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Introduction

The gender wage gap is a very prominent point of discussion in the professional world, but in the sports world, it has taken the spotlight in recent years. One sport that has seen discussion and debate over salary differences is the National Basketball Association and Women's National Basketball Association. In 2018, the average salary in the NBA was 6.4 million dollars, while the average salary in the WNBA was 71,635 dollars. A reason why these salaries are so differently is due to the amount of revenue that each league brings in. The NBA brings in roughly 7.4 billion dollars a year, compared to the 60 million that the WNBA brings in. However, of the 60 million that the WNBA brings in, only 20% of it is directed towards player salary while the NBA players see 50% of revenue set aside for salaries (Jope, 2019).
The disparities here raise two important questions for this research. First, why does the WNBA bring in so little revenue compared to the NBA. Second why are the WNBA players seeing such a small portion of revenue invested in them? Using data from both leagues answers to these questions will be sought.

Background

In order to understand the salary gap, and how performance effects salary, we first needed to learn more about the pay structure in both the NBA and WNBA. There are many differences between the attention, and revenue that both leagues generate, but they are both owned by essentially same group of people. The WNBA has 20 teams, and 50% of the league is controlled by those 20 owners. Additionally, there are 30 NBA teams, and those owners control the other 50% of the league. However, the NBA has a longer season with 1230 games in their regular season, compared to the WNBA's 204 games of regular season. As Table 1 outlines, the NBA also has a larger fan base, the 2019 finals were viewed by 15.14 million people and the

WNBA finals of the same year were viewed by 231,000 people. More consistent viewers bring with it the more lucrative TV deals, incredible profit from merchandise and ticket sales.

Average Viewership	
2019 NBA Finals 15.14 million	In 2018: 231,000 viewers
Average Attendance	
18,000	6,768
Ratings	
2019 NBA Finals had an 8.8 rating reaching 15.14 million	2019 WNBA season had a 0.6 rating, a 200% increase

Table 1: Differences between NBA and WNBA (Jope, 2019)

The answer to the question of why the WNBA is fighting for increased pay has to do with equality in payments and equity between the leagues. Table 2 outlines some of these differences. There has been a long-standing debate on the causes and reasons for the gender wage gap, and in the case of professional sports, the difference in pay between successful male athletes and successful female athletes is very evident. We can track this fight back to at least 1973, when Billie Jean King challenged the patriarchy of the world of professional tennis and fought for women to have equal opportunities and pay (Mervosh and Caron, 2019).

Top Salary in WNBA	$117,500 (max salary)	**Top Salary in NBA**	$37.4 million (max salary)
Female Soccer Players	$260,000 (for winning world cup)	**Male Soccer Players**	$1.1 million (for winning world cup)
Women's Pro Tennis	$495,000 (for winning grand slam title 2018)	**Men's Pro Tennis**	$731,000 (for winning grand slam title 2018)

Table 2: Differences between male and female monetary structures

One of the more recent, and well-known controversies is with the US Women's Soccer team, who won the last world cup making it their 4th world cup win. In 2019 women's team then began their lawsuit against the governing body of US soccer leagues, the United States Soccer Federation (Gertman, 2020). They were suing for equal pay, but the key idea people miss in this argument is that equal pay does not mean the exact same number for everyone's salary, but the same amount proportionally according to the format that generates the salary for the men's team. The findings that came out during the court case was that the women get paid more than the men if you look at purely the numbers.

> "The court found that the female players "received more money than [male] players on both a cumulative and an average per-game basis. Indeed . . . payments to the [female athletes] totaled approximately $24 million and averaged $220,747 per game, whereas payments to the [male players] totaled approximately $18 million and averaged $212,639 per game.'"(Gertman, 2020)

However, the argument that the women were presenting is that based of the formula that determines the men's salaries, the women should be making more money based off their performance. This situation is related to the conflict in the WNBA currently. The female basketball players are also fighting for equal pay, under the idea that the way men's salary is computed would equal a proportionally higher salary for the women.

The WNBA, while 50% of it is owned by those same owners who profit of the highly profitable NBA, still struggles to get even a fraction of the fan base, TV deals, and ticket sales as their male league counterparts. The revenue brought in by the ticket sales, merchandise, and TV broadcasting is usually well into the billions for the NBA while the WNBA comes in around 50-70 million on average.

