Significance and Effect of Handedness in Baseball

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Introduction

For my STAT 499 senior project, I looked at baseball data regarding handedness in batting versus handedness in pitching. It has been traditional in baseball to have batters in your lineup that swing from the side of the plate that is opposite from the pitcher’s throwing hand. For example, if the starting pitcher is right-handed, the conventional wisdom is that it would be more beneficial for the team to start as many left-handed batters as possible. This idea stems from a few scientific reasons. First, when a pitch from a right-handed player goes to a right-handed batter, the ball seems to be coming directly at the batter, which may cause a slight hesitation. This slight hesitation against a pitch might be enough to disrupt the reaction time needed to hit it. The same pitch coming from the opposite side, however, gives the batter a better view across the body. Second, a curve ball from a same-handed pitcher will typically move away from the hitter, causing the batter to reach across the plate (Chu). These reasons may be why so many teams have left-handed batters on their roster.

Data Collection

I used data from the MLB main website (www.mlb.com) for every batter in the three most recent MLB regular seasons (2017, 2018, and 2019). The three key variables tested in this project were batting average, on-base percentage (OBP), and slugging percentage (SLG). Some important baseball terms are listed here:

- At-bats: Plate appearances minus sacrifice flies, walks, and hit by pitches
- Batting Average: Hits/At-bats
- OBP: Percentage of time a batter ends up on base; i.e., (Hits + Walks + Hit by pitch)/Plate Appearances
- SLG: The measure of the power of a hitter; i.e., Total Bases/At-bats

Methodology

For each of the three key variables of batting average, on-base percentage, and slugging percentage, I ran a Two-Way ANOVA test using the statistical software R. Each Two-Way ANOVA test investigated the following questions:

1. Is there a significant difference between left-handed batters and right-handed batters?
2. Is there a significant difference between left-handed pitchers and right-handed pitchers?
3. Is there a significant interaction between the handedness of the batter and the handedness of the pitcher?

From the interaction plot below, we observe that right-handed batters have significantly better batting averages against left-handed pitchers than against right-handed pitchers, while left-handed batters have slightly better batting averages against right-handed pitchers than against left-handed pitchers. Overall, left-handed pitchers tend to do better than right-handed pitchers, while right-handed batters have slightly better slugging percentages against right-handed pitchers than against left-handed pitchers.

On-Base Percentage Results

From the interaction plot below, we observe that right-handed batters have significantly better on-base percentages against left-handed pitchers than against right-handed pitchers, while left-handed batters have slightly better on-base percentages against right-handed pitchers than against left-handed pitchers. Overall, left-handed pitchers tend to do better than right-handed pitchers, and left-handed batters tend to do better than right-handed batters.

Slugging Percentage Results

From the interaction plot below, we observe that right-handed batters have significantly better slugging percentages against left-handed pitchers than against right-handed pitchers, while left-handed batters have slightly better slugging percentages against right-handed pitchers than against left-handed pitchers. Overall, left-handed pitchers tend to do better than right-handed pitchers, while there is not a significant overall difference between left- and right-handed batters.

Conclusion

There is a significant difference in performance between batters facing a same-handed pitcher versus an opposite-handed pitcher. Batting on the opposite side leads to better batting averages, on-base percentages, and slugging percentages. Interestingly, performance appears to be better for right-handed batters against left-handed batters than for left-handed batters against right-handed batters.

For future work, we could use a fuller data set of the breakdown of each batter against each pitcher. Even though this data set would still violate the independence assumption of Two-Way ANOVA, I could have performed a Two-Way ANOVA with repeated measures instead, which would account for the fact that the same players appear in the data set multiple times. We could also test the effect of handedness on other baseball statistics and use more seasons of MLB data.

References:


Faculty Advisor: Professor Tiffany Kolba, Department of Mathematics and Statistics

Batting Average Results

The histograms below display the distribution of batting average before (left) and after (right) data cleaning.

Base Percentage Results

The histograms below display the distribution of base percentage before (left) and after (right) data cleaning.

Slugging Percentage Results

The histograms below display the distribution of slugging average before (left) and after (right) data cleaning.

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