

Run Differential vs. Batter Plate Approach

By: Robert Greenberg

Outline:

1. Abstract
2. Introduction
3. Materials and Methods
4. Results
5. Discussion
6. Conclusion
7. Citations/References
8. Future Considerations

Abstract:

I investigated three questions surrounding batters' plate approaches in terms of the pitch count per at bat. I wanted to know if batters change their approach in different game situations, if batters change their approach in close games, and if batters "give up" when winning or losing by a large number of runs. I did a series of data transformations to form variables that would help me in my analysis and proceeded to use the 2017 MLB season to examine my questions. I used both all 2017 batters and a select group of elite batters to get a full picture of the trends I was exploring. I determined that some batters have different approaches in some game situations,

batters generally don't change their approach the later it gets in a close game, and batters do not give up in wide margin games. Continue reading for a detailed look at my hypotheses, methods, results and conclusions.

Introduction:

Batters do not approach each plate appearance the same every time they are up. Depending on the number of outs, the score, the number of men on base, inning, the weather, or pitcher, batters will change their approach for an at bat. I performed my research to find out what factors influence a batters' decision to change their plate approach. The answer to this question would help managers, pitchers, and batters better understand game situations and how they affect a batters' pitch count on average. There has been a lot of research looking at how players change their strategies with different counts (see References section). We know a player is more likely to take a strike in a 3-0 count compared to a 0-2 count. However, taking a macro look at what goes into a players decision to either work a pitcher during an at bat or go down after 1 pitch with a pop-up has yet to be fully investigated. I structured my research around answering 3 questions surrounding different situations and a batters' approach.

1. Do batters change their approach when they are in varied run differential scenarios?
2. As the game progresses, if a game is close, do batters take less pitches in an

effort to get back into the game?

3. When a team is losing or winning by a certain amount of runs or more, do batters' pitch counts start to fall since they may feel as if "the game is already decided"?

Initially, I created a pitch count column in R which counted the number of pitches in one at bat and a run differential column which calculated the difference between the home team's score and the away team's score at all points in the game (a run differential of 1 means the home team is winning by 1). I also decided to analyze not only all 2017 batters, but the 2017 top 200 wOBA leaders to see if being a "good" hitter had any effect on these hypotheses.

In order to find out whether or not batters change their approach when in different run scenarios, I split up at bats into 5 categories: Down Runs Early, Down Runs Late, Up Runs Early, Up Runs Late, and Other. By down/up "runs", I used anything more/less than 1 run. By early/late, I used the first 3 innings to represent "early" and the last 3 innings (not including extra innings) to represent "late" game. I determined that when down runs early the wOBA leaders took 1 more pitch than all players in 2017 in the same scenario. This was also 1 more pitch than nearly all of the other scenarios.

To check whether or not batters take less pitches in close games, I defined a close game as being in a situation where a homerun will either tie the game or give the batter's team a lead. I calculated a `men_on_base` column that determined, given a run differential, if a homerun was enough to tie/take the lead in the game. I analyzed this

statistic throughout the timespan of a game to see if later in games, the average pitch counts decreased to show a sense of urgency in getting back in the game. I found that overall, there is no correlation between pitch count and inning when in a close game.

Lastly, to determine whether or not being up or down by a large number of runs caused pitch counts to fall, I calculated the absolute value of run differential and looked at the pitch counts for each differential. My hypothesis was that the more runs a team is down/up by, the less amount of pitches their batters will take because they will give up on this game and look to the next one. I found that that overall, there is no correlation between pitch count and run differential, players' do not seem to give up when down by many runs.

