Modern Portfolio Theory and the MLB Bullpen

This week's update will be shorter, more of a musing on what I'm thinking on/hoping to come than anything else.

As a Phillies fan, enduring last season's worst-ever bullpen (no really - essentially the worst bullpen ever) has sent me down spiraling down too many black holes to count. The crux of it all is - how hard can it really be to build a bullpen these days? Get a bunch of guys who throw hard and have one alpha among that lot, find some spin-based diamonds in the rough, and play the genetic lottery to dig up a southpaw you can rely for at most a few outs a game.

Thinking more broadly - those all feel like different archetypes that are compiled to make up the a larger unit which we can analyze as a whole. Sort of like a portfolio of financial assets, each with its own contours of risk and return expected, some more similar than others, but all part of a larger investment strategy.

Sort of like Modern Portfolio Theory.

Yes, it's a wonky financial term, but don't be intimidated. It's not all that complicated. More importantly, I think it's going to be an easy way to understand bullpens.

What is MPT? "Modern portfolio theory (MPT) is a theory on how risk-averse investors can construct portfolios to maximize expected return based on a given level of risk."

Huh?

Basically, MPT says the following: you should approach investing (in gold, in stocks, in bonds) not by just assessing how risky that asset is or what its expected return is and plowing ahead, but rather what its addition to your entire PORTFOLIO of assets would do to the risk or return of the entire basket.

When you start investing, MPT dictates you should have either the desired risk (i.e., variance i.e. "spread" of possible outcomes) or desired return (i.e. profit/loss) in mind. You anchor yourself to either one of those as a "given" and from there, you can construct the optimal portfolio that either minimizes risk (if you have a desired return in mind) or a maximizes return (if you have desired risk in mind). You do this by considering how each asset in the portfolio plays off one another and moves the entire risk and return, and most critically, adjust the weight of that asset in the portfolio at large to accomplish this.

It's far from a perfect framework (and I'll get into some of the obstacles in applying this in another post) but I think it can make thinking about bullpen construction in baseball that much easier. Here's how:

- Weighting is simple - a bullpen has X numbers of innings to account for going into the year (could vary by team, and that's a consideration as well). The amount of innings or pitches or batters faced or any combo thereof can be used as a per player weighting.
- The types of asset classes can be spliced any number of ways: handedness, velocity, spin rate, age, pitch usage are just some of the first things that popped into my hand. Additionally, as the age of research and development has shown us, players are not static - an asset class could be "velo gainers" or "spin rate change candidates" if such items were easily identifiable.
- The expected return on a given player is, at this stage in baseball's analytical history, well known via public and private projection systems. In that sense, a reliever's return can be any number of projections headed into the year: FIP, xFIP, ERA, WAR, etc.
- The expected risk of a given player is a little more difficult to calculate in the public sphere as I'm not aware of any projection system that publishes anything besides median projections on a player basis each year. This is likely not a problem on the private side. In our case, though, we need some combo of standard deviation and correlation between assets. In the investing world, this is accomplished through a calculation called BETA. This is definitely the trickiest variable to consider right now, but I think there is a work around. Based on historical projection performance, we could determine the standard deviation of all right-handed relievers, say, or all players who throw 95+ MPH. From there, we could determine how well each of them correlate with the "market" broadly - i.e., how ERA moves on a league level, or how WAR accounts for "replacement level" market risk.

Super high-level, I think this helps us understand bullpens. Going into a given year, considering your place on the win curve (i.e., risk tolerance) and starting pitching profile and offensive and defensive capabilities, you could easily assess a "win-based risk" your team was looking for. For instance, in a competitive division with a contention window that's rapidly closing, the 2021 Phillies would look to their bullpen as necessarily being more "risky", that is, providing a greater chance for more wins and a greater chance for more losses as well. They need upside bets to hit, they need development from their young pitchers, and they need offseason signings to perform.

For a team like the 2021 Pirates, their bullpen is inherently less risky. They're likely happy to predict within relatively certainty what their bullpen performance will be, as they audition players for the future contenders and look to field a competent team more than one with the possibility of flaming out in spectacular fashion.

All these are just thoughts I'll attempt to flesh out a later point.

Thanks as well to the indispensable Investopedia:

https://www.investopedia.com/terms/m/modernportfoliotheory.asp