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SPM 295: Research Methodology

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Comparing WAR with Salary

Intro

For our project, we used the players with the top 10 WAR and compared their salary to the league average and how that relationship varied from 2011-2019 and in 2021. We were able to use statistics from the baseball reference website. In order to have a good understanding of how WAR and salary relate to each other, we needed to read articles about how WAR, from Stadium Reviews, salary and arbitration, from Belly Up Sports, works. After building an understanding on how these parts of baseball work, we started to make graphs in excel that showed the relationship between WAR and salary. As a group, we came to a hypothesis that there is a positive linear relationship between WAR and salary.

Lit Review

In order to compare WAR and salary, we must know how WAR, or wins above replacement, works. The metric WAR measures how much better or worse a player is when compared to a replacement-level player. In order to calculate WAR for hitters you must use the equation, $\text{WAR for hitters} = (\text{RBI} + \text{Fielding Runs Above Average} + \text{Positional Adjustment} + \text{League Adjustment} + \text{Base Running Runs}) + \text{Runs Added or Lost Due to Grounding into Double Plays} / \text{Runs Per Win}$. In summary, this metric takes hitting, baserunning, fielding, and pitching into account. In order to get the correct comparison, you must compare a player to a

replacement-level player in that same position. However, you must calculate WAR for pitchers differently. This is done by using the equation, WAR for pitchers (FIP) = $((\text{Homeruns}) + (\text{BB} + \text{HBP}) + (\text{K} + \text{IFFP})) / \text{IP}$. FIP stands for Fielding Independent Pitching which is a pitcher's quality when compared to the number of runs they give up. According to The Stadium Reviews, a player who has a WAR less than 0 is a replacement level player, a player with a WAR from 0-2 is is a backup level player, a player with a WAR from 2.1-4.9 is considered is considered an average starter, a player with a WAR from 5-7.9 is considered an All-Star caliber player, and a player with a WAR greater than 8 is considered to be having an MVP season. WAR can have a huge impact on how baseball players are seen by their potential employers. For a free agent, having a good WAR can make you a much more marketable free agent. A player could use WAR to help negotiate for a better contract and a manager could use WAR as a metric to help decide what players to go for in the free agent market.

However, the way salary works in baseball can greatly impact free agent destinations. In baseball there is no salary cap. This means that a team can spend as much as an owner is willing to. Because of this there is an unfair advantage to big market teams such as the Yankees, Red Sox, and Dodgers. One way the MLB tries to limit spending by those big market teams is by imposing a luxury tax that taxes teams that spend more than the predetermined threshold. This is unusual when compared to other leagues because in most of the other globally competitive leagues there is a salary cap that limits how much each team can spend. Due to the lack of a salary cap those big market teams have been able to put together lineups that can almost be considered an all star team on their own. This gives these teams a huge advantage over the small market teams in attracting free agents.

In order to help to know how to allocate their resources, a team may look to WAR as a factor in what players to sign or trade for. According to Bat Flips and Nerds, a team would have to spend a whopping \$10.5 million for one WAR and the cost of this has been steadily increasing in the last 10 years. There has been shown to be a linear relationship between the two so you could pay the same for one player that has a WAR of 4 and 2 players with a WAR of 2. However, while free agency is one of the more cost-efficient ways to pay for WAR, it is not the most cost-efficient. The most cost-efficient way of having a player with a high WAR is by re-signing them according to Bat Flips and Nerds. Therefore, in order for the team to be the most cost-efficient at signing WAR, they would need to identify talent early and either draft them or trade for them while they are still in the minor leagues.

Data and Methodology

To collect our data we used the website baseball-reference which has all baseball data in the history of the sport. We took the top 10 WAR values from the past ten years excluding the 2020 covid shortened season. We looked at the players who held these WAR values and then looked at their salaries for that year. Using the WAR values and salaries we created dot charts in excel and then insert lines of best fit. The lines of best fit allowed us to get an r-value and see if there was any correlation between WAR and salary in any of the years. These R-values will help us prove or null our hypothesis of a positive correlation between salaries and WAR values. As we actually started digging and plugging in our data we started to learn all the different functions of excel. This allowed us to start experimenting with new things like averaging out all the R-values and salaries for more years and more players but this came with no good news as it was the same as

what we started with. So we just stuck to the top ten players in WAR yearly and their salaries for that year.