Materials and Methods:

To perform my my research, I used the 2017 Events dataset from RetroSheet. I also used the FanGraphs Batting Leader data from 2017 to group the 2017 wOBA leaders for comparison to all batters. I needed to access the pitch count and run differential columns that I calculated for all players, so I joined these two tables on player_id using a master_id file that contains names and ids for baseball players across all different common sources to pull sabermetric data. For each of these three questions, I processed the data differently and created subsets that I was able to explore and find answers to these questions. The first step I took for all data was converting some variables to different types in R so that I could do math with them. I converted home and away score, which were type char, into numerics so that I could

calculate the run differential. I also took sequence, which is the sequence of pitches (XBB...) and converted that to a count so that I could have pitch count per at bat. I didn't care about the types of pitches or the outcome of the at bat, just the number of pitches taken. Then, I appended these two metrics to the current dataset. Now that I had these two columns which I needed for all of my analyses, I started to break down my first question: **Do batters change their approach when they are in varied run differential scenarios?**

At first, I thought of looking at the data inning by inning in all differential variations. After trying this, it ended up being tedious and messy. I decided that grouping the data in categories was a better a way to visualize the problem for this purpose and try to find patterns. I took the original data set (merged with FanGraphs Batting Leader data) and split it into 5 subsets. I created a new string variable called `time_in_game` which labeled the scenarios I briefly outlined above. Down Runs Early was filtered by the run differential being less than 5 and being in the first three innings. Down Runs Late was filtered by run differential being less than 5 in the last three innings. Up Runs Early and Up Runs Late followed a similar logic except with run differential being greater than 5. I arbitrarily used 5 runs because I thought it was a reasonable number where I would stop calling a game close. Once I had all of the at bats categorized into the different scenarios, I decided to plot a series of violin/boxplots to represent the distributions of the data for both all 2017 batters and the 2017 wOBA leaders.

As for my second question, **As the game progresses, if a game is close, do batters take less pitches in an effort to get back into the game?**, I started by breaking down what it meant to be in a close game. I decided to define a close game as being in a situation where a homerun would either give a team the lead or tie the game up. I started by creating a new variable called `men_on_base` that calculated the men on base when a batter is up. I then used that number to determine if the game was close or not (by my assumed definition). For example, if a team is down by 4 and the bases are loaded I called that a close game, whereas being down 4 and having 2 men on base was not considered a close game. While I understand that many situations can constitute a close game, this term is imperfect and has no formal definition. I carried out the rest of my analysis with this assumption in mind. Once I had these close game scenarios subsetted out, I was able to plot pitch counts in different innings for at bats where the game is in a close game.

Lastly, I designed my methodology to break down my final question: **When a team is losing or winning by a certain amount of runs or more, do batters' pitch counts to fall since they may feel as if "the game is already decided"?** Since I did this analysis last, I had a lot of the variables that I needed to test this question. I took the run differential column and created a subset that contained the absolute value of run differential. Whether a team was winning by 7 runs or losing by 7 runs, the pitch counts that I considered in this test were from both positive and negative run differentials. Once

I had this subset, I simply plotted the absolute value of run differentials against pitch counts to see if when losing or winning by more runs, batters took less pitches because the game was essentially over.

Results:

1. When looking at whether batters change their approach when in different run scenarios, the results are presented below:

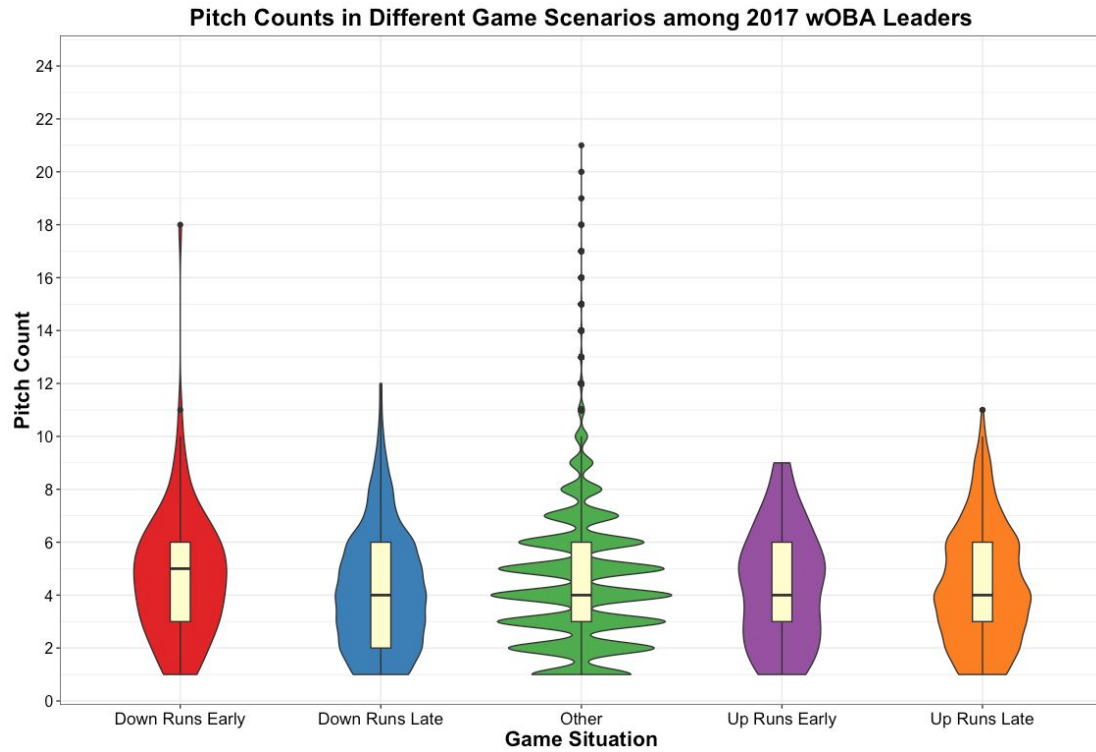


Figure 1

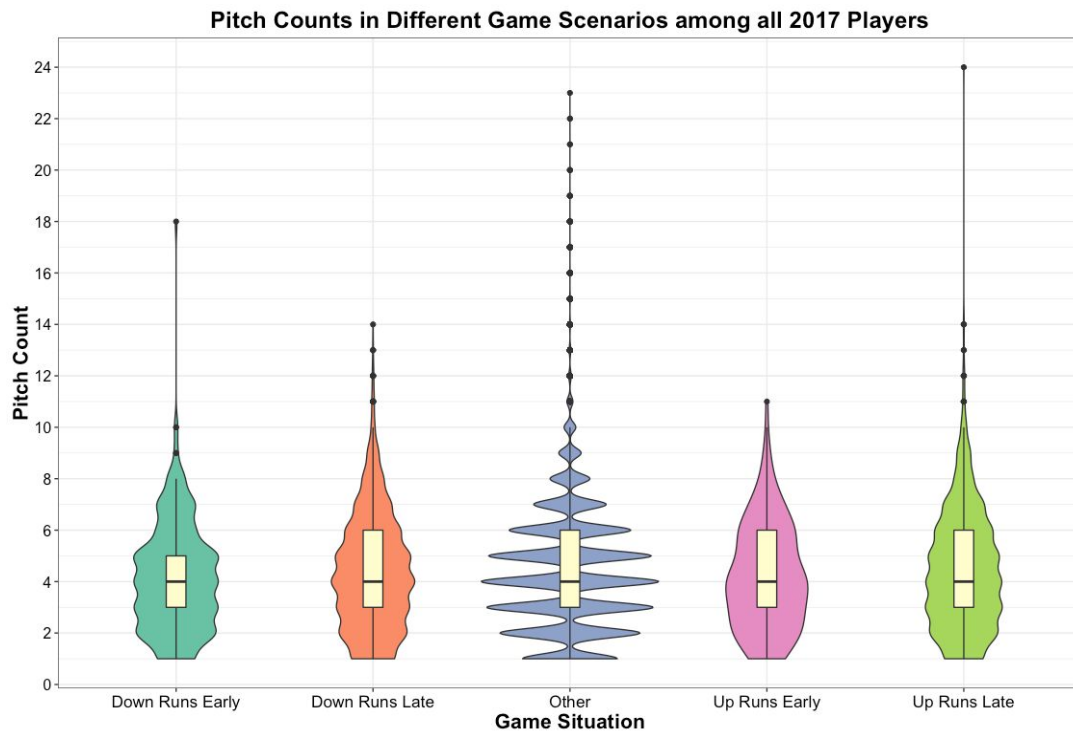


Figure 2

I hypothesised that batters' approaches would change in different scenarios. If you look at Down Runs Early in Figure 1 as compared to Figure 2, the median pitch count is a pitch higher at 5 pitches per at bat compared to 4. Additionally, looking at the shapes of the distributions the wOBA leaders in Figure 1, generally have a higher distribution of higher pitch counts. The p-value for the means between these two different data sets is 0.266, which means that there is not a significant difference in their means.

2. When looking at close games and seeing if pitch count decrease as the game progresses, the results are presented below:

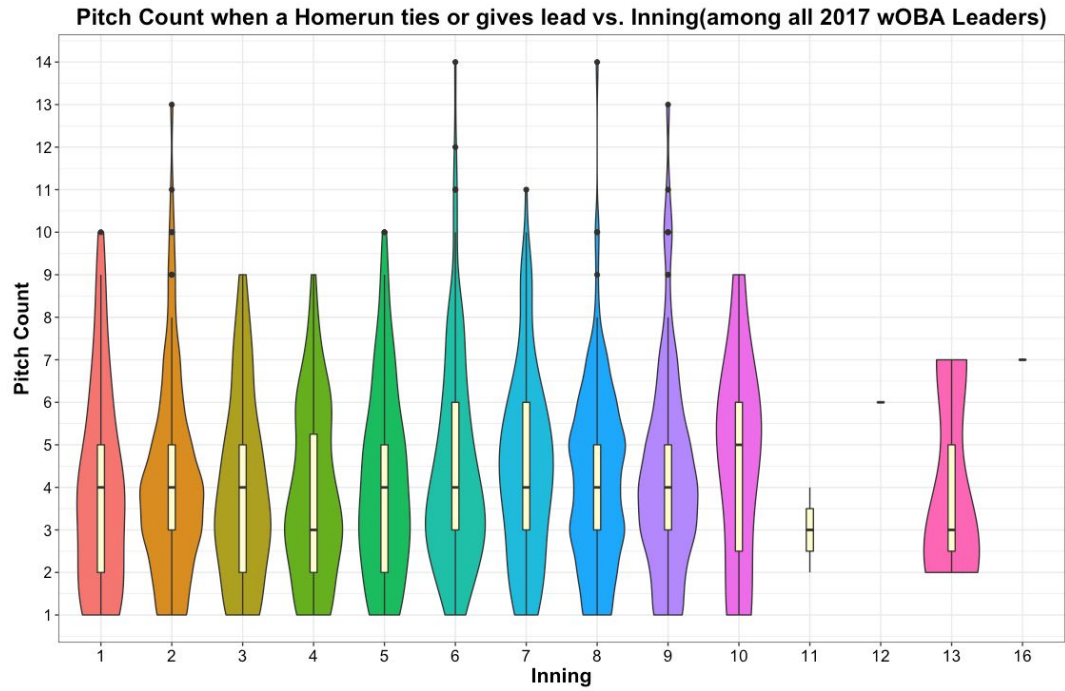


Figure 3

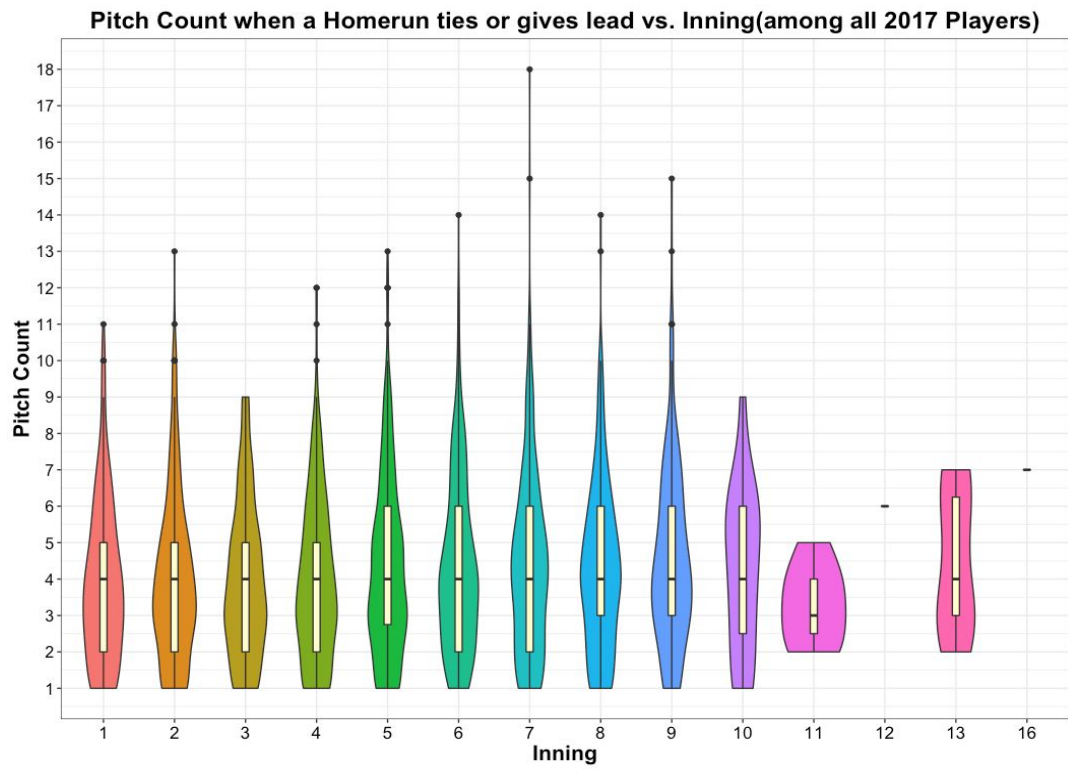


Figure 4

I hypothesised that later in close games, the pitch count decrease due to a sense of urgency in getting back in the game. Comparing Figure 3 to Figure 4, there is not much of a difference between the medians across different innings. For the wOBA leaders, the medians vary from 3-5 pitches, but there is no clear pattern. For all players, the data is very consistent. This leads to an indication that in close games batters do not change their approaches as the game goes on. With a p-value of 0.76, we can conclude that the means are nearly the same between the wOBA leaders and all batters in 2017 in terms of pitch counts in close games.

3. When looking at close games and seeing if pitch count decrease as the game progresses, the results are presented below:

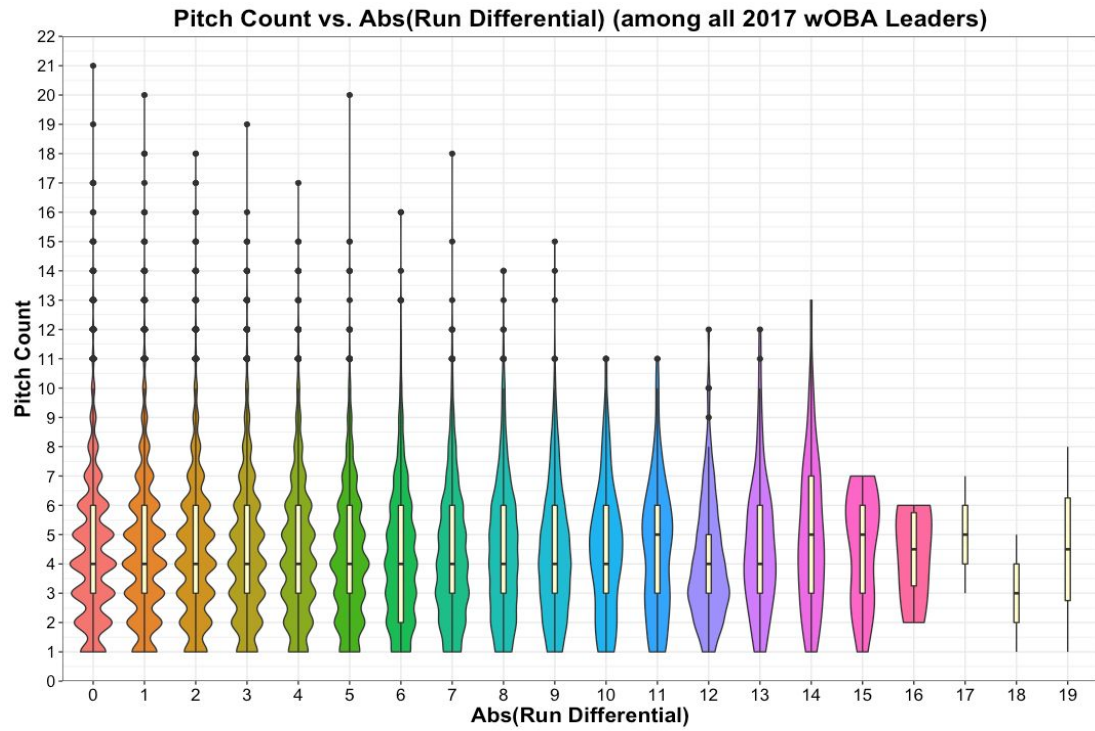


Figure 5

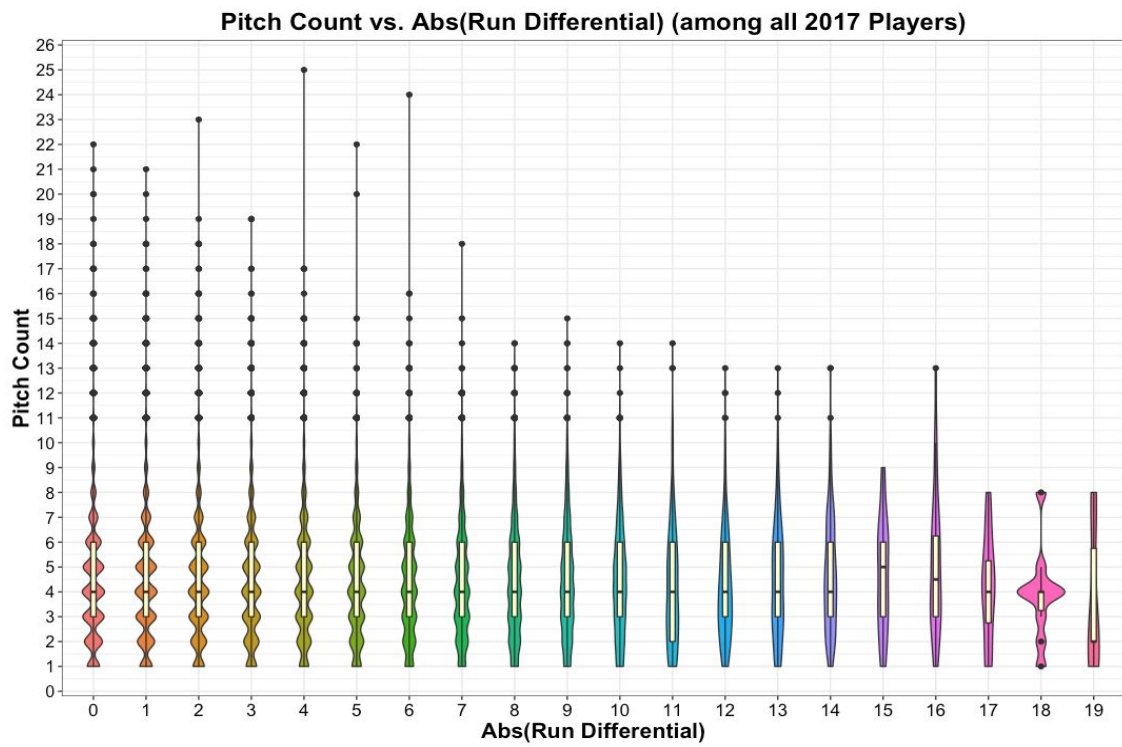


Figure 6

I hypothesised that when a team is winning or losing by more runs, at a certain point they will change their approach and “give up” on the game. Based on the graphs, it appears as if the medians throughout all absolute run differentials are the same. While there is some variation in both groups, especially when the run differential is large, there does seem to be any pattern associated with larger differentials being associated with lower pitch counts. The p-value for the means between these two different data sets is 0.27, which means that there is not a significant difference in the means between the two groups.

Discussion:

For my first question, **Do batters change their approach when they are in varied run differential scenarios?**, we saw that the Down Runs Early pitch count for the wOBA leaders was higher than that for all batters in 2017 (seen in Figures 1 and 2). This could be do to dealing with starting pitching. More often than not, the starting pitcher will pitch through the third inning. This is one reason that could lead to a higher pitch count, these pitchers are often teams’ aces. Another reason why pitch count could be higher for wOBA leaders is because they are simply more disciplined hitters. It is possible that when they are down early in a game, they are more focused/better at getting on base and that could explain why they might work a count. Ultimately, it is interesting that for the other game scenario categories there is not much of a difference of pitch counts per at bat. In the future, I would try to break this problem down and look at other factors such as pitching or game significance.

For my second question, **As the game progresses, if a game is close, do batters' take less pitches in an effort to get back into the game?**, we saw that there is not much of a difference when it comes to approach whether or not the game is close, no matter what inning it is. Even in close games, it seems that batters don't change their approach and try to swing for the fences. They seem to take around 4 pitches in most scenarios. One interesting thing to note is in Figure 3, looking at the 10th inning of wOBA batters in close games. They seem to take a median 5 pitches