> "Exploitation was defined by Joan Robinson as a worker being paid a wage less than their marginal revenue product. As noted in Sports Economics, we expect this to happen if the worker's bargaining power is limited by an employer with monopolistic power."(Stanek, 2016)

This not only applies to women's college basketball, but the professional leagues as well. There are drastically different salaries for the players in the WNBA compared to the NBA. In 2017 the highest salary in the WNBA was 2.18% of yearly revenue. In the NBA, the lowest salary was 3.2% of revenue. These numbers come from the percentage of each leagues yearly revenue that is diverted into salary, rather than the absolute value, so they are comparable. This is explicit evidence that the players in these two leagues are compensated very differently. Based upon the low bargaining power of the WNBA, this could be a reason as to why they were not able to negotiate higher salaries until this past January. According to the data on Statistica, the NBA made 8.01 billion dollars in revenue in 2017 while the WNBA brought in only 51.5 million. The fan base, and public interest in the WNBA is low and therefore they do not possess the bargaining power to negotiate higher salaries. That was the case up until this past January, where they negotiated a new Collective Bargaining Agreement with commissioner Adam Silver. The old CBA was lacking in many conditions. The limit to salary raises was restricted based on predicted growth in television viewing, and when their viewing expectations were exceeded the salaries did not reflect that.

> "...the last CBA put the rookie salary of those players chosen 1-4 in the 2014 WNBA Draft at $48,670. By 2018, that number for players picked 1-4 in the draft increased to $52,564. That's an increase of 8%. The maximum player base salary was $107,500 in 2014, per the

> terms of the last CBA, and $115,500 in 2018. That's an increase of 7.4%. The television revenue went up 108.3% over that same period.” (Megdal,2018)

There was a lot of discussion focusing specifically on allotments for game day travel, medical exemptions, and salary percentage. This new contract could potentially triple the max salary for WNBA players. A lot of the salary changes are contingent upon the league hitting certain revenue benchmarks which were not published and securing a larger television deal with ESPN. Even though the WNBA has seen growth in their television viewing, and did not see compensation to match, they will still be required to boost viewing numbers even more before their can see their salaries change.

This raises a question as to why the WNBA players are not seeing the proportional compensation as the NBA players, as the WNBA is also owned by the same group that decided the men will get 50% of yearly revenue to ensure higher salaries. The newly negotiated Collective Bargaining Agreement (CBA) that was just agreed upon by all WNBA and NBA board members brought in some new additions for the women. For many of the new benefits, such as a potential tripling in maximum salary, and paid maternity leave, are conditionally on the league accomplishing more growth. While looking through several of the new “benefits” in the CBA, there are certain items that seem to be pandering to the women such as guaranteed funds for women to freeze their eggs. The women aimed to negotiate for equity in pay, and treatment but it is unclear if the commission aimed to grant them that or simply created a list of anything they could think applied to women and put it in a contract.

Literature Review

The question that motivates this paper the reasons behind why female athletes are paid less than their male counter parts. More specifically, an investigation of why WNBA players make significantly less than NBA players. This idea requires analytical observations. Two different analytics to look at NBA player salary in order to determine if they are being over or under paid are Earned Wins Added (EWA), and Wins Produced (WP). The first metric is Hollinger's Estimated Wins Added (EWA) statistic, which approximates how many points a player adds to his [or her] team above that of a replacement player. The focus of this statistic is mainly offensive statistics that are combined into one value to calculate the player efficiency rating (PER). The problem is that it is not adjusted for minutes played. This metric was designed to measure a players per-minute productivity, but it did not consider how much more productive a player is based on how many minutes they play. They altered the statistic to include quantity of contribution and changed it to a Value Added (VA) measurement, which essentially is just the measurement of how much playing time increases a player's value.

Value Added = ((Minutes * (PER – Position Replacement Level)) / 67) *

* "A point of PER over the course of 2,000 minutes is worth about 30 points to a team, meaning that one point of PER over one minute is worth 1/67th of a point)"

The second metric is Berri's Wins Produced (WP) statistic, which looks at a player's offensive and defensive statistics relative to his [or her] teammates and the rest of the league. This is a six-step approach for coming up with the estimate of how much each player contributed to a team win. Unlike Hollinger's, this metric uses both offense and defense statistics. (Stanek, 2016). The purpose of using these different ways to essentially measure a player’s productivity is to then look at productivity next to wages and observe if there is a correlation. Instead of trying to measure a player's value per minute and assigning a score, Berri looks at how a player's stats correlate to team wins. While this paper focuses on whether the NBA players are over or under paid, the same structure can be applied to the WNBA players in order to determine if they are truly under paid based on their athletic performance. This strategy is common for determining whether salaries are just, in fact a similar tactic was used to determine the fairness of MLB player salaries in 2007. (Stanek, 2016). This mode of analysis is effective in determining is salaries are appropriate because it bases value of the player off game performance and can be applied to any level of player. The value of player performance combined with the information of how much revenue a team brings in allows us to see if the front office is appropriately distributing the team salary. However, there is still disagreement about the accuracy of some measure of productivity because some weight offensive stats more heavily than defensive.

