

Traditional Alignment vs Shift On Baseballs Hit Up The Middle Of The Field

Github Repo:

https://github.com/smt-data-challenge/smt_data_challenge_2023

Tableau Dashboard:

<https://public.tableau.com/app/profile/matthew.rabin/viz/SMTDataChallenge2023/SMTDataChallenge>

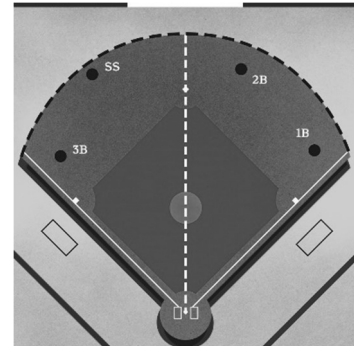
Abstract

There is a rule change in Major League baseball in 2023 requiring defenses to position a minimum of four players in the infield with at least two infielders on either side of second base. The rule change is intended to increase batting average on balls in play. This project assesses the difference in the rate that infielders can acquire baseballs hit up the middle of the field in shifted vs traditional defensive alignments.

Introduction/Background

The Defensive Shift Limits rule change is defined on MLB.com as the following:

- *The four infielders must be within the boundary of the infield when the pitcher is on the rubber.*
- *Infielders may not switch sides. In other words, a team cannot reposition its best defender on the side of the infield the batter is more likely to hit the ball.*
- *If the infielders are not aligned properly at the time of the pitch, the offense can choose an automatic ball or the result of the play.*
- *This rule does not preclude a team from positioning an outfielder in the infield or in the shallow outfield grass in certain situations. But it does prohibit four-outfielder alignments.*



In *Ahead of the Curve - Inside the Baseball Revolution*, Brian Kenny described how "we'd all been trained to see the ball hit back up the middle and think "base hit"". This has changed in recent years with the increased frequency of teams using shifted infield alignments.

There are examples of shifts against pull-hitting lefties at least as far back as Ted Williams in the 1940s. (see appendix 1) The shift was not widely adopted throughout the MLB, however, until Joe Maddon and the Tampa Bay Rays began to shift more than any team in baseball in the 2000's. The Rays provided a template for success to the rest of the league. According to Kenny, "there were 2,358 shifts employed throughout MLB in 2011. In 2014, the number of shifts would top 13,000." The trend continued after Kenny's book was published in 2016. This has resulted in a decline in offensive production to the point of league intervention.

According to MLB.com, "The league-wide batting average on balls in play of .290 in 2022 was six points lower than in 2012 and 10 points lower than in 2006." Banning the shift is expected to "allow infielders to better showcase their athleticism and to restore more traditional outcomes on batted balls." The traditional outcome of a base hit up the middle of the field is assessed in this paper. The analysis of sample data from Sports Media Technology aims to predict if the Defensive Shift Limits rule will result in more hits up the middle of the field in 2023.

Data

Game events data was used to track pitches, ball bounces and balls acquired. Ball position data was used to plot baseballs at the time of the bounce. Player position data was used for batter handedness and to plot infielder location at the time of the pitch. A limitation of the data was that play outcomes (base hit/out) were not available. This analysis only measures if the infielder or the outfielder was the first player to acquire the baseball.

Methodology

Data was limited to only plays where the baseball was acquired by a first baseman, second baseman, third baseman, shortstop or outfielder. The timestamp of the pitch was used to identify the X and Y coordinates of the infielders and batter. The sum of infielders to the left and the right of second base were used to flag shift/no shift. Batter handedness was identified by the location of the batter relative to home plate during the pitch. The location of the first ball bounce was used to define if the ball was hit up the middle. Only plays where the ball bounced before a fielder acquired it were used to eliminate fly ball outs from the dataset. The angle used to define "up the middle" was based on the average positioning of the middle infielders in traditional non-shifted alignments (see appendix 2 for additional details). The "Rate of Baseballs Acquired by Infielder" was compared for traditional vs shifted infield alignments.

Rate of Baseballs Acquired by Infielder = Baseballs acquired by infielders / (Baseballs acquired by infielders + baseballs acquired by outfielders)

Data was prepared in R Studio and then visualized in a Tableau dashboard. The dashboard includes graphs for Location of First Bounce with conditional color for the result. It also includes graphs for the Location of Infielders at the Time of Pitch with conditional color for player position. Filters are available for home team, away team, year, day, maximum distance of the first bounce from home plate and batter handedness.

Discussion/Conclusions

The results of the analysis did not validate the hypothesis. The expected outcome was that the rate of Rate of Baseballs Acquired by Infielders would be higher for shifted infield alignments than for traditional infield alignments. The results found that 57.8% of baseballs hit up the middle of the field were acquired by infielders in traditional infield alignment compared to only 53.1% for shifted alignments. Traditional alignments had a higher rate compared to shifts for both left and right handed batters.

