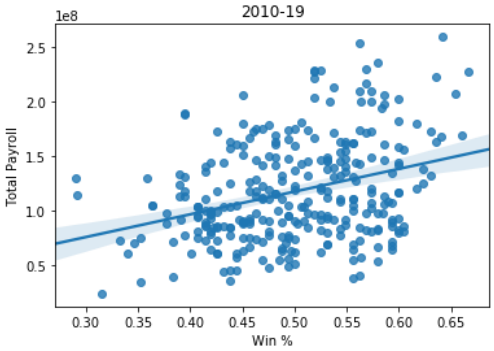
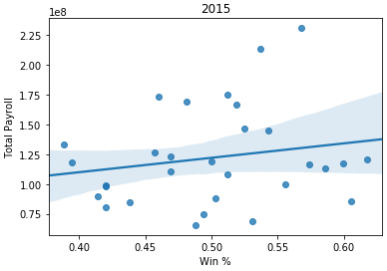
James Casey
MSDS 457 SEC 55
Week 4 Assignment: Player and Team Valuation

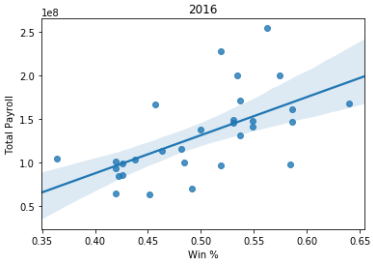
In order to evaluate the Chicago Cubs' performance last year, and to determine how the organization should allocate its finances, one must assess the following questions:

**Is it true that spending more money equates to more wins? How do we compare with other organizations over the last few years?**

To determine this, historical MLB data was acquired from the 2010 – 2019 seasons. This time span was selected in order to obtain a large number of data points, while also capturing whether money spent is correlated to winning in the modern-day MLB. In these seasons, the two stats that were focused in on were **win percentage** and **total payroll**. These two variables were plotted against each other for each season, as well as a total from the 10 seasons. Furthermore, a linear regression analysis, in which slope and R-squared were calculated, was completed for these plots in order to determine how correlated win percentage is to total payroll. Below are the results of a few examples of the plots from this analysis:




2010-19
**Slope**: 208220486.39974216
**R^2 Value**: 0.10891364870965209

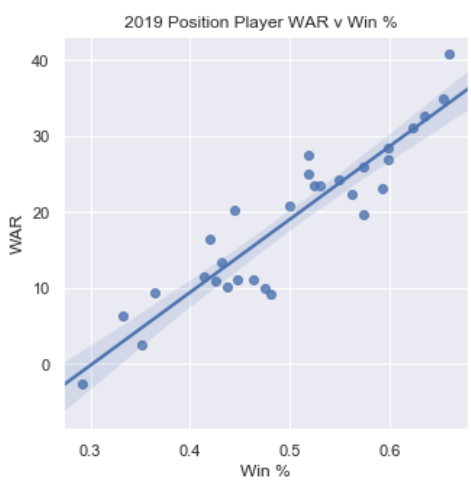
2016
**Slope**: 437097242.4942173
**R^2 Value:** 0.36877789350171675

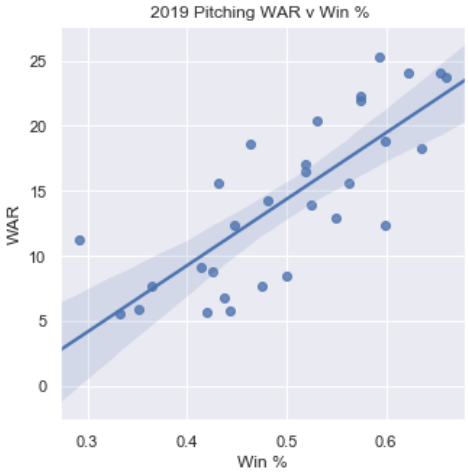
2015
**Slope**: 121021063.562126
**R^2 Value**: 0.03690499498620661

One can recognize few things here. First, on these plots, the correlation (R-squared value) is low, but the slope is positive. This indicates that there is a slight trend between winning and spending more money, but it does not necessarily guarantee a higher win percentage. Next, some correlations are a bit

higher than others. For instance, in 2016 the R-squared value was about 10 times larger than that of the previous year. It is possible that money was of greater value in some years over others. This data does not indicate that spending equates to wins. However, it does suggest that those in positions to spend more may perhaps, have a better chance to win, depending on how money was spent.

