Gender Pay Equity in Sports

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Abstract

In this paper, we will use statistics to analyze various data sets describing the monetary compensation gap across men's and women's sports. We will compare pay within both individual sports and team sports, evaluating the pay gap between men and women in each. We will also determine whether there is a correlation between league revenue and player salaries.

1 Introduction

In this paper, we will use statistics to analyze various data sets describing the monetary compensation across men and women's professional sports. Historically, women are paid less than men. We will examine both individual sports, such as tennis and golf, and the team sport of basketball.

2 Background

In this section, we will discuss preliminary information essential to the statistical methods and strategies implemented in our research. We will also provide necessary background information necessary to understand the given data.

2.1 Gender Pay Gap in the United States

Gender pay equity refers to the compensation of employees performing substantially similar job functions with equal pay regardless of gender, race, or ethnicity. The Equal Pay Act requires that men and women in the same workplace be given equal pay for equal work [7]. Focusing specifically on young workers in the United States, Figure 1 shows the median hourly earnings of women in comparison to their male counterparts. Since 1982, there has been a slow increase in women's pay that has contributed to the narrowing of the gender pay gap. Historically, women have been paid less than men for doing the same work. In 2022, women made 82 cents of a man's dollar. This has barely increased over the past 20 years, as women made 80 cents for every dollar a man made in 2002 [3]. This is true across all fields

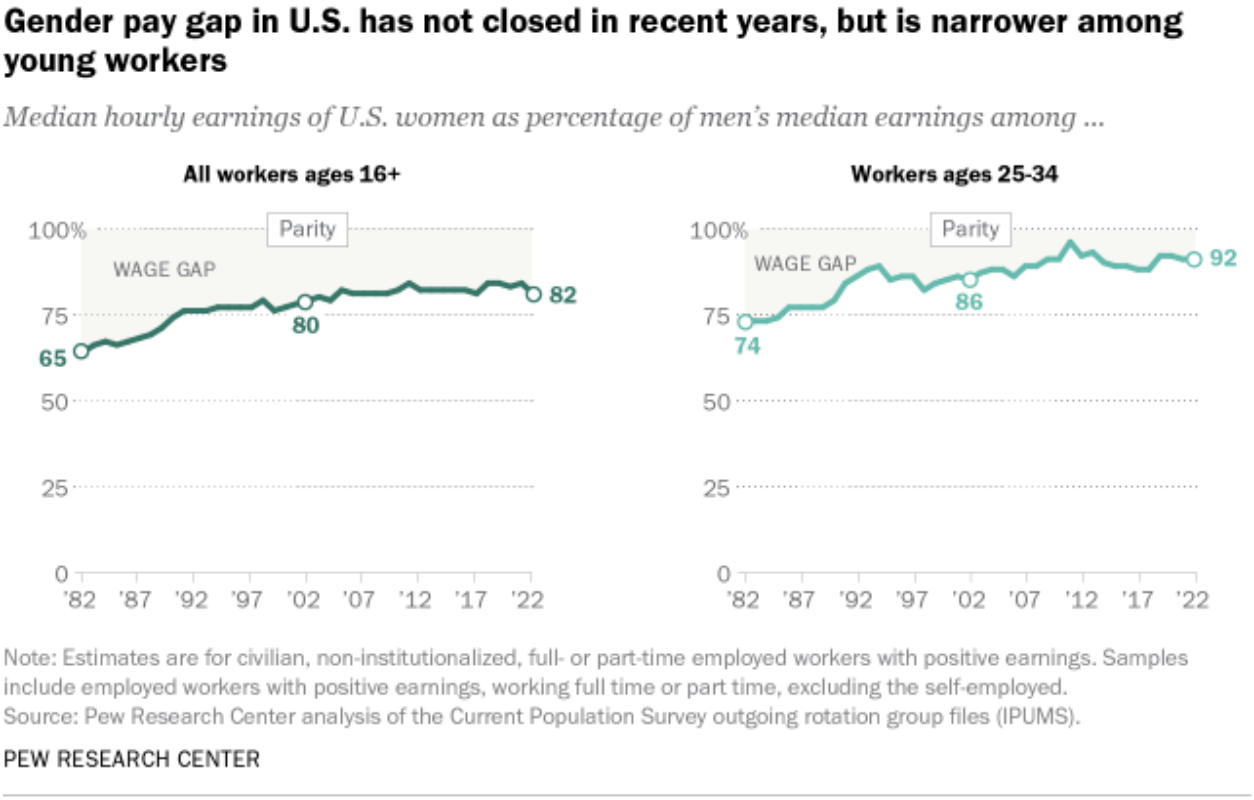

Figure 1: Gender Pay Gap in the United States [3]

of work, but in this paper, we will consider the male dominated field of sports.

2.2 Individual Sports

Individual sports are considered those played by a single person. In this paper, we will consider only two individual sports: tennis and golf. Similarly, an individual player of either sport competes for their own prize. Monetary compensation is based on personal performance and competition outcome. Personal performance refers to how well a player executes their game. Competition outcome is whether or not they win the game. A player

may perform well and lose the competition, or conversely, perform poorly and win the game. Successful personal performance enhances the player's game statistics, while competition outcome depends on how the two opponents perform in comparison to each other.

2.3 Team Sports

Team sports require multiple athletes to form a team of players. In this paper, we will discuss the team sport of basketball. Monetary compensation in team sports depends on team performance and individual player statistics. The team performance refers to whether or not a given team wins a game. Individual player statistics refers to individual success. For example, in basketball, individual statistics include field goals scored, field goals attempted, field goal percentage, etc. Field goals are each basket scored. So, how many points a player gets versus how many they've attempted would produce the field goal percentage. A high field goal percentage may earn a player more money. We see an example of this in Figure 3, where the relationship between points per game and salary in the WNBA is shown.

