Predictive Plate Appearance Model

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Plate appearances can be predicted to determine when to make a pitching change decision.

Model Building

Using a linear mixed-effects model, making an objective decision on this is possible. The fixed effects of this model are pitcher and hitter wOBA, while the random effects are the times through the order and platoon matchup.

I took data from 2018 and 2019 to run the model on those variables. It ended up giving me the values shown to the right of this text. Negative numbers mean that the variable favors the pitcher and vice versa.

What those numbers exactly mean is that, for example, if a left-handed pitcher faces a right-handed hitter, the predicted wOBA in that matchup goes up by 0.0143 points. Another example is in the first time through the order, predicted wOBA goes down by 0.0078. One thing to note with time through the order is that in the 4th time through, wOBA goes down, this is due to small sample size as typically only good pitchers can get there.

Platoon	Intercept
LHP vs LHH	-0.0233
LHP vs RHH	0.0143
RHP vs LHH	0.0115
RHP vs RHH	-0.0024

TTO	Intercept
1	-0.0078
2	0.0029
3	0.0092
4	-0.0043

In Game Application

To apply this to an actual game, a manager could take peek at the projected matchups and decide what to do. One of my favorite games to apply this to was game 5 of last year's NLDS between the Cardinals and Braves. Dakota Hudson looked solid through 4 but lost the lead to an Ozzie Albies home run in his 3rd at bat. That matchup's predicted wOBA was .366. Tyler Webb came in after that, but if he would have come in against Albies, the predicted wOBA would have been .317, a .049 point drop.

Fixed Effects	Estimate
Intercept	-0.323
Pitcher wOBA	0.9954
Batter wOBA	0.9955

Validation

To validate this model, I partitioned my data into training and testing sets. 80% of the data went into a training set and 20% went into a testing set. I created a model based on the training set and ran it on the testing set.

This gave me an RMSE of .534 and a standard deviation of .539. This model is not perfect, but it can give a good idea of how certain matchups may go.

	Training	Testing
% Data	80%	20%
# Observations	273,364	68,341

Results

This model can be used for in game usage to help managers in objectively making pitching changes. It adds more fuel to the times through the order research as teams can see how that affects their matchups. Another way this could be used is for bringing in pinch hitters. Teams can have more information from this and make better decisions.