> “Nuoya Li (2014) of Clemson University analyzed offensive and defensive statistics of players in contract years, in which players are playing for a new contract. In her study, she found that while many offensive statistics such as points and assists are individually significant to salary, only blocks are individually significant to salary.” (Huang, 2016).

This creates a problem for measuring player productivity and how it contributes to their salary, because some players who are more offensive powerhouses will receive a better score from productivity than those who work exclusively defense. The metrics for measuring player productivity are a work in progress, and so is the fight for higher wages in the WNBA. While many in the public see the wages of professional athletes and feel they are overpaid, economists would disagree. If you observe the market for professional athletes, there are several restrictions on the market, such as free agency and salary caps, that prevent players from receiving a salary that the free market dictates (Huang, 2016). The most observable answer for why WNBA players are receiving such low salaries compared to NBA players is because of a restriction on the market placed by their front office and the board of directors. The amount of revenue that is diverted to players' salaries is drastically different between the leagues. In the NBA, 50% of revenue is directed to salaries while in the WNBA 20% is allocated for salaries (Berri, 2018). With this specific hurdle to pay equality, the first step would be to allocate the same percentage of revenue for salaries so there can be equity between the leagues. In efforts to improve the WNBA's player support, there was a renegotiation of their league contract. This meeting did result in new clauses allowing for higher salaries to players, conditional that they grow their viewership. It seems that the league owners, and board of directors are trying to work towards more equality in the area of professional basketball, but the results are yet to be seen.

Data

Data has been complied from NBA and WNBA Advanced Stats for the years 2017, 2018, and 2019. Table 3 outlines the variable names and descriptions that will be used in the study. Tables 4 and 5 include summary statistics for both the NBA and WNBA. There are a few notable findings from these tables that merit discussion. For the WINPCT models any statistic which contributes positively to team game play we expected to see a positive sign on that variable, indicating a positive correlation with the teams win percentage. In the salary model, we also expected that all variables that were positive contributions to a team's game play would also reflect positively on players salary. The variables steals, field goal percentage, three-point percentage, free throw percentage, blocks, assists, and rebounds were used in both regressions and are all stats that would be considered positive contributions to the team.

Table 3

Variable Name	Variable Description (Team Stats)
STL	Average number of steals per game
FGPCT	Field Goal Percentage, average number of shots attempted, divided by average number of shots made (does not include free throws)
THREEPPCT	3 Point Percentage, average total number of 3 pointers attempted, divided by the number of 3 pointers made
FTPCT	Free Throw Percentage, average total number of free throws attempted, divided by the number of free throws made
BLK	Average number of blocks per game
AST	Average number of assists per game
REB	Average number of rebounds per game
lnNsalary	The log of the team salary of the following year
WINPCT	Win Percentage, Total number of games player, divided by number of games won

Tables 4 and 5 below are the statistics that describe each of our variables in both the NBA and WNBA data sets. By looking at the maximum value of each variable we can compare which league preforms better in each area. Our data indicated that on average the NBA players are better at 3-point shots, rebounds, assists, steals, and blocks. The WNBA preforms better only with free throws. Based on the data collected, on average NBA players are preforming better than WNBA players.

Table 4

summary stats NBA

Statistic	N	Mean	St. Dev.	Max	Min
WINPCT	60	0.50	0.15	0.79	0.21
FGPCT	60	46.04	1.40	50.30	43.30
THREEPPCT	60	35.86	1.37	39.20	32.90
FTPCT	60	76.72	2.81	81.90	69.50
REB	60	44.34	2.09	49.70	39.80
AST	60	23.91	2.12	29.40	19.50
STL	60	7.67	0.76	9.30	6.10
BLK	60	4.88	0.76	7.50	2.40
Salary	60	115,296,455	15,564,031	153,171,497	79,180,081
NSalary	60	123,051,825	12,629,452	153,171,497	79,180,081
lnNsalary	60	18.62	0.11	18.85	18.19