compared to 4 in nearly all other innings. Since this is extra innings, it would make sense that there is a little more effort to work a pitcher and get on base, since a run is more significant that late in the game. In the future, I would look at extra innings as well as games of significance, for example a Wildcard game or Game 7 of a series where a tie or a lead can really make or break a season.

For my final question, **When a team is losing or winning by a certain amount of runs or more, do batters' pitch counts to fall since they may feel as if "the game is already decided"?**, we did not see much of a change of pitch count in varied absolute run differentials. No matter how far a game is lost or won, it looks like batters did not grow tired of playing and begin taking fewer pitches to speed up the outcome of the game in 2017. It might be interesting to look at this data by team and see if a winning team has a different approach when winning or losing in a game compared to a losing team. This would help in investigating if there is a point in a game or in a season when a team gives up or continues to "fight" for a playoff spot.

Conclusions:

Based on my research, I have determined that to some extent, great batters may have different approaches in different game situations than the average batter. I would like to investigate some of the factors that play into wOBA leaders taking an extra pitch compared to all batters when down runs early. Secondly, it looks like batters do not change their approach throughout a close game. Whether it is early in the game or the last inning, batters overall seem to keep an even keeled approach. Lastly, batters do not give up on games that some would say are already won or lost based on large run differentials. I would like to look more into specific teams and game significance to determine if season success/game importance impacts players approaches. This research has provided a better understanding of how players approach at bats in different situations, and tells us more about batters' plate strategies in major league baseball games.

References:

1. <https://www.fangraphs.com/fantasy/batters-with-new-approaches/>
2. <https://sites.google.com/site/baseballhobbist/hitting/article-3---hitting-plate-approach-swinging-in-the-different-counts>