Results and Discussion

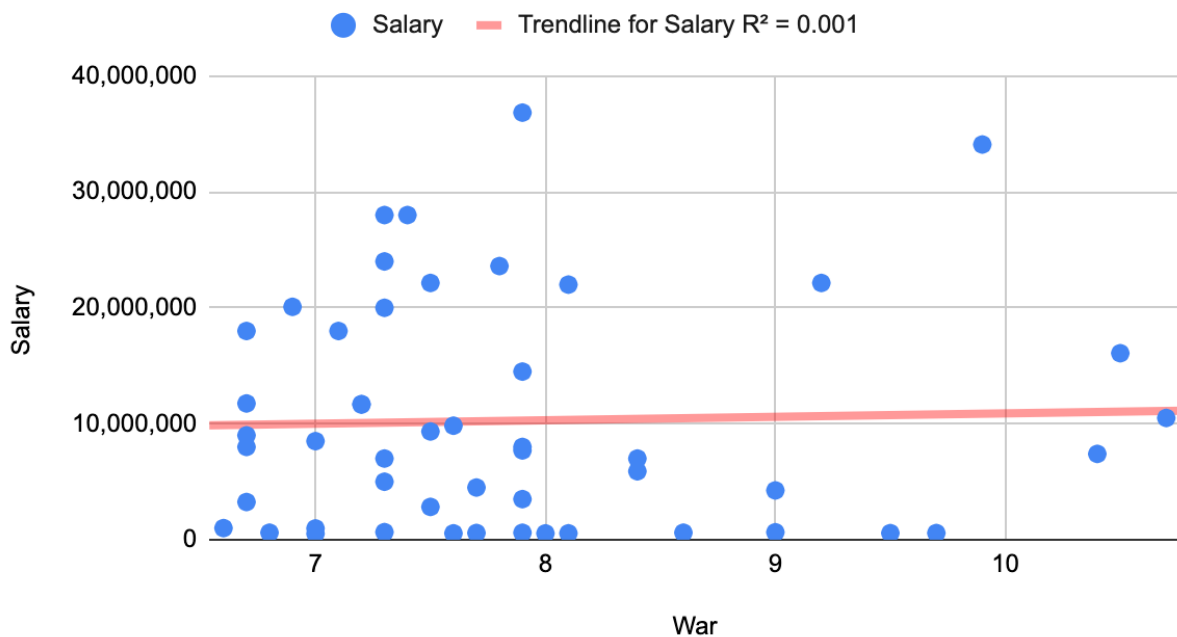
Salary vs. War 2011-2015



There is a slight, negative correlation between salary and WAR from the 2011-2015 MLB seasons. There is an R-value of -0.12. A majority of the data comes from players of lower WAR, and due to this, there are a lot more players of a higher salary that have high, but not the highest WAR. A large reason why there is a negative correlation is because of outliers -- or players, like Mike Trout 2012, (10.5, 492,500), 2013, (8.9, 510,000). Where they are still on their cheap rookie contracts and, in this case, they have the highest WAR in the entire MLB. Because players tend to play 6-8 years of professional baseball before they are given a large contract (which they would have deserved given their production.) There are additionally other players with high production still on cheap deals, such as Buster Posey 2012, (7.6, 615,000), and Corey Kluber

2014 (8.1, 514,000). Values like these are the reason why the trendline is pulled downwards and there is a negative correlation over this 5 year period. In 2011, and 2015 there were positive correlations, however, from 2012-2014, there were all negative correlations between salary and WAR. This highlights the fact that the correlations vary from positive to negative depending on the year. Throughout the 5 years, there is a slight, negative correlation between salary and WAR.