Therefore, instead of just looking into how win percentage and payroll are related, it is a good idea to analyze how money is allocated. First, the amount of money spent on pitchers in relation to win percentage was observed. This yielded similar results as the previous analysis – a positive slope with very low correlation. Since this did not reveal much, the total Win Above Replacement (WAR) stat for each team was used next. This stat is used to determine how much each player contributes to a team. The total WAR of each team was plotted with win percentage, and the results were much more informative.




Since there are different WAR values for position players and pitchers, both were taken into account. The linear regressions had much more correlation, as seen, by their R-squared values of 0.85 and 0.62 for position players and pitchers, respectively. This indicates that teams with players that have higher WAR values tend to win more. Therefore, spending more money alone does not equate to wins. However, if money is being spent appropriately on right players, a team is more likely to win.

In regard to how the Cubs compare to other teams over the past 10 seasons, they place 14th in the league for average win percentage, 7th for total payroll, and 3rd (tied) in total World Series victories. Also, in the past season, they placed 9th and 11th in WAR for position players and pitchers, respectively. This indicates that Cubs have performed better than half of the league, but also have room for improvement. This can be improved by searching, drafting, or trading for players with higher WAR statistics.

**How much is our organization worth at the moment? What would be a viable sales price in 5 years?**

In order to estimate the organization's worth and sales price in the next five years, a Discounted Cash Flow Analysis, as proposed by Thomas Miller in *Sports Analytics and Data Science*, was implemented. This involves estimating the profit, cost, and sales price. Profit and cost were estimated based on the Cubs' financial data since 2002. The average difference of profit and costs were used to approximate these values. The sales price was estimated based on the purchase of Cubs in 2009 for $900 million. The current day revenue compared to that of 2009 is about three times larger. Therefore, a viable sales price would be about $2.5 billion. With this information, two models were built, with and without cost control, which can be found below:

| Year | Cash In | Cash Out | Cash In-Out | Discounted Cash In-Out |
|---|---|---|---|---|
| **2020** | 490 | 419 | 71 | 67.45 |
| **2021** | 509 | 435 | 74 | 70.3 |
| **2022** | 528 | 451 | 77 | 73.15 |
| **2023** | 547 | 467 | 80 | 76 |
| **2024** | 566 | 483 | 83 | 78.85 |
| **Sale** | 2500 | 0 | 2500 | 2375 |
| **Net Present Value** | | | | **2740.75** |

**No Cost Control – Values are in millions of dollars*

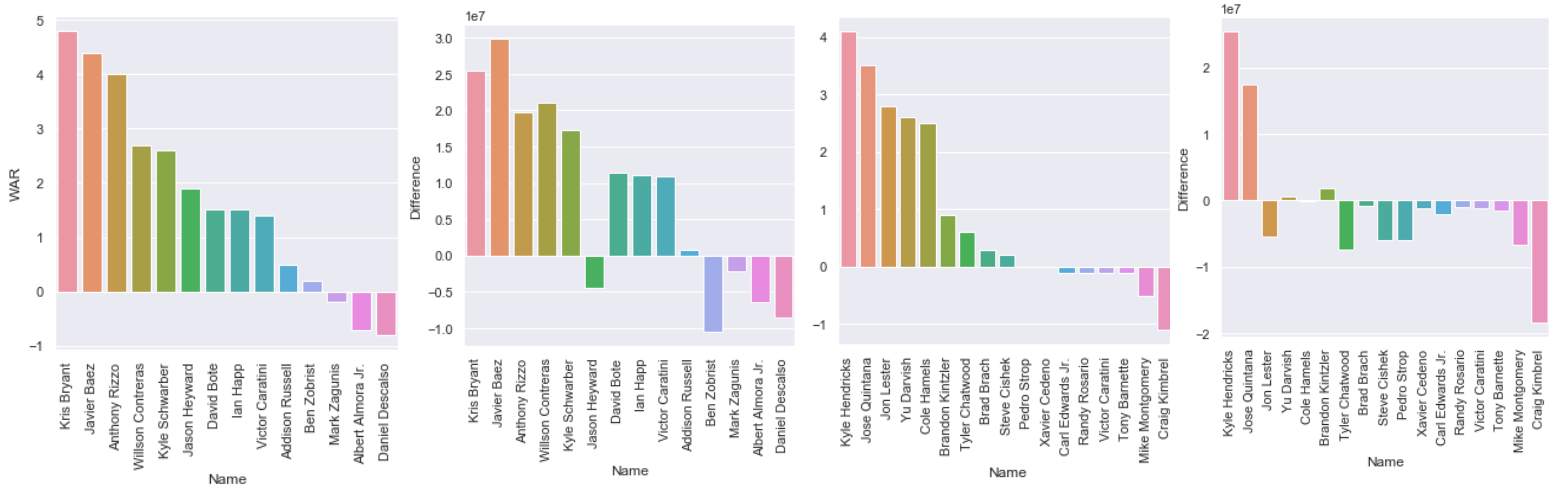
| Year | Cash In | Cash Out | Cash In-Out | Discounted Cash In-Out |
|---|---|---|---|---|
| **2020** | 490 | 400 | 90 | 85.5 |
| **2021** | 509 | 400 | 109 | 103.55 |
| **2022** | 528 | 400 | 128 | 121.6 |
| **2023** | 547 | 400 | 147 | 139.65 |
| **2024** | 566 | 400 | 166 | 157.7 |
| **Sale** | 2500 | 0 | 2500 | 2375 |
| **Net Present Value** | | | | **2983** |