3 Individual Sports

In this section, we will go in depth on tennis and golf. After considering differences in game play between men's and women's teams, we will dive into their compensation history. Following these trends of pay, we will look at pay discrepancies between male and female athletes of each respective sport.

3.1 Tennis

3.1.1 Rule Differences

Tennis, while sometimes comprised of teams, is competed in singles or doubles. In this paper, we will be considering singles tennis matches and individual players. The only difference in rules between men and women's tennis is that women play best of three sets, while men sometimes play best of five sets. In tennis, the prize money is often referred to as the "purse." So, the total purse of a tournament is the total amount of money given out to all of the players. The champion will receive the most money, then the runner-up, then semi-finalists. Following the winner, compensation decreases depending on performance.

3.1.2 Compensation History

The game of tennis originated in the 12th century and has since evolved into a professional spectator sport. It wasn't until 1972 that male professional tennis players came together to officially establish the Association of Tennis Professionals (ATP) [12]. Women's professional tennis began in 1970, when nine players signed $1 dollar contracts to compete in the Virginia Slims Series, a new women's tennis tour that would come to be known as the Women's Tennis Association (WTA) [1]. Among these nine women was Billie Jean King, who would come to be one of the most famous advocates for equal pay in professional tennis. Major tournaments in tennis are called the grand slams: the Australian Open, the French Open, Wimbledon, and the US Open. Both men and women compete in these four major tournaments. The US Open offered equal prize money to men and women for the first time in 1973, but that

wasn't the case for all major tournaments. The Australian Open, for example, did not offer equal prize money until 1984, then stopped between 1996-2000, and resumed offering an equal purse again in 2000.

3.1.3 Pay Discrepancies

Tennis is one of few sports that pay male and female athletes fairly equally. Since there aren't significant discrepancies between salaries, we will compare revenue in this section.

In 2021, the ATP brought in $176.8 million in revenue, while the WTA brought in $87.8 million [28]. This disparity in revenue often reflects in prize money for respective ATP and WTA events. League revenue depends largely on viewership and sponsors. The difference in revenue can be accredited to popularity among the public. However, when analyzing ATP and WTA salaries, we find that they are comparable. This would imply that professional tennis salaries do not have a direct correlation to league revenue. We will look at this claim specifically in Section 6: Statistical Analysis.

3.2 Golf

3.2.1 Rule Differences

Golf is a true individual sport, as each person represents themselves. Golf can be played in nine or eighteen holes. There are three sets of tee off points for each hole. Regardless of gender, anyone is allowed to shoot from any tee, depending on skill level and swing speed. Generally, amateur women shoot from the tee closest to the hole, amateur men and female

professionals shoot from the middle tee, and male professionals from the farthest tee. This accounts for physical differences in men and women. Other than this, there are no differences in the rules of golf between men and women.

3.2.2 Compensation History

The Professional Golf Association was established in 1916 [6]. The Ladies Professional Golf Association (LPGA) was established in 1950, when 13 women fought for a platform for women's golf. In the LPGA's first 10 years, they had 14 tournaments with a total purse of $50,000 [18]. Conversely, in 1950 alone, the total purse for the PGA was $459,950 for a total of 33 events [20]. Women's golf has five majors: Chevron Championship, US Women's Open, KPMG Women's PGA Championship, Evian Championship, and AIG Women's Open [11]. In men's golf, there are four major tournaments, consisting of The Masters, US PGA Championship, US Open, and The Open [19].

3.2.3 Pay Discrepancies

Since the beginning of the LPGA, male and female professional golfers have not been compensated equally. In Figure 2, we can see the difference in total prize pool between men on the left of the graphic and women on the right. In 2023, the total purse for the PGA over 38 tournaments was $460 million. For the LPGA, the total purse in 2023 for 33 tournaments was $101.4 million. In the following calculations, we can determine the total purse per tournament for both the PGA and LPGA.

