Kevin Luo

Recommendations based on Trackman

Overview

During this analysis, I will refer to our pitcher as Joe. The provided data appears to be the length of a single season for a starting pitcher; with a sample size as small as this, some metrics will be reliable and others will not. The core of this analysis will be guided by K%, BB%, Putaway%, and Whiff% because each of these are stable given the sample size and are often fair indicators of a pitcher's effectiveness. On the other hand, metrics like wOBA and HR/9 will be mentioned but mostly used as secondary pieces of evidence due to their noisiness given the sample size.

Below is a table which summarizes Joe's effectiveness in general. The number in parentheses represents the percentile Joe falls in for the given metric (across pitchers who faced at least 50 batters during 2020).

	K%	Whiff%	Putaway%	BB%	wOBA	HR/9
Joe	21.8% (41)	**26.3% (62)**	18.4% (49)	8.9% (48)	**0.350 (34)**	1.73
League Average*	23.6%	24.7%	18.8%	8.9%	0.332	1.3

Note: League Average was computed by aggregating the results of all at-bats across 2020.

The above table yields 4 observations:
1) Joe has a good Whiff% but his K% is below average and his Putaway% is exactly average. Clearly, Joe's raw stuff misses bats well during games but he has not been able to translate this into the outcome we all want: strikeouts.
2) His walks appear under control so the main focus of this recommendation will not center around avoiding walks or control issues.
3) His wOBA is significantly below average, which confirms that Joe's raw stuff has not translated to preventing runs.
4) His HR/9 is also significantly below average but HR/9 can take a while to stabilize so I won't weigh this too aggressively. His HR/FB ratio is 0.247 which is huge compared to the roughly league average rate of 0.1 which is good for Joe because HR/FB usually regress heavily towards the mean. However, I did notice some things Joe can fix to directly counteract homers as well.

The most glaring question mark is the gap between his good whiff% and his pedestrian strikeout numbers. The size of this gap also presents the most obvious area where large gains can be made quickly. I structure my analysis as follows:

Section I: Two-Strike Situations

Below, I break down each of Joe's pitches to understand his arsenal:

tagged_pitch_type	frequency	num_pitches	strike_prob	exit_speed	angle	woba	whiff_rate	putaway_rate	2str_prop
ChangeUp	0.185094	375	0.365101	84.164668	4.180917	0.383505	0.380435	0.190083	0.197390
Curveball	0.136723	277	0.261175	82.981064	-4.978477	0.204464	0.516484	0.270270	0.181077
Fastball	0.560711	1136	0.546449	87.042832	19.645526	0.373026	0.157221	0.147059	0.499184
Slider	0.115992	235	0.404706	85.537730	12.056047	0.320000	0.383929	0.202703	0.120718

Joe's curveball has an elite 51.6% whiff rate, yet he throws it a mere 13.7% of the time. In contrast, Joe throws his fastball a whopping 56.1% of the time even though its 15.7% whiff rate is below league average. In other words, Joe's curveball is approximately 3x more deceptive to hitters yet he throws the fastball 4x more often. This leads us to our most important recommendation: **in general, throw the curveball more and the fastball less**.

Joe's current pitch mix is even more concerning during two strike situations. Even when there are two strikes, he features the fastball 50% of the time. More importantly, he features the curveball only 18.1% of the time during these strikeout situations. Joe's curveball isn't just an elite whiff pitch; its 27% putaway rate is far above the league average rate at 20% which means that when he throws it on two strikes he gets the strikeout at an elite rate. So in two strike counts, I can connect my recommendation directly to a tangible outcome: more strikeouts. **Concretely, if Joe refines his two-strike strategy so that he throws the fastball 35% of the time and the curveball 33% of the time** (slider and changeup frequencies stay constant) and we assume the Putaway% of each pitch remains constant then his Putaway% will increase from 18.4% to 20.2% which will lift him from 49th percentile to 65th percentile. Assuming he finds himself in the same number of strikeout opportunities against the same number of batters, this new Putaway% would lift his K% from 21.8% to 23.96% (41st percentile to 55th percentile). Furthermore, by throwing less fastballs in general, the evidence indicates that he may get batters to more two strike counts than he does now which would also increase his K%.

I'm not saying that 35% fastball and 33% curve during two strike situations are the optimal numbers to aim for; the exact optimal numbers depend on how comfortable Joe feels when it comes to changing a pitch strategy that he is already used to and how his pitches best tunnel together. But I do recommend shifting the numbers by a margin in that neighborhood. Increasing the K% by the number I put forth above is a huge advantage because it significantly increases the rate at which Joe can achieve a controllable and high-value outcome.