**Cost Control of $400M per year – Values are in millions of dollars*

As seen by this analysis, the Cubs organization can be valued close to $3 billion. However, this is also dependent on how closely the cost control is followed. If it is not, the organization's valuation is closer to $2.7 billion.

**How much did each player on our roster (and in the league) contribute last year? How much did each player on our roster (and in the league) make last year? Given their salary, did they over or under perform?**

Lastly, in order to analyze the contributions from each player and their performance, the WAR metric will be referred to again. The WAR metric is a single metric that can evaluate how much a player contributes to a team and how much he is worth in terms of salary. A WAR of 1 currently equates to about $8 million. Therefore, one can determine if the Cubs are over or underperforming.




*(From left to right- Position Player WAR, Difference between WAR salary and actual salary for position players, Pitcher WAR, Difference between WAR salary and actual salary for pitchers)*

One can notice that Kris Bryant, Javi Baez, Kyle Hendricks, and Anthony Rizzo were the Cubs top contributors, while Craig Kimbrel, Daniel Descalsco, Mike Montgomery, and Albert Almora Jr. cost the team wins in the 2019 season. Next, if one looks at how much the player is worth compared to how much he is actually being paid, one will notice that Javi Baez, Kyle Hendricks, and Kris Bryant, are over performing the most, while Craig Kimbrel, Ben Zobrist, and Tyler Chatwood are underperforming the most. As a team, most position players are overperforming their current salary, while all but four pitchers are underperforming.

Compared to the rest of the league, as previously metioned, the Cubs are $9^{th}$ and $11^{th}$ in WAR for position players and pitchers, respectively. Also, in 2019, the Cubs had the third highest payroll. Regarding how the players compared on an individual basis to the rest of the league, the average WAR for pitchers and position players are 3.5 and 3.0, respectively, while the average salary is $4.5 million. For the Cubs' pitchers, 10 of 17 make over the average league salary. However, only Hendricks and Quintana met or exceeded the league average WAR. For positional players, five players make over the average league salary, while only Bryant, Baez, and Rizzo are above the league average WAR.

**Closing Statement**

In conclusion, the Chicago Cubs have room for improvement, and have the financial means to do so. However, money should be in spent in accordance with the WAR statistic, and to make sure that players are not overpaid. Currently, the Cubs main issue is overpaying pitchers who underperform. If they acquire players with higher WAR values with appropriate salaries then the Cubs will be utilizing their resources in the best possible manner, which should lead to a higher win percentage.

**References:**

Slowinski, Steve. “What Is WAR?” *What Is WAR? | Sabermetrics Library*, library.fangraphs.com/misc/war/.

Miller, Thomas W. *Sports Analytics and Data Science: Winning the Game with Methods and Models*. Pearson Education, Inc, 2016.

**Data Sources:**

MLB Payroll Data: http://www.thebaseballcube.com/topics/payrolls/byYear.asp?Y=2010

MLB Salaries Data: https://www.usatoday.com/sports/mlb/salaries/2015/player/all/

MLB WAR Data:

https://www.fangraphs.com/leaders.aspx?pos=all&stats=pit&lg=all&qual=y&type=6&season=2019&month=1000&season1=2019&ind=0&team=0&rost=0&age=0&filter=&players=0&startdate=2019-03-28&enddate=2019-09-29

Cubs Income: https://www.statista.com/statistics/829566/chicago-cubs-operating-income/

Cubs Revenue: https://www.statista.com/statistics/196641/revenue-of-the-chicago-cubs-since-2006/