 for the Black leagues and 0.10 for the White leagues. The Ginis were almost the same, at 0.17 and 0.10.

The HHI index (a measure of market domination used in economics) calculated for championship series indicated that the White World Series had considerably more across-season variation than the Colored World Series (ECL versus NNL, 1924-1927), but the Negro World Series (NAL versus NNL, 1942-1948) had more variation than the White Series for the same set of seasons. -- *Charlie Pavitt*

**Cleary, Rick and Peter Staab (2021), Same-score streaks: A case study in modeling, Math Horizons, Vol. 28 No. 4, pp. 5-9.**

In 2013, the Barton College basketball team won three consecutive games by the scores of 76-68, 76-68, and 76-68. A reporter from a small North Carolina newspaper asked the first author the obvious question: How unlikely is a string of three consecutive identical scores?

The authors decided to study a generalized version of the question: How likely is a same-score streak of order N? ("Order N" is a more formal way of referring to N consecutive games.)

The authors proposed a distribution from probability theory (a Weibull distribution) and also analyzed same-score streaks using simulations. But first, the authors moved the venue to MLB because the database is larger and more orderly than for college basketball. Then they looked for actual streaks.

It turns out that order-2 streaks are fairly common (between 20 and 80 a year from 1901 and 2019). But order-3 streaks are quite rare (134 over the same 119-year span). Order-4 streaks? They found only three, shown below. -- *Ken Ross*

**Senators, Sept 19-22, 1958, lost 0-2**  
**Giants, July 4-7, 1961, lost 1-2**  
**Padres, June 4-7, 2008, won 2-1**

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# Hall of Fame Vagabond Blues

Jeff Witmer

*All else being equal, does a player have a better chance of going to the Hall of Fame if he spent his entire career -- or even just most of it -- with a single team? Here, the author builds on a Bill James study to answer the question more precisely using a regression model.*

Does it help a Hall of Fame case for a player to have spent most of his career with one team?

The short answer is "Yes, spending a full career with one team is worth about as much as one full extra season of MVP-worthy baseball, in the eyes of voters, compared to moving among teams."

That confirms what Bill James found in his January, 2022 article, "Vagabonds and Homebodies."<sup>1</sup> In that study, James constructed a statistic he called "OneTeam%" for Hall of Fame candidates. That statistic is a measure of how much of a player's career was spent with one team. For example, Lou Whitaker spent his entire career with the Tigers, so his OneTeam% is 100.0%. Gary Sheffield, on the other hand, played for six different teams and never spent many seasons with any of them, giving him a OneTeam% of only 14.4%.

James's study was denominated in Win Shares, but I chose to use WAR. I collected, from Baseball Reference, data for the top 550 players ranked by career WAR. Some of those 550 are still active or recently retired, so not yet HoF eligible. I removed Barry Bonds and Roger Clemens, as well as players with more than half of their careers in the 1800s. I also removed few who played most of their careers in the Negro Leagues, since we really don't have complete data for those. This left 426 players in my analysis.

With these data, I can address the same general question that Bill James addressed, more formally.

Start by putting aside the vagabond/homebody information, and just think about WAR vs. HOF. If I were to tell you the career WAR value for a player; that would give you a pretty good idea of the chance that player is in the Hall of Fame. Using a logistic regression model we can see that as WAR goes up, the chance of being in the Hall of Fame goes up. We might think that Hall of Fame voting has changed over time so we might want to take into consideration the era in which someone played (1920s vs 1940s vs 1960s, etc.); we can do this by adding a predictor variable that records the midpoint of the player's career.<sup>2</sup> It is also helpful to know adding how many times a player was MVP.<sup>3</sup>

Figure 1 plots a graph that shows how the chance of being in the Hall of Fame relates to WAR for a player who played in the 1950s and never won an MVP award.<sup>4</sup>