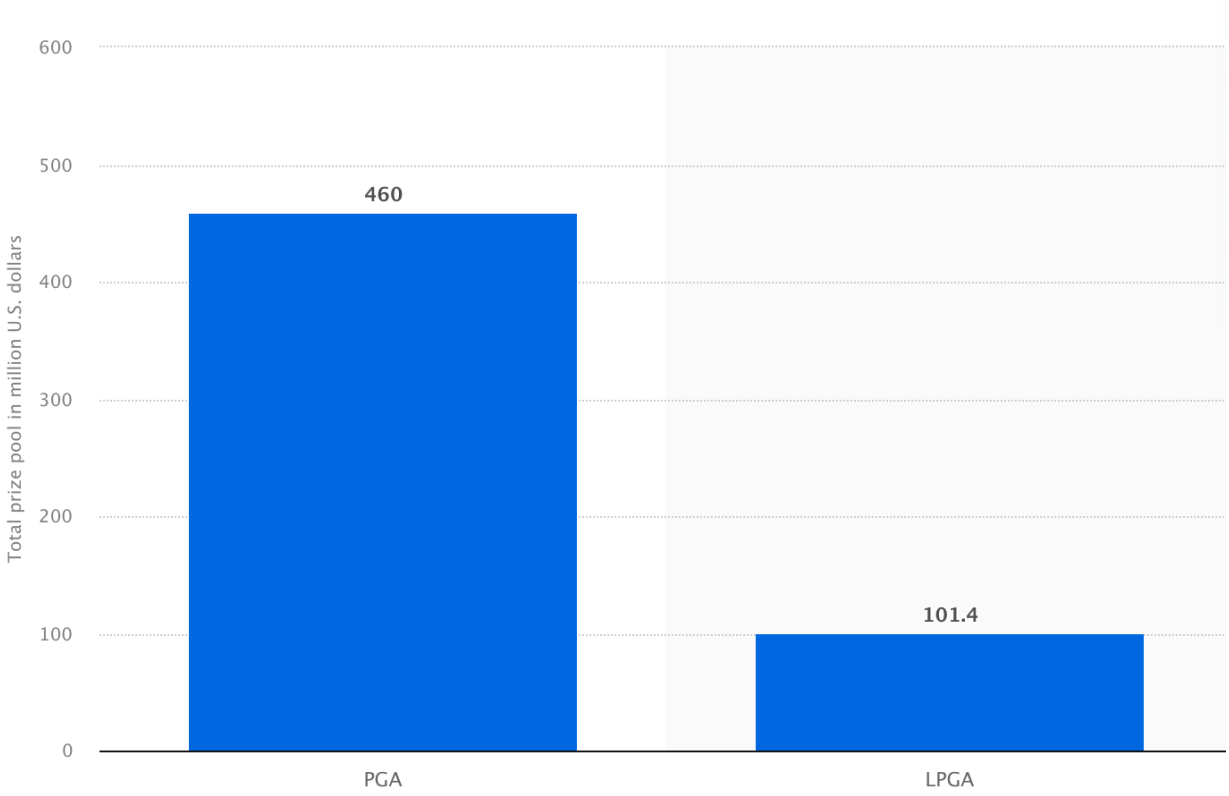

Figure 2: Total Prize Fund for the PGA and LPGA Tour in 2023 [25]

$$\frac{\$460,000,000}{38} = \$12,105,263.20$$

$$\frac{\$101,400,000}{33} = \$3,072,727.27$$

Then, we can divide the LPGA's total purse per tournament by the PGA's total purse per tournament.

$$\frac{\$3,072,727.27}{\$12,105,263.20} = 0.2538$$

$$0.2538 * 100 = 25.38\%$$

Here, we find that professional female golfers were compensated 25% of what professional male golfers were compensated in 2023. In terms of revenue, the PGA brought in $192,132,824 in 2021 [2]. The LPGA brought in $165,790,559 in 2021 [17]. Again, this disparity is accredited to popularity and viewership among the general public. Unlike other sports, the PGA and LPGA are non-profit organizations. Their prize money does not come solely from revenue, but from league reserves, as well. This explains the magnitude of purses, sometimes reaching in the millions.

4 Team Sports

In this section, we will consider basketball. As before, we will acknowledge rule differences, if they exist. Then we will analyze compensation history and the differences in pay between men and women.

4.1 Basketball

4.1.1 Rule Differences

There are no difference in rules across men's and women's basketball. In women's basketball, the ball itself is slightly smaller than that of men, to account for the physical and biological difference in size of hands.

4.1.2 Compensation History

The NBA began in 1949, comprised of 30 different teams in the league. The WNBA began in 1997, with the league consisting of 12 teams [6]. Men's and women's basketball have never been compensated equally. Due to a difference in league contracts, they have one of the most drastic gaps in pay. The NBA has allotted over half of their league revenue to salaries, while the WNBA salaries are comprised of a fraction of their revenue [29]. We will revisit these statistics in the next section.

4.1.3 Pay Discrepancies

The average salary in the NBA sits at $9.6 million, while the average salary in the WNBA is $102,751 [16].

$$\frac{\$102,751}{\$9,600,000} = 0.0107$$

$$0.0107 * 100 = 1.07\%$$

This means that female athletes in the WNBA make 1.07% of that of their male counterparts. Steph Curry is the highest-paid player in the NBA, with a salary of $48 million. The highest

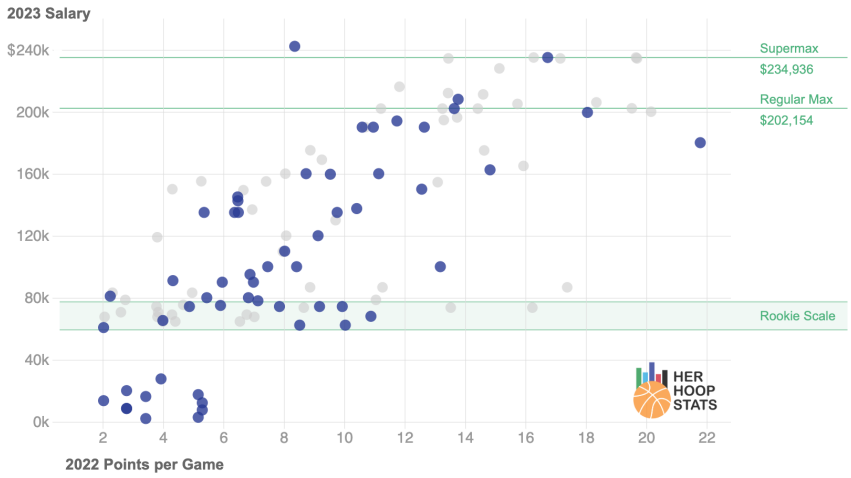

Figure 3: WNBA Salary vs Points Per Game

paid player in the WNBA is Jewell Lloyd, with a salary of $228,094 [16]. In Figure 3, we see how game performance affects salary. This specific chart shows a positive correlation between points per game and annual salary for the WNBA in 2023. Now, it is important to note the difference in revenue across the NBA versus the WNBA. Revenue relies heavily on the audience. The 2022 NBA finals had an average of 12.4 million viewers, while the WNBA's highest viewed game in all of 2022 averaged 852,000 viewers. On average, the NBA brings in $10 billion a year in revenue. The WNBA, however, only brings in $60 million [16].

$$\frac{60,000,000}{10,000,000,000} = 0.006$$

$$0.006 * 100 = 0.6\%$$

This means the WNBA earns 0.6% in revenue in comparison to the NBA. Now, considering their average salaries, we calculated that athletes in the WNBA earn 1.07% of that of their male counterparts. While this seems proportional to their respective revenues, we must now

consider how much of each league's revenue is devoted to payroll. In the WNBA, players make 9.3% of the total league revenue, which has decreased over the past few years, while viewership increased 171% over 2021. NBA players, on the contrary, make 51% of the total league revenue [29]. We can conclude that WNBA player salaries are not directly tied to league revenue, while player salaries in the NBA are directly correlated with revenue.