Section II: Zero-Strike and One-Strike Situations

A huge part of pitching success is getting batters to two-strike counts, because batters tend to have much lower wOBA and pitchers can access their highest value outcome in the strikeout. **I believe that Joe can get more batters to two strikes by adopting the following strategy during 0-strike and 1-strike counts: attempting to throw his curveball for a strike, and maximizing his strike probability by aiming for medium height**. Below is a table which illustrates how each of Joe's pitches does at each discretized zone height. Note that I define $Clean\% = \frac{\#\ called\ strikes + \#\ swinging\ strikes}{total\ pitches}$.

	Zone Height	*Clean%*	*Whiff%*
Fastball	Low	30.1%	7.4%
Fastball	Medium	30.3%	10.3%
Fastball	High	21.7%	23.7%
Curveball	Low	33.5%	57.7%
Curveball	Medium	**46.9%**	18.2%
Curveball	High	19.4%	0%
Slider	Low	28.0%	49.3%
Slider	Medium	**40.4%**	14.3%
Slider	High	33.3%	27.3%

Clean% is a strong indicator of how often a pitcher can secure a strike without causing contact. A weakness of Whiff% is that it only looks at swing scenarios and thus ignores situations where a pitch freezes a hitter or is placed in a location where hitters just don't want to swing at it. By including called strikes, clean% makes up for this blind spot.

Joe's curveball at medium height has a 46.9% Clean which is his best Clean% by far. Yet he throws his fastball a whopping 61.6% of the time during 0-strike counts and 55% of the time during 1-strike counts and barely throws his curveball during such situations. There is a further advantage; if Joe aims for medium height with his curveball and misses low he ends up throwing a low strike (where he gets good whiff rates). So even if Joe's curveball control isn't so good he can inflate his strike probability by just aiming towards medium height instead of low height directly (but I believe that Joe has relatively good control of his curve based on the tight clustering of where he throws it).

Joe threw 55% fastballs in 1-strike counts with a clean% upper-bounded by 30%; as a rough approximation, we can say that he went from one strike to two strikes "cleanly" 16% of the time using his fastball with the old strategy. Let's assume that he only throws 30% fastballs and uses the free space to throw curveballs at medium height; then he goes from one strike to two strikes "cleanly" 18.4% of the time! If we assume that getting from one strike to two strikes without incurring a ball in play mirrors this pattern, then we are basically increasing Joe's odds of getting to two strikes by about 15%. This approximation is overly generous to the old strategy as well; a 30% clean rate on his 1-strike fastballs is a loose upper bound. Furthermore, throwing more curveballs at medium height may increase the strength of the fastballs he throws up in the zone. Joe concentrates his curveballs heavily below the zone and those may look less like high fastballs and might weaken the deception.

In fact, Joe's curveball at medium height isn't the only option that has an awesome Clean% but is underutilized; his slider at medium height has a Clean% of 40.4% and thus should be thrown more for the same reasons as above. Similarly, missing low with the slider and getting a low strike is not a problem because of the huge whiff rate down there. **Thus, I also recommend that Joe increase his slider usage during 0-strike and 1-strike counts and specifically aim his slider at medium height**. If Joe feels comfortable with his control, he could even aim medium-low. An early-count mix where Joe frequently features curveballs and sliders for strikes possesses enough diversity that it would be difficult for hitters to sit on any pitch. I believe that this recommendation can also help lower the number of homers. 73% of the homers were hit off of Joe's fastball; furthermore, 59% of the homers were hit off of fastballs during 0-strike or 1-strike counts.

To conclude this section, I also believe that this recommended strategy will lower Joe's walk rate by getting him to two strikes earlier without throwing as many balls. By increasing his strikeout opportunities, Joe's K% should also see marked improvement (dare I say a 15% increase?).

Conclusion

Joe has good pitches but he has negated this by relying too much on his fastball. To summarize, I make the following suggestions:

1) During two strikes, replace a significant portion of his fastball usage with curveball usage. For example, 35% fastball and 33% curveball. In practice, this would mean working with Joe such that he is comfortable tunneling the fastball and curveball back-to-back for instance.

2) During zero-strike and one-strike counts, rely less on his fastball to get strikes. Instead, use his curveball and slider more to steal those strikes; aim closer to medium height to minimize the probability that the pitch ends up a ball because it is vertically out of the zone. If comfortable with control, feel free to adjust to medium-low for example. Important that the pitch mix features enough high fastballs so it is difficult for hitters to sit offspeed that's not down in the zone.