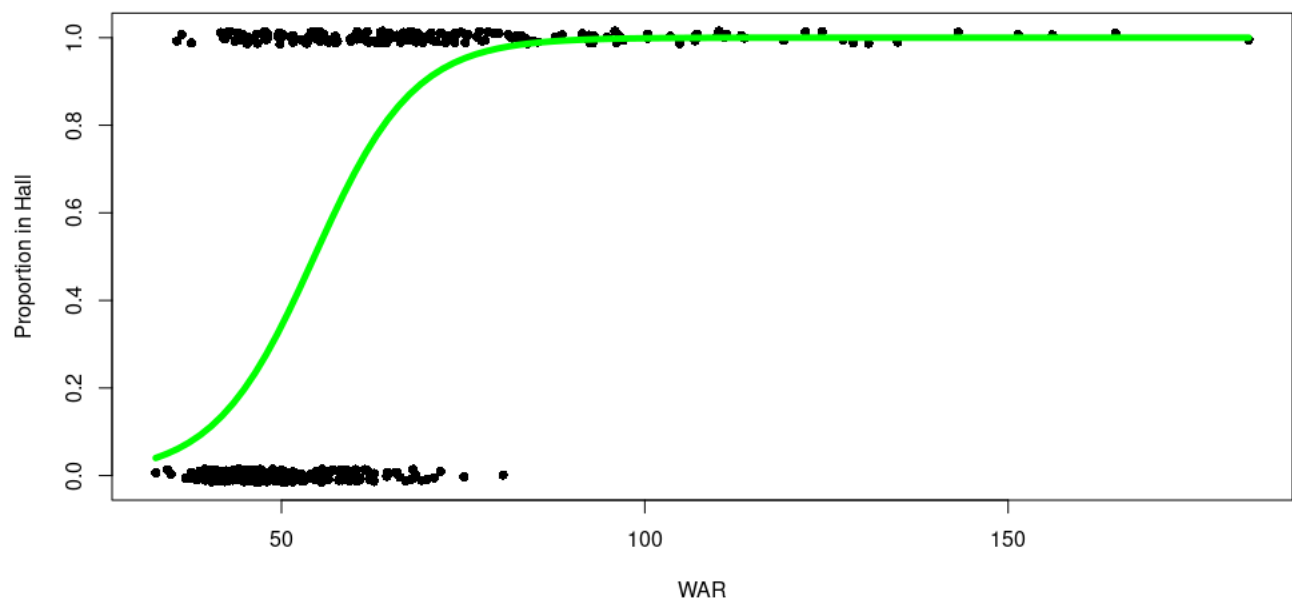
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<sup>1</sup> [https://www.billjamesonline.com/vagabonds\\_and\\_homebodies/](https://www.billjamesonline.com/vagabonds_and_homebodies/)

<sup>2</sup> James used "era" in his analysis, dividing players into cohorts, but I use *Year* is a quantitative predictor, which has a quadratic relationship with the odds of being elected to the Hall of Fame.

<sup>3</sup> It turns out that how often a player won the Cy Young Award is not a helpful predictor.

<sup>4</sup> For purpose of illustration, I chose 1955 as a representative year and 0 MVP awards. Other choices do not substantially change the effect that WAR has on Hall of Fame probability.



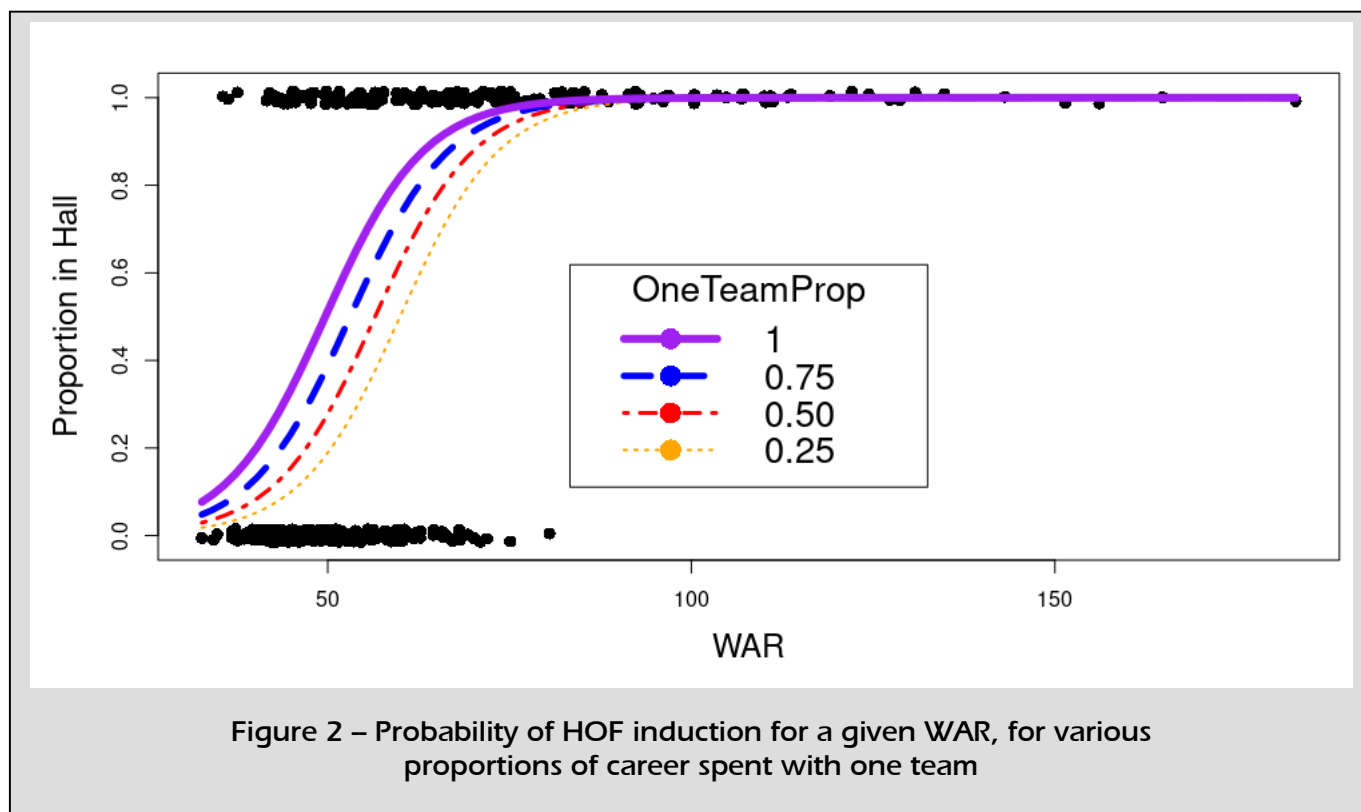
**Figure 1 – Probability of HOF induction for a given WAR, players with no MVP award**