5 Methods

In this section, we will include definitions and theorems relevant to our analysis.

Definition. *A **sampling distribution** is a probability distribution of a statistic that is obtained through repeated sampling of a specific population [15].*

The sampling distrubution describes a range of possible outcomes for a statistic.

Theorem 5.1 (**Central Limit Theorem**)**.** *The distribution of sample means approximates a normal distribution as the sample size gets larger, regardless of the population's distribution [15].*

This theorem says that the sample mean tends to follow the same normal distribution of a bell curve, no matter how the population is distributed.

Definition. *The **variance** (σ^2) is a measurement of the spread between numbers in a data set; measures the degree of dispersion of data around the sample's mean [15].*

Variance is measured in the square of the data's original units, so it can often be hard to interpret. We then define standard deviation to be $\sqrt{variance}$.

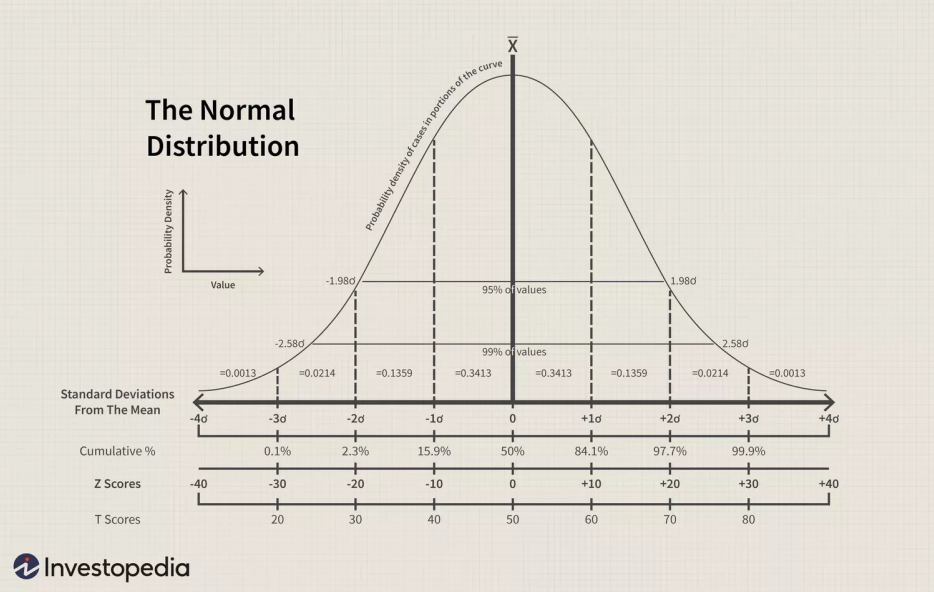

Figure 4: Normal Distribution Bell Curve

Definition. *The* ***standard deviation*** *(σ) measures the dispersion of a dataset relative to its mean [15].*

We see the standard deviation in relation to a population's mean in Figure 4.

Definition. ***Hypothesis testing*** *is a systematic procedure for deciding whether the results of a research study support a particular theory which applies to a population [14].*

Hypothesis testing consists of two hypotheses, the research hypothesis and the null hypothesis.

Definition. *The* ***research hypothesis*** *(H_A) is the proposed hypothesis stating the existence of some relationship between two variables [14].*

Definition. *The* ***null hypothesis*** *(H_0) is the opposite of the research hypothesis. It states there is no relationship between the two variables [14].*

When conducting a hypothesis test, we operate under the assumption that the null hypothesis is true and look for evidence against this assumption. Depending on the nature of our hypotheses, we can conduct different types of statistical tests. In every test, however, the test statistic is the critical quantity used to determine if the data collected provides sufficient evidence against the null hypothesis. If sufficient evidence is found, we can reject the null hypothesis.

Definition. *A* ***test statistic*** *is a number calculated for a statistical test of a hypothesis from the data collected [4].*

Test statistics show how closely the observed data matches the distribution expected under the null hypothesis. It can be used to calculate the p-value of the results.

Definition. *A* ***p-value*** *is a statistical measurement used to validate a hypothesis against observed data [15]. The p-value measures the probability of obtaining the observed results, assuming that the null hypothesis is true.*

We aim to reject the null hypothesis. The lower the p-value, the greater the statistical significance of the observed difference. A p-value of 0.05 or lower generally indicates that the observed data is statistically significant. A statistically significant p-value would allow for the rejection of the null hypothesis.

Definition. *A* ***t-test*** *is a statistical tool used to evaluate the means of one or two populations using hypothesis testing [27].*

A t-test is any hypothesis test where the test statistic has a t-distribution.

Definition. *A **t-distribution** describes the standardized distances of sample means to the population mean when the population standard deviation is not known, and the observations come from a normally distributed population [27].*

Definition. *A **two-sample t-test** is a method used to test whether the unknown population means of two groups are equal or not [27].*

Lemma 5.2. *Let $\bar{x}$ and $\bar{y}$ be the sample means of two sets of data of size n_x and n_y respectively. If x and y are normally distributed, or n_x and n_y are sufficiently large for the Central Limit Theorem to hold, and x and y have the same variance, then the random variable*

$$t = \frac{(\bar{x} - \bar{y}) - (\mu_x - \mu_y)}{s\sqrt{\frac{1}{n_x} + \frac{1}{n_y}}}$$

has distribution T(n_x+n_y-2) where

$$s_p^2 = \frac{(n_x - 1)s_x^2 + (n_y - 1)s_y^2}{(n_x - 1) + (n_y - 1)}$$

.

