DSC680-T302

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Project 1, Milestone 2: Draft

**Breaking Balls are like Kryptonite:  
*The Decline of Javy Baez***

**Business Problem**

Javy Baez broke into Major League Baseball (MLB) with the Chicago Cubs and was a solid offensive performer for them for about 6 years. He reportedly turned down a significant contract extension offer from the Cubs in 2020 and signed a large free-agent contract with the Detroit Tigers in 2021, marking the beginning of a tremendous decline in his offense. I’ll attempt to answer this question: *Has a change in the way MLB pitchers approach Javy Baez accounted for his struggles in Detroit?*

**Background**

In the 2011 MLB Draft, the Chicago Cubs selected Ednel Javier (“Javy”) Baez with the ninth overall selection in the first round (Wikipedia, 2025). When Baez signed his draft contract with Chicago, the Cubs obtained his player rights for the first 6 full years of his MLB career (Moser, 2024). Baez got a taste of the big leagues in 2014 and 2015; he was finally promoted full-time in 2016, meaning that the Cubs would control his rights through the 2021 MLB season.

Baez was widely considered among the most exciting players in baseball (Rogers, 2018) due to his penchant for big hits, his controlled aggression while running the bases (Chicago Cubs, 2020), his stunning knack for tagging baserunners (Crazy for Baseball, 2017), and the defensive wizardry (EduardoBeisbol, 2024) that earned him the nickname “El Mago” (the Wizard). In early 2020, the Cubs allegedly made an effort to extend their contract with Baez for a likely term of nine years and a guaranteed value in the area of $180 million (Taylor, 2021), which Baez turned down, believing that he could get even more money by reaching free agency. Because their rights to Baez expired after the 2021 season and they were not in playoff contention that year, the Cubs traded Baez (Wikipedia) to the New York Mets as part of a deal for Pete Crow-Armstrong on July 30, 2021. Baez finished the season with New York and was declared a free agent.

Baez signed a 6-year deal with the Detroit Tigers in November, 2021, guaranteeing himself $140 million (Petzold, 2021). Baez has performed poorly in Detroit, causing some to call his contract a “nightmare” (Ziegler, 2024) and putting him in real danger of losing his starting role in the Tigers’ lineup, leaving him to become a very high-priced player in a bench role (Clark, 2025).

I’ll be looking at whether Baez’s struggles can be partially explained by MLB pitchers throwing him more breaking balls. Baez’s style of hitting uses a very long swing (Ziegler) to generate significant power, but it can hamper his ability to handle elite fastballs and to adjust when breaking pitches move out of the strike zone. Being able to connect Baez’s decline to a changing pitch mix has the potential to help the player adjust to the new pitch mix and perhaps tweak his swing to account for it; it may also help his team understand whether they think Baez’s problem can be “fixed,” or whether they should just accept the sunk cost of the contract and move on from Baez.

**Datasets**

*Season performance statistics:  
Baseball Reference. (*<https://www.baseball-reference.com/players/b/baezja01.shtml>*)*

I used statistics collected for each MLB season in Baez’s career. I examined his offensive performance using his batting average (BA or AVG), on-base percentage (OBP), and on-base plus slugging (OPS). Batting average is a statistic that baseball fans have been using for about as long as there have been baseball statistics; a player’s average is calculated by dividing his total number of hits by the number of times he was charged with an “at bat.” OBP is typically a little bit higher than a player’s average, since it also gives him credit for walks and getting hit by pitches; it represents a player’s ability to reach base without getting out, but it doesn’t reward him for defensive mistakes. OPS adds together a player’s OBP with his “slugging percentage,” which is essentially a way to weight extra-base hits (like doubles and home runs) more heavily because they contribute more to the offense.

*Pitch data:  
pybaseball API for Python (*[*https://pypi.org/project/pybaseball/2.0.0/)*](https://pypi.org/project/pybaseball/2.0.0/)I)

I used pitch data from all MLB pitches thrown to Baez over his career. I grouped the data for each season, aggregating to find the total number of pitches, number of fastballs, number of breaking balls, and the percentage of each of those general pitch types. I also found the mean velocity of fastballs faced and the mean spin rate for breaking balls he faced, but I didn’t use those in my analysis.

*Data Preparation (See appendix A)*

My basic datasets were available through a public API (pybaseball, which retrieves data from Statcast, a service of Baseball Savant) and a public website (Baseball Reference), but they each required some work to be in a usable form for my purposes. I used python in a Jupyter notebook to get the data and build a dataframe for each data set that I needed. I saved the larger of the two dataframes in memory and operated from a copy of it, because fetching it from the API takes a while and I wanted to be able to revert to the pristine copy of the dataset without having to fetch it again.