We can see that when WAR is around 55, a player has a 50-50 chance of getting into the Hall. (More precisely, the 50-50 point is 54.5 WAR.)

Now suppose that I also tell you what percentage of a player's career was spent with one team. Have I given you valuable additional information?

One way to look at this is to add a predictor, which I called "OneTeamProp", to the multiple logistic regression model, where OneTeamProp is the proportion of games that the player played for the team with which he earned the most WAR (usually, but not always, the team for which he played the most games). That is, my OneTeamProp is a substitute for James's OneTeam%.

My finding confirms James's. By spending all or most of his career with one team, a player substantially increases his HoF chances. In Figure 2, I show four curves. The highest curve, in purple, shows how HoF proportion relates to WAR if a player spends his entire career with one team. The second curve, in blue, is for players who acquire 75% of their WAR with one team. The third curve, in red, is for players who play half of their careers with one team and the other half with one or more other teams. The lowest curve, in orange, is for players who move around so much the most WAR they get with any one team is just 25% of their career WAR, while the other 75% comes from being with multiple other teams.



Let's focus on purple vs red. Consider a player who played in the 1950s, never was MVP, and had 55 WAR in his career; from the first graph we know that such a player has about a 52% chance of getting into the Hall of Fame. But suppose the player only has a OneTeamProp value of 0.5, meaning that they got half of their career WAR with one team. Looking at the red curve above, we see that he would have a smaller chance of having been elected to the Hall (41%, according to detailed output from the model).

For players with higher WAR, the advantage of a large OneTeamProp is smaller, in absolute terms, because the player had a high chance of winding up in the Hall anyway. For example, when WAR is 70, a player with OneTeamProp of 1 – playing a full career with one team – means an 95% chance of being in the Hall, while dropping OneTeamProp to 0.5 does reduce that chance, but only from 95% to 86%.

Overall, having OneTeamProp at 1 is worth about 7 WAR: The red curve at 67 WAR is as high as the purple curve at 60 WAR. Another way to think of this is that the red curve is shifted to the right of the purple curve by about 7 WAR.

Bill James used slightly different statistics and looked at year effects by dividing players into cohorts. He found that players who spent their full careers with one team are greatly over-represented in the Hall of Fame, given their Win Shares, when compared to players who spent their careers on many teams. I used logistic regression modeling to quantify James's findings in a particular way, but my results reinforce what James found: Being a vagabond, rather than a homebody, hurts your chances of making it into the Hall of Fame. I find that staying with one team rather than spending half a career on each of two teams is worth about 7 WAR in the eyes of Hall of Fame voters.

## Appendix

The fitted multiple logistic regression equation is

$$\log(\text{Odds Of HOF}) = -1610.3 + 0.147(WAR) + 2.012(\text{One Team Prop}) + 1.03(MVPs) + 1.67(\text{year}) - 0.00043(\text{year}^2)$$

All coefficients had small p-values; the highest was 0.013.

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## Back issues

Back issues of "By the Numbers" are available at the SABR website, at <http://sabr.org/research/statistical-analysis-research-committee-newsletters>, and at editor Phil Birnbaum's website, [www.philbirnbaum.com](http://www.philbirnbaum.com).

The SABR website also features back issues of "Baseball Analyst", the sabermetric publication produced by Bill James from 1981 to 1989. Those issues can be found at <http://sabr.org/research/baseball-analyst-archives>.

## Submissions

Phil Birnbaum, Editor

Submissions to *By the Numbers* are, of course, encouraged. Articles should be concise (though not necessarily short), and pertain to statistical analysis of baseball. Letters to the Editor, original research, opinions, summaries of existing research, criticism, and reviews of other work are all welcome.

Articles should be submitted in electronic form, preferably by e-mail. I can read most word processor formats. If you send charts, please send them in word processor form rather than in spreadsheet. Unless you specify otherwise, I may send your work to others for comment (i.e., informal peer review).

I usually edit for spelling and grammar. If you can (and I understand it isn't always possible), try to format your article roughly the same way BTN does.

I will acknowledge all articles upon receipt, and will try, within a reasonable time, to let you know if your submission is accepted.

Send submissions to Phil Birnbaum, at [110phil@gmail.com](mailto:110phil@gmail.com).

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