The pooled variance, $s_p^2 = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}$, provided that the sample variances are assumed equal, estimates a common variance between the two samples.

When conducting a two-sample t-test where the variances are unknown, it must then be determined whether these unknown variances are assumed equal or unequal.

To find if the variances are equal or not, we can conduct an F-test, denoted by

$$F = \frac{S_X^2}{S_Y^2}$$

[13].

Thus, we proceed with one of two formulas.

Theorem 5.3 (Two-Sample T-Test, σ unknown, assumed equal)**.** *[9]*

$$t = \frac{\bar{x_1} + \bar{x_2}}{\sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}\left(\frac{n_1+n_2}{n_1 n_2}\right)}}$$

If the variances are assumed equal, we use Theorem 5.3 to find the test statistic. The numerator, $\bar{x_1} + \bar{x_2}$, denotes the difference of the two sample means. The denominator estimates the standard error of the difference in the two population means [27]. In the denominator, we have the square root of the pooled variance multiplied by the sum of the two sample groups, divided by their product.

Theorem 5.4 (Two-Sample T-Test, σ unknown, unequal)**.** *[9]*

$$t = \frac{\bar{x_1} + \bar{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

If the variances are unequal, we proceed with Theorem 5.4 to find the test statistic. Here, the denominator represents overall standard error, but instead of using a common variance, we take the standard error of each group.

We can observe that the numerator of each formula remains the same. As before stated, the numerator, $\bar{x_1} + \bar{x_2}$, denotes the difference of the two sample means. The difference between the two formulas for two sample t-tests lies in the denominator when dealing with representation of standard error. Regardless of which formula is used, the end result provides us with a test statistic stating whether the population means of two groups are equal or not.

Proof. We aim to prove Theorem 5.4.

Let σ be the standard deviation of x and y. Then, by the Central Limit Theorem (Theorem 5.1), $\bar{x} - \bar{y}$ has a normal distribution (as shown in Figure 4) with a mean $\mu_x - \mu_y$

and the standard deviation

$$\sqrt{\frac{\sigma^2}{n_x} + \frac{\sigma^2}{n_y}} = \sigma\sqrt{\frac{1}{n_x} + \frac{1}{n_y}}$$

Random variable z has a standard normal distribution with arbitrary mean μ and standard deviation σ by applying the following formula:

$$z = \frac{x - \mu}{\sigma}$$

Defining random variable z as follows, we know that z has distribution $N(0, 1)$.

$$z = \frac{(\bar{x} - \bar{y}) - (\mu_x - \mu_y)}{\sigma\sqrt{\frac{1}{n_x} + \frac{1}{n_y}}}$$

In applying the chi-squared distribution probability density function (pdf),

$f(x) = \frac{1}{\gamma(\alpha)\theta^\alpha} x^{\alpha-1} e^{-x/\theta}$, we find that $\frac{(n-1)s_x^2}{\sigma^2}$ has distribution $\chi^2(n_x - 1)$ and $\frac{(n-1)s_y^2}{\sigma^2}$ has distribution $\chi^2(n_y - 1)$, with $n_x - 1$ and $n_y - 1$ degrees of freedom, respectively. So,

$$u^2 = \frac{(n_x - 1)s_x^2}{\sigma^2} + \frac{(n_y - 1)s_y^2}{\sigma^2}$$

has distribution $\chi^2(n_x + n_y - 2)$. Here, we have combined the degrees of freedom:

$(n_x - 1) + (n_y - 1) = (n_x + n_y - 2)$.

Now, defining $t = \frac{z\sqrt{m}}{u}$, where $m = n_x + n_y - 2$, we can use our previously defined variables, z and u to find t.

$$t = \frac{z\sqrt{m}}{u}$$

$$= \frac{\frac{((\bar{x}-\bar{y})-(\mu_x-\mu_y))\sqrt{n_x+n_y-2}}{\sigma\sqrt{\frac{1}{n_x}+\frac{1}{n_y}}}}{\sqrt{\frac{(n_x-1)s_x^2+(n_y-1)s_y^2}{\sigma^2}}}$$

Multiplying by the reciprocal of the denominator, we get:

$$= \frac{((\bar{x}-\bar{y})-(\mu_x-\mu_y))\sqrt{\frac{(n_x-1)+(n_y-1)}{(n_x-1)s_x^2+(n_y-1)s_y^2}}}{\sqrt{\frac{1}{n_x}+\frac{1}{n_y}}}$$

$$= \frac{((\bar{x}-\bar{y})-(\mu_x-\mu_y))\frac{1}{s}}{\sqrt{\frac{1}{n_x}+\frac{1}{n_y}}}$$

$$= \frac{((\bar{x}-\bar{y})-(\mu_x-\mu_y))}{s\sqrt{\frac{1}{n_x}+\frac{1}{n_y}}}$$

where s is defined as in Lemma 5.2.

It follows by Lemma 5.2 that t has distribution $T(m)$. [30] □

Definition. *The **covariance** is the average of the products of deviations of each observation from its respective mean [5].*

Theorem 5.5 (Covariance)**.** *The covariance, denoted by $cov(X, Y)$, is represented in the following equation:*

$$cov(X, Y) = \frac{\sum_{i=1}^{N}(x_i - \mu_x)(y_i - \mu_y)}{N}$$

[9].

Definition. ***Correlation** is a statistical measure that expresses the extent to which two variables are linearly related. The **correlation coefficient (r)** quantifies the strength of the relationship between two variables [5].*

Theorem 5.6 (Correlation Coefficient)**.** *The correlation coefficient, denoted by r, is expressed using the following formula:*

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - x)^2 \sum(y_i - y)^2}}$$

In a situation where we know the covariance, we can use this information to find the correlation coefficient, ρ. Note that the correlation coefficient can be represented by either r or ρ. Using ρ, we can find the correlation coefficient in terms of covariance.

$$\rho_{xy} = \frac{cov(X, Y)}{\sigma_x \sigma_y}$$

[9].