Baez’s season data contained a couple extra lines from the season in which he was traded, along with a couple small-sample-size season early in his career before he was an established MLB player. I chose to ignore the seasons before he was a full-time big-leaguer, but I did include the 2020 season which was shortened due to COVID. This kind of committed me to using aggregated “rate” statistics (like breaking ball percentage) rather than raw “counting” statistics (like number of pitches seen) if I wanted to be fair across seasons, but this turned out to be fine.

In addition to just being a big table (15,000 records) the pitch data required a more preparation. I narrowed down the data set considerably and classified each pitch as a fastball, breaking ball, or neither, based on the pitch type specified by Statcast. Then I created a data set of aggregated fastballs and aggregated breaking balls. Finally, I merged the pitch data onto the season batting statistics and calculated the pitch percentages to produce the final data set.

**Methods/Analysis**

My first look at relationships in the data was to find the correlations between the pitch statistics and the offensive production statistics.

A screenshot of a computer screen

AI-generated content may be incorrect.

I had hoped to find significant evidence of a correlation between a particular pitch types faced by Javy Baez faced and his offensive statistics, and I certainly did! In fact, the absolute strongest correlation coefficient between a pitch type and a measure of offense was the -0.776105 coefficient between the percentage of breaking balls thrown and Baez’s OBP, generally indicating that the higher percentage of breaking balls he sees, the less likely he is to reach base safely. Put another way, the more pitchers throw breaking balls, the more likely Baez is to get out!

I decided to plot all three of the offensive percentage statistics together on one graph to see if I could identify the pattern visually.

A graph of multiple scatter plots

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The trend looks pretty evident, with most of the higher breaking ball percentages leading to lower offensive success from Baez. There’s absolutely no question that Baez simply doesn’t perform as well offensively if pitchers throw him more breaking balls. In fact, we can plainly see that Baez’s 4 worst seasons (by ANY one of the 3 measures) occurs in the 5 seasons in which he saw the most breaking balls!

It made sense to find regression fits for all the offensive statistics, since they all show some negative correlation with breaking ball percentage. I went ahead and found the regression coefficients and plotted all three of the stats in one graph (next page), and the story could not be more clear.

A screen shot of a graph

AI-generated content may be incorrect.

Baez’s AVG and OBP both trend slightly downward with more breaking balls, but the regression for his OPS is stark. The final interesting question that remains: have MLB teams/pitchers realized Baez’s weakness? The best way to answer the question seemed to be to plot the percentage of breaking balls Baez has seen in each year of his career.

A graph with blue dots

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It should come as no surprise at all that MLB pitchers have generally thrown Baez a higher percentage of breaking balls as his career has gone on. MLB organizations have massive statistical analysis staffs, budgets, and hardware resources, so it seems awfully likely that if a statistical advantage like this exists, they’re exploiting it.

**Conclusion**

Javier Baez has less offensive success when pitchers throw him a higher percentage of breaking balls over the course of a season.

**Assumptions/Limitations/Challenges**

I don’t think I faced any particular limitations or challenges in the project. I had access to all the data that I needed for the analysis, and even have access to the same data from separate sources for corroboration. I did make the assumption that OPS would be the most effective measure of an MLB player’s success, but that’s a fairly widely-held opinion. Even among those who think there are better indicators of a player’s overall offensive success, OPS is still considered a decent measurement.

**Recommendations/Implementation**

For Javy Baez and the Tigers, I would recommend spending a significant of his practice time working on recognizing breaking balls and not swinging at them. If Baez can avoid chasing breaking balls outside the strike zone, pitchers will be forced to throw more fastballs or to throw breaking balls in the strike zone, which Baez is likely to have better luck hitting.

For MLB teams/pitchers playing against Javier Baez, I would recommend throwing him 40% or more breaking balls. Even if Baez manages to recognize those pitches and stop swinging at them, the slower nature of breaking ball is likely to make fastballs seems even faster, giving pitchers an opportunity to exploit a new weakness.

**Ethical Assessment**

My data is not really at risk, since it’s available through other sources if my primary sources become unavailable. There’s little reason for concern about the ethics of using the data, since it’s all publicly available from multiple sources, including through MLB itself. Finally, there’s no likely ethical impact from the results, since all 30 MLB organizations and many independent sites are already doing similar modeling.

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