Rate of Baseballs Acquired by Infielders

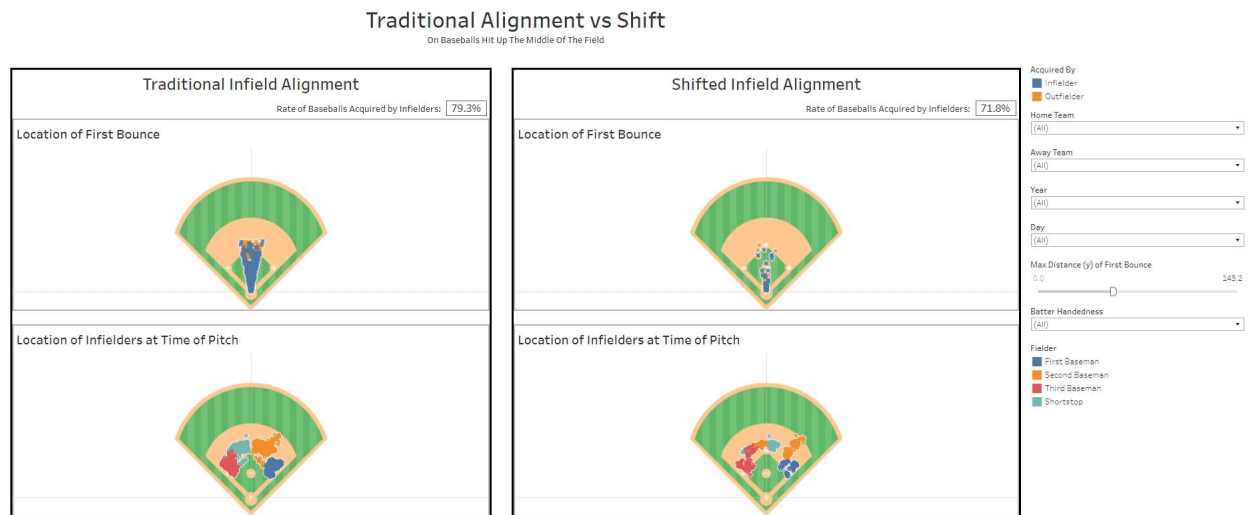
Batter Handedness	Shifted	Traditional
Left Handed	52.5%	60.2%
Right Handed	54.3%	55.7%
Grand Total	53.1%	57.8%

TeamA3 was the only team that demonstrated a higher Rate of Baseballs Acquired by Infielders in the shift vs traditional alignment.

Rate of Baseballs Acquired by Infielders

Home Team	Shifted	Traditional
TeamA1	61.1% (11/18)	65.9% (122/185)
TeamA2	57.1% (12/21)	59.9% (118/197)
TeamA3	63.2% (12/19)	49.5% (136/275)
TeamB	42.1% (16/38)	59.0% (180/305)
Grand Total	53.1% (51/96)	57.8% (556/962)

The maximum distance of the first bounce (y) can be filtered to a shorter distance from home plate. This estimates the results for only infield ground balls. The results at shorter distance, however, still did not validate the hypothesis. The average y distance of the shortstop and second baseman in traditional alignments (referenced in appendix 2) was 143.2 feet. At 143.2 maximum feet of first bounce, 79.3% of baseballs were acquired by infielders in traditional infield alignment compared to 71.8% for shifted alignments.



The analysis generated unexpected results but the sample size is too small, especially at the team level. Additional research is needed to conclude whether the Defensive Shift Limits rule will result in more hits up the middle of the field in 2023.

Improvements/Future Work

The game information data source could be incorporated in future work to infer play outcome. This could be used to quantify Batting Average on Balls in Play (BABIP) for the middle of the field. Additional logic could be used to determine if the first bounce of the baseball occurred in front of or behind the infielders. There was a significant difference in the sample size of traditional alignment plays (962) compared to shift plays (96). A larger dataset would improve the accuracy of the analysis. Future work could include a year-over-year comparison of 2022 to 2023 MLB data to determine if the new rule has resulted in a higher BABIP up the middle of the field. A similar analysis could be done with BABIP on the pull side of the field rather than balls up the middle of the field.

Acknowledgements

- Lectures from Dr. Ted Hayduk's course in Foundations of Sports Analytics at New York University were referenced for support with R programming
- Meredith Wills, Senior Data Scientist and Academic Lead, SMT-U, provided valuable feedback during office hours for this project.

References

- MLB Shift rules and statistics referenced from:
 - <https://www.mlb.com/glossary/rules/defensive-shift-limits>
- Baseball field background image referenced from:
 - <https://pearlyarts.com/product/baseball-field-clipart/>
- “Ahead of the Curve - Inside the Baseball Revolution” by Brian Kenny
- “Analyzing baseball data with R. Second Edition” by Max Marchi, Jim Albert and Ben Baumer
- <https://www.calculator.net/right-triangle-calculator.html>

Appendix

1.



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2.

The average distance (x) between the middle infielders on non-shifted plays from these results was 34.5 feet. The average distance (y) from home to the fielders on the y axis was 142.3. These values were used to calculate the angle defined as “up the middle of the field”. Opposite side (y value) divided by the adjacent side (x value) of the right angle drawn from each ball location is compared to the tangent of +/- 1.3329 radians to determine if the ball was hit up the middle. This is referenced in lines 155-156 of the R code.