Table 5

summary stats WNBA

Statistic	N	Mean	St. Dev.	Max	Min
WINPCT	24	0.50	0.18	0.79	0.18
FGPCT	24	44.31	2.20	47.90	40.60
THREEPPCT	24	34.10	2.43	38	29
FTPCT	24	79.54	3.31	85.80	74.20
REB	24	34.16	2.41	38.70	28.20
AST	24	18.54	1.83	21.20	15.00
STL	24	6.99	0.85	9.30	5.70
BLK	24	3.81	0.84	5.60	2.70
Salary	24	745,564.00	327,630.10	1,305,550	161,756
Nsalary	24	915,089.60	183,953.90	1,305,550	413,759
lnNsalarywnba	24	13.70	0.25	14.08	12.93

Table 6

Win% and Wage Models

	Dependent variable:			
	lnNsalary	lnNsalarywnba	WINPCT	
	(NBA)	(WNBA)	(NBA)	(WNBA)
FTPCT	0.005	0.027	0.009*	0.011
	(0.006)	(0.018)	(0.005)	(0.007)
THREEPPCT	-0.004	-0.015	0.035***	0.017
	(0.012)	(0.033)	(0.010)	(0.014)
FGPCT	0.016	-0.050	0.043***	0.053**
	(0.017)	(0.046)	(0.014)	(0.019)
REB	0.017**	0.057**	0.037***	0.038***
	(0.008)	(0.025)	(0.007)	(0.010)
AST	-0.015	0.067	-0.022***	-0.045**
	(0.010)	(0.048)	(0.008)	(0.020)
BLK	0.037	0.041	0.024	0.070**
	(0.023)	(0.062)	(0.019)	(0.025)
STL	0.004	0.107	0.063***	0.090***
	(0.022)	(0.062)	(0.018)	(0.025)
Constant	17.027***	10.210***	-5.132***	-4.687***
	(0.758)	(2.236)	(0.627)	(0.919)
Observations	60	24	60	24
R^2	0.202	0.473	0.693	0.831
Adjusted R^2	0.095	0.243	0.651	0.756
Residual Std. Error	0.105 (df = 52)	0.213 (df = 16)	0.087 (df = 52)	0.088 (df = 16)
F Statistic	1.881* (df = 7; 52)	2.054 (df = 7; 16)	16.745*** (df = 7; 52)	11.205*** (df = 7; 16)
Note:				*p**p***p<0.01

Results

Table 6 outline the Ordinary Least Squares estimated regression equation for both the NBA and WNBA salaries and Win Percentage. What we can draw from the results of our regressions is what variables statistically impact salary and win percentage, and how large of an effect certain variable have on the win percentage of the team or salary of the team. Something interesting to note is that in the WNBA blocks contribute 4.6% more to win percentage than in the NBA and are valued .4% more toward team salary in the WNBA. The variable for blocks is only significant for the WINPCT regression for the WNBA. The expectation was that the sign on all the variables would be positive, because based on the research there is not any statistic in our data that would decrease a player's value. However, the sign on AST is negative in all models except the WNBA wage model, and the constants for both WINPCT models are negative. The reason for the negative constants with he WINPCT models would be an omitted variable that would have a negative impact on win percentage, which could be any number of things, but could be due to high correlations between the variables. These econometric tests need to be further investigated.

Having no statistically significant variables in the wage models is not surprising because the salaries in the data were for the entire team, while the stats apply more to individuals. The information we see from our wage model is more about the comparison between the two leagues. The coefficient for the variables shows us how valuable each stat is to each league. In the WNBA we see that FTPCT(free throw percentage) is 2.2% more valuable than in the NBA. It appears that every statistic in this regression came out with a coefficient indicating that these stats are valued more in the WNBA compared to the NBA. An assumption we could make from this is that the WNBA tends to put more emphasis on team play, while the NBA could be focusing more on individual players. However, something that is reassuring to see from this wage model data is that salaries are not predetermined, they are earned by each player unique set of skills and stats. We hope to continue developing this research and break it down even further by looking at individual players in each league as well as investigating the "front office" decisions that determine salaries.

Conclusion

The motivation behind this paper was exploring why female athletes are paid less than their male counterparts, in particular why WNBA players see significantly lower salaries than NBA players. After researching the wage structure in both leagues, we found that there is a large difference between the amount of revenue brought in by each league, but also the distribution of revenue to salaries. Additionally, after gathering the player statistics from 2017-2019 we observed that there is a difference in player performance between the leagues as well. NBA team statistics indicate that their players preform, on average, better in almost all the areas we looked at. Unfortunately, after running out regressions there was not strong statistical significance of many variables and we were not able to make a definite statement on whether or not WNBA players have earned a higher level of compensation. While the statistics we gathered unearthed some differences between the men and the women, we still need to do further investigation to determine if there is a statistical difference between the team's performance. We aim to continue this project in the honors research capacity this coming year, where we will focus more on the individual player level.