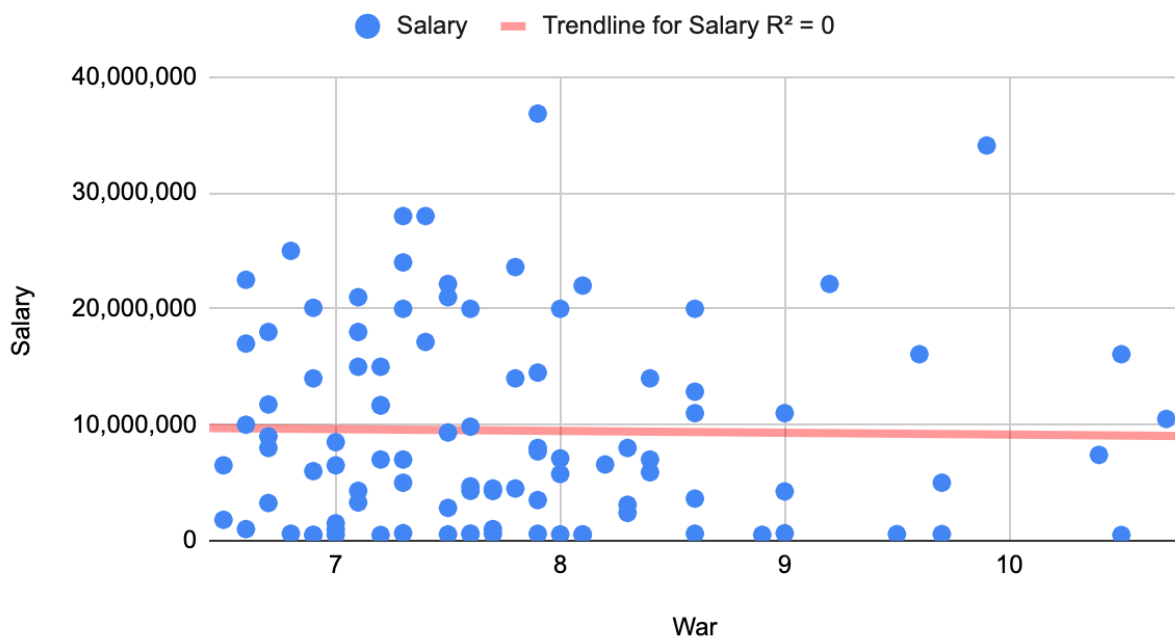
Salary vs. War 2016-2019, 2021



There is a very slight, positive correlation overall between salary and WAR over the 2016-2019, and 2021 seasons. There is a very small R-value of 0.03. 2016, 2017, and 2019 all have small, negative correlations, whereas 2018 and 2021 have small, positive correlations. While more years have negative correlations, the individual R-values for the positively correlated seasons are higher than the individual R-values for the negatively correlated seasons. For example, in 2018 there is an R-value of roughly 0.46, but in 2016 and 2017, there are R-values of -0.08, and -0.05, respectively. That is a large reason for why there is a very very

slight positive correlation over the 5-year period. The fact that there is a positive correlation over the past 5 years can possibly indicate a shift in the relationship between salary and WAR. In addition to the possibility of higher spending in the MLB over the past 5 years playing a role. However, the data over the course of the 5 years