The closer to 1 the r-value is, the more positively correlated the two variables are. The closer to -1 an r-value is, the more negatively correlated two variables are. An r-value of 0 implies no correlation between the two variables.

6 Statistical Analysis

In this paper, we considered the sports of tennis, golf, and basketball. To analyze trends and relationships within compensation of each sport, we must consider a variety of data. Using Google Sheets, we can utilize different statistic analyzing functions to produce our test statistics.

In Figures 5-9, we see a collection of many salaries across men's and women's leagues of each sport. Gathering as many salaries as possible makes a more accurate data set.

Since the number of salaries collected per sport varied, we focus on a randomized sample of 30 salaries per sport, as seen in Figure 10. These random samples were taken from the original salary lists, as mentioned before, using a random number generator. This randomized sample served as a representative for salaries of men's and women's leagues of each sport.

In terms of gender pay equity in sports, we can develop our own hypotheses.

- Research Hypothesis (H_A): There exists a difference in pay between men and women in professional sports.
- Null Hypothesis (H_0): There does not exist a difference in pay between men and women in professional sports.

We aim to reject the null hypothesis.

Figure 11 lists mean salaries and revenue for men's and women's leagues of each sport [24], [23], [21], [8], [26]. Then, a t-test is conducted between men's and women's leagues for each sport to produce a p-value. This p-value indicates statistical significance in pay discrepancies between men and women of each sport. Additionally, an F-test was necessary in finding the equality of variances for each sport. If we conducted a t-test by hand, rather than in Google Sheets, this F-value would indicate which t-test formula to use. Since a p-value of 0.05 or lower proves statistical significance, we can see in the "T-Test/P-Value" table of Figure 11 that tennis did not produce a significantly significant p-value, while golf and basketball did. Since the p-value for tennis, $0.2716294966 > 0.05$, we cannot reject the null hypothesis. Hence, we have found that there does not exist a significant difference in pay between men and women in professional tennis. The p-value for golf, $0.0001787899716 < 0.05$, so we can

reject the null hypothesis. Hence, we have found that there exists a difference in pay between men and women in professional golf. The p-value for basketball, $0.0000001426374965 < 0.05$, so we can reject the null hypothesis. Hence, we have found that there exists a difference in pay between men and women in professional basketball.

Now, considering the "Correlation Coefficient (r) -Between Mean Salaries and Revenue" table of Figure 11, we can look at the relationship between mean salaries and revenue.

For tennis, we see that mean salaries and revenue have a correlation coeefficient, $r = -1$. This would imply that there exists a direct negative correlation between mean salaries and revenue. Here, we considered the mean salaries of the ATP and WTA, and how these relate to their respective revenues. Since revenue was ultimately greater than the mean salaries, this results in a negative correlation coefficient. Since purses are determined in advance, revenue is not always a direct factor. For golf and basketball, we have correlation coefficients of $r = 1$. This means mean salaries and revenue have a direct positive correlation in both sports.

7 Conclusion

In this paper, we have considered the pay gap between male and female professional athletes in tennis, golf, and basketball. We found that there was not a significant difference in pay between men and women in tennis. However, we have confirmed the existence of pay discrepancies between men and women in both golf and basketball. We have found the correlation between league revenue and salaries to be subjective, depending on leagues.

Some leagues contribute their revenue to player salary, while others do not. Ultimately, the gender pay gap in the United States translates into the world of sports.