Bibliography

Berri, D. (2018, May 17). *Macmillan Learning Community*. Retrieved from Measuring Exploitation In Women's College Basketball: https://community.macmillanlearning.com/t5/economics-blog/measuring-exploitation-in-women-s-college-basketball/ba-p/6026

Gerstmann, E. (2020, May 4). *Forbes*. Retrieved from This Is Why The U.S. Women's Soccer Team Lost Its Pay Discrimination Suit: https://www.forbes.com/sites/evangerstmann/2020/05/04/this-is-why-the-us-womens-soccer-team-lost-their-pay-discrimination-suit/#2de358ed2886

Huang, J(2016). "Salary in the National Basketball Association", *Joseph Wharton Scholars*. http://repository.upen.edu/joseph_wharton_scholars/16

Jope, C. (2019, July 18). *World Sports Network*. Retrieved from NBA vs WNBA: Revenue, Salaries, Viewership, Attendance and Ratings: https://www.wsn.com/nba/nba-vs-wnba/

Megdal, H. (2018, November 19). *Forbes*. Retrieved from WNBA CBA Negotiations: Adam Silver, Terri Jackson Discuss The Stakes And The Grand Bargain: https://www.forbes.com/sites/howardmegdal/2018/11/19/wnba-cba-adam-silver-terri-jackson-discuss-stakes-and-the-grand-bargain/#2aa381185b7b

Megdal, H. (2020, January 16). *New York Times*. Retrieved from W.N.B.A. Makes 'Big Bet on Women' With a New Contract: https://www.nytimes.com/2020/01/14/sports/basketball/wnba-contract-collective-bargaining-agreement.html

Mervosh, S., & Caron, C. (2019, March 8). *Forbes*. Retrieved from 8 Times Women in Sports Fought for Equality: https://www.nytimes.com/2019/03/08/sports/women-sports-equality.html

Roys, N., & Berri, D. (2017, September 20). *Forbes.* Retrieved from Basketball's Growing Gender Wage Gap: The Evidence The WNBA Is Underpaying Players: https://infogram.com/nba-vs-wnba-wage-gap-nate-roys-1ho16v3dvpo74nq

Stanek, T (2016). "Player Performance and Team Revenues: NBA Player Salary Analysis", CMC *Senior Theses*. Paper 1257 http://scholarship.claremont.edu/cmc_theses/1257

Appendix

R script

```
library(stargazer)

library(dplyr)

attach(ShorterNBA)

lnNsalary<-log(NSalary)

attach(ShorterWNBA)

lnNsalarywnba<-log(Nsalary)

#NBA

wagemodelnba<-lm(lnNsalary~FTPCT+THREEPPCT+FGPCT+REB+AST+BLK+STL, data =
ShorterNBA)

stargazer(wagemodelnba, type = "html", title = "Wage Model NBA", digits = 3, out =
"wagemodelnba.hml")

#WNBA

wagemodelwnba<-lm(lnNsalarywnba~FTPCT+THREEPPCT+FGPCT+REB+AST+BLK+STL,
data = ShorterWNBA)

stargazer(wagemodelwnba,type = "html", title = "Wage Model WNBA", digits = 3, out =
"wagemodelwnba.hml")

#WINPCT NBA

attach(ShorterNBA)

winpctnba<-lm(WINPCT~FTPCT+THREEPPCT+FGPCT+REB+AST+BLK+STL,data =
ShorterNBA)

stargazer(winpctnba, type = "html", title = "WIN%nba2", digits = 3, out = "WIN%nba2.hml")

#WINPCT WNBA

attach(ShorterWNBA)

winpctwnba<-lm(WINPCT~FTPCT+THREEPPCT+FGPCT+REB+AST+BLK+STL, data =
ShorterWNBA)

stargazer(winpctwnba, type = "html", title = "WIN%wnba2",digits = 3, out =
"WIN%wnba2.hml")

stargazer(wagemodelnba,wagemodelwnba,winpctnba, winpctwnba, type = "html", title = "Win%
and Wage Models", digits = 3, out = "allmodels.hml")

stargazer(as.data.frame(ShorterNBA,ShorterWNBA, lnNsalary, lnNsalarywnba),type="html",
summary.stat=c("n", "mean", "sd", "max","min"),digits=2, title="summary stats",
out="summarystats1.hml")

summary(lnNsalary,lnNsalarywnba)
```

```
stargazer(as.data.frame(ShorterWNBA),type="html", summary.stat=c("n", "mean", "sd",
"max","min"),digits=2, title="summary wnba", out="summarywnba.hml")
```