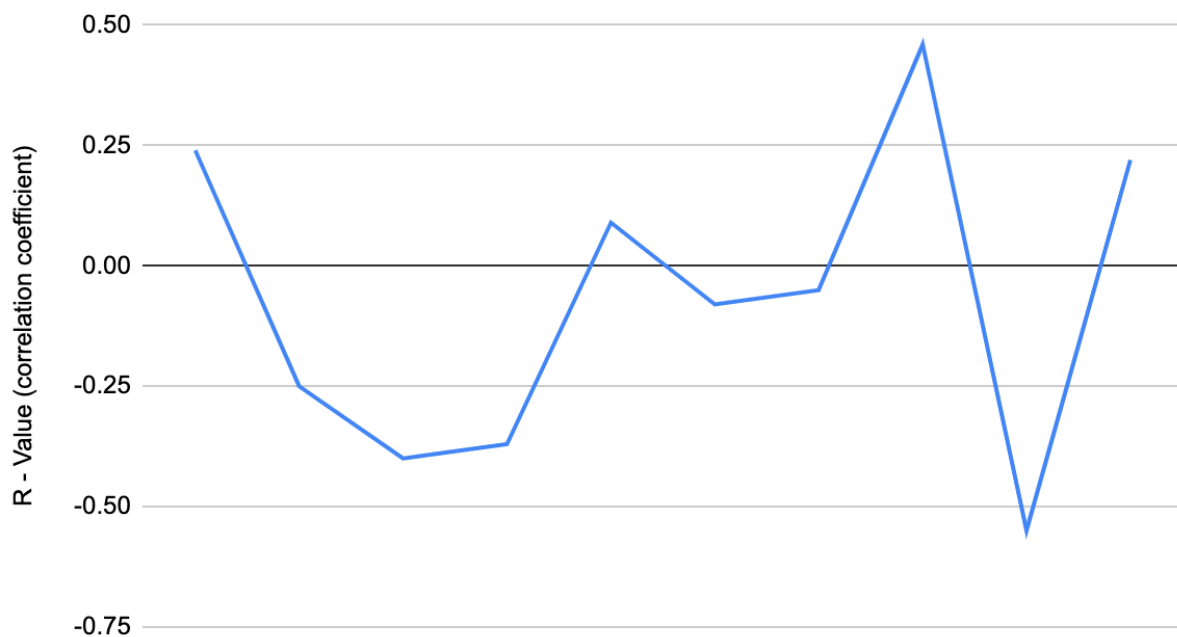
Salary vs. War 2011-2021 (no 2020)



This dot plot and trend line highlight the overall answer to the question presented. The R-value is 0, indicating that there is no correlation between salary and WAR. Most of the data present itself in the (7-9, 0-20,000,000) range. There are players with differing salaries (high and low) and the same WAR which essentially evens out the randomness of the correlation, essentially canceling one another out. There are so many high-level players with a high WAR, above 10 for example, while at the same time the salaries for those values vary from (492,500, and 16,083,000). Because of this dynamic, there is really no way to differentiate between salary and WAR, because there will always be large differences between the highest and lowest earners with

similar WAR values, which essentially just cancel each other out. Especially due to arbitration and contract rules in the MLB, there will always be high-level WAR players that are making less money than they deserve, while there are similar-level players who are just paid for their level of play. For example, Mike Trout's first year in the MLB was 2011, and he had the highest WAR in 2012, meaning that after being the highest player in WAR, he had to play for 4 more years until he was able to sign a contract in free agency, because of the way arbitration is set up in the MLB prevents there from being a correlation between higher salaries and higher WARs.

R - Value (correlation coefficient)



This graph demonstrates all of the R-values relatives from salary to WAR over the 2011-2019 and 2021 seasons. As can be seen in the graph, the R-values over the 10 years vary greatly. One year there can be a positive correlation while the next year can have a negative correlation. This randomness indicates that there is no correlation between salary and WAR.

Overall, it can be determined from all the data that there is no correlation between salary and WAR. The R-values are too variable and the variance in trendlines from 2011-2015, 2016-2019, and 2021, and the trendline from the whole 10 years demonstrates that there is no real correlation between salary and WAR.

Conclusion

In this project, our group utilized the players who were top 10 in WAR and compared their salary to the league average. Using a collection of data from baseball-reference we looked at how that relationship varied from 2011-2019 and 2021. Initially, our group hypothesized that there would be a positive linear relationship between WAR and a high salary. After further exploration and research we found that there was no correlation; hence, proving our hypothesis. This means that in the MLB you can not buy wins. Yes, there are the Los Angeles Dodgers, New York Yankees, and Boston Red Sox who seem to always be contending because of their large influx of talent due to a large output of money. But there are the outliers such as the Tampa Bay Rays this year and the Milwaukee Brewers who had great records despite being small-market franchises. An extraneous variable is that some players who have a top ten WAR and have a small salary are younger and are due for a huge contract. For a younger player on a cheap deal who is efficient his average cost per win will be much lower than an established star in this league. This influences franchises to look from within and grow their talent. Ultimately, we found that spending more money does not directly contribute to winning more games. It most definitely can contribute to wins; however, there are other factors that contribute to wins like a younger player who develops on a cheap contract, a criminally underpaid veteran, or a player having a fluke year.

Works Cited

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