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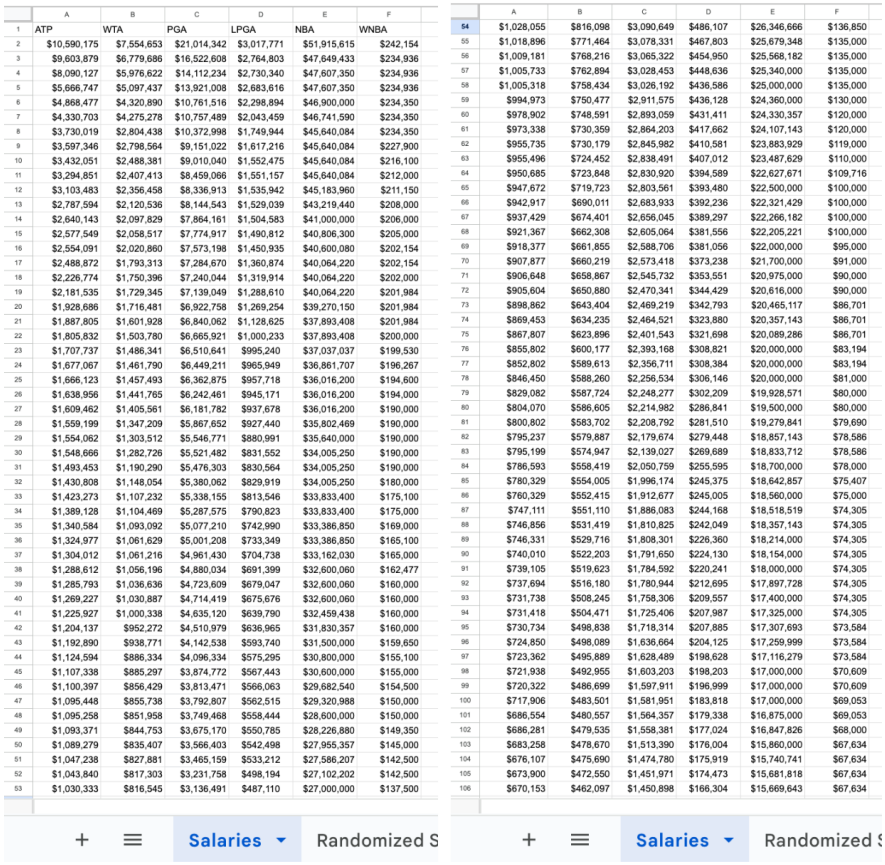
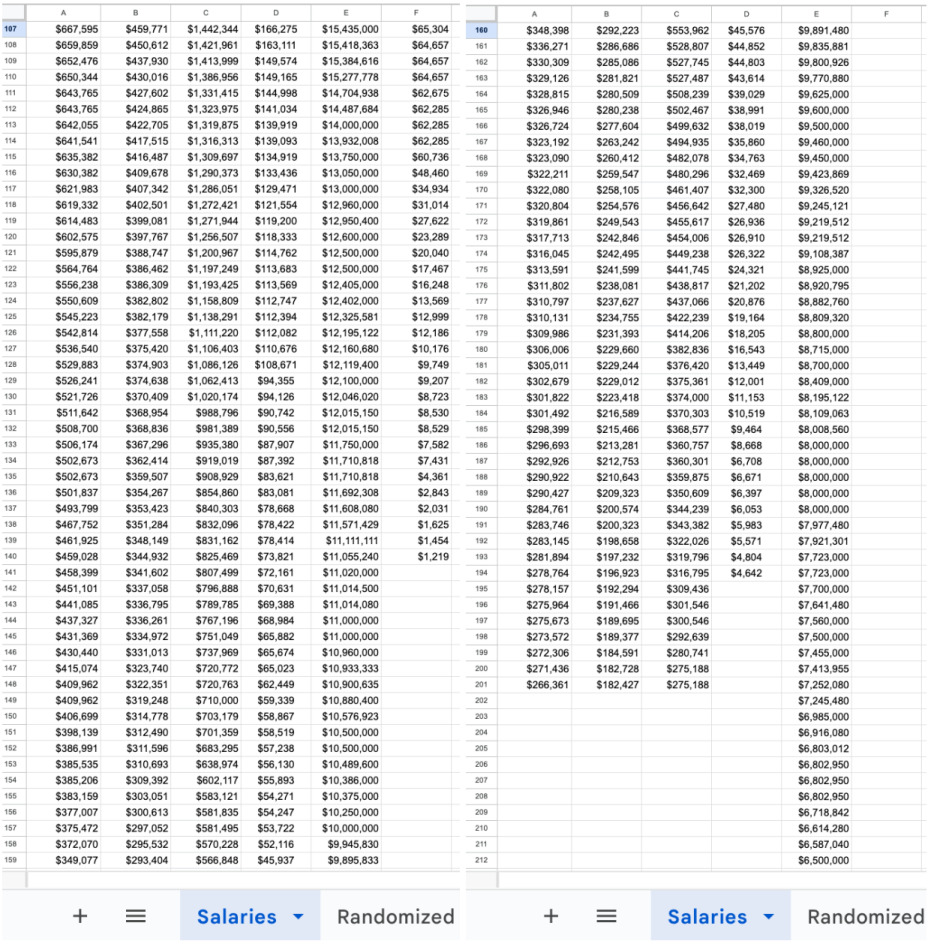


ATP	WTA	PGA	LPGA	NBA	WNBA
$10,590,175	$7,554,653	$21,014,342	$3,017,771	$51,915,615	$242,154
$9,603,879	$6,779,686	$16,522,608	$2,764,803	$47,649,433	$234,936
$8,090,127	$5,976,622	$14,112,234	$2,730,340	$47,607,350	$234,936
$5,666,747	$5,097,437	$13,921,008	$2,683,616	$47,607,350	$234,936
$4,868,477	$4,320,890	$10,761,516	$2,298,894	$46,900,000	$234,350
$4,330,703	$4,275,278	$10,757,489	$2,043,459	$46,741,590	$234,350
$3,730,019	$2,804,438	$10,372,998	$1,749,944	$45,640,084	$234,350
$3,597,346	$2,798,564	$9,151,022	$1,617,216	$45,640,084	$227,900
$3,432,051	$2,488,381	$9,010,040	$1,552,475	$45,640,084	$216,100
$3,294,851	$2,407,413	$8,459,066	$1,551,157	$45,640,084	$212,000
$3,103,483	$2,356,458	$8,336,913	$1,535,942	$45,183,960	$211,150
$2,787,594	$2,120,536	$8,144,543	$1,529,039	$43,219,440	$208,000
$2,640,143	$2,097,829	$7,864,161	$1,504,583	$41,000,000	$206,000
$2,577,549	$2,058,517	$7,774,917	$1,490,812	$40,806,300	$205,000
$2,554,091	$2,020,860	$7,573,198	$1,450,935	$40,600,080	$202,154
$2,488,872	$1,793,313	$7,284,670	$1,360,874	$40,064,220	$202,154
$2,226,774	$1,750,396	$7,240,044	$1,319,914	$40,064,220	$202,000
$2,181,535	$1,729,345	$7,139,049	$1,288,610	$40,064,220	$201,984
$1,928,686	$1,716,481	$6,922,758	$1,269,254	$39,270,150	$201,984
$1,887,805	$1,601,928	$6,840,062	$1,128,625	$37,893,408	$201,984
$1,805,832	$1,503,780	$6,665,921	$1,000,233	$37,893,408	$200,000
$1,707,737	$1,486,341	$6,510,641	$995,240	$37,037,037	$199,530
$1,677,067	$1,461,790	$6,449,211	$965,949	$36,861,707	$196,267
$1,666,123	$1,457,493	$6,362,875	$957,718	$36,016,200	$194,600
$1,638,956	$1,441,765	$6,242,461	$945,171	$36,016,200	$194,000
$1,609,462	$1,405,561	$6,181,782	$937,678	$36,016,200	$190,000
$1,559,199	$1,347,209	$5,867,652	$927,440	$35,802,469	$190,000
$1,554,062	$1,303,512	$5,546,771	$880,991	$35,640,000	$190,000
$1,548,666	$1,282,726	$5,521,482	$831,552	$34,005,250	$190,000
$1,493,453	$1,190,290	$5,476,303	$830,564	$34,005,250	$190,000
$1,430,808	$1,148,054	$5,380,062	$829,919	$34,005,250	$180,000
$1,423,273	$1,107,232	$5,338,155	$813,546	$33,833,400	$175,100
$1,389,128	$1,104,469	$5,287,575	$790,823	$33,833,400	$175,000
$1,340,584	$1,093,092	$5,077,210	$742,990	$33,386,850	$169,000
$1,324,977	$1,061,629	$5,001,208	$733,349	$33,386,850	$165,100
$1,304,012	$1,061,216	$4,961,430	$704,738	$33,162,030	$165,000
$1,288,612	$1,056,196	$4,880,034	$691,399	$32,600,060	$162,477
$1,285,793	$1,036,636	$4,723,609	$679,047	$32,600,060	$160,000
$1,269,227	$1,030,887	$4,714,419	$675,676	$32,600,060	$160,000
$1,225,927	$1,000,338	$4,635,120	$639,790	$32,459,438	$160,000
$1,204,137	$952,272	$4,510,979	$636,965	$31,830,357	$160,000
$1,192,890	$938,771	$4,142,538	$593,740	$31,500,000	$159,650
$1,124,594	$886,334	$4,096,334	$575,295	$30,800,000	$155,100
$1,107,338	$885,297	$3,874,772	$567,443	$30,600,000	$155,000
$1,100,397	$856,429	$3,813,471	$566,063	$29,682,540	$154,500
$1,095,448	$855,738	$3,792,807	$562,515	$29,320,988	$150,000
$1,095,258	$851,958	$3,749,468	$558,444	$28,600,000	$150,000
$1,093,371	$844,753	$3,675,170	$550,785	$28,226,880	$149,350
$1,089,279	$835,407	$3,566,403	$542,498	$27,955,357	$145,000
$1,047,238	$827,881	$3,465,159	$533,212	$27,586,207	$142,500
$1,043,840	$817,303	$3,231,758	$498,194	$27,102,202	$142,500
$1,030,333	$816,545	$3,136,491	$487,110	$27,000,000	$137,500
$1,028,055	$816,098	$3,090,649	$486,107	$26,346,666	$136,850
$1,018,896	$771,464	$3,078,331	$467,803	$25,679,348	$135,000
$1,009,181	$768,216	$3,065,322	$454,950	$25,568,182	$135,000
$1,005,733	$762,894	$3,028,453	$448,636	$25,340,000	$135,000
$1,005,318	$758,434	$3,026,192	$436,586	$25,000,000	$135,000
$994,973	$750,477	$2,911,575	$436,128	$24,360,000	$130,000
$978,902	$748,591	$2,893,059	$431,411	$24,330,357	$120,000
$973,338	$730,359	$2,864,203	$417,662	$24,107,143	$120,000
$955,735	$730,179	$2,845,982	$410,581	$23,883,929	$119,000
$955,496	$724,452	$2,838,491	$407,012	$23,487,629	$110,000
$950,685	$723,848	$2,830,920	$394,589	$22,627,671	$109,716
$947,672	$719,723	$2,803,561	$393,480	$22,500,000	$100,000
$942,917	$690,011	$2,683,933	$392,236	$22,321,429	$100,000
$937,429	$674,401	$2,656,045	$389,297	$22,266,182	$100,000
$921,367	$662,308	$2,605,064	$381,556	$22,205,221	$100,000
$918,377	$661,855	$2,588,706	$381,056	$22,000,000	$95,000
$907,877	$660,219	$2,573,418	$373,238	$21,700,000	$91,000
$906,648	$658,867	$2,545,732	$353,551	$20,975,000	$90,000
$905,604	$650,880	$2,470,341	$344,429	$20,616,000	$90,000
$898,862	$643,404	$2,469,219	$342,793	$20,465,117	$86,701
$869,453	$634,235	$2,464,521	$323,880	$20,357,143	$86,701
$867,807	$623,896	$2,401,543	$321,698	$20,089,286	$86,701
$855,802	$600,177	$2,393,168	$308,821	$20,000,000	$83,194
$852,802	$589,613	$2,356,711	$308,384	$20,000,000	$83,194
$846,450	$588,260	$2,256,534	$306,146	$20,000,000	$81,000
$829,082	$587,724	$2,248,277	$302,209	$19,928,571	$80,000
$804,070	$586,605	$2,214,982	$286,841	$19,500,000	$80,000
$800,802	$583,702	$2,208,792	$281,510	$19,279,841	$79,690
$795,237	$579,887	$2,179,674	$279,448	$18,857,143	$78,586
$795,199	$574,947	$2,139,027	$269,689	$18,833,712	$78,586
$786,593	$558,419	$2,050,759	$255,595	$18,700,000	$78,000
$780,329	$554,005	$1,996,174	$245,375	$18,642,857	$75,407
$760,329	$552,415	$1,912,677	$245,005	$18,560,000	$75,000
$747,111	$551,110	$1,886,083	$244,168	$18,518,519	$74,305
$746,856	$531,419	$1,810,825	$242,049	$18,357,143	$74,305
$746,331	$529,716	$1,808,301	$226,360	$18,214,000	$74,305
$740,010	$522,203	$1,791,650	$224,130	$18,154,000	$74,305
$739,105	$519,623	$1,784,592	$220,241	$18,000,000	$74,305
$737,694	$516,180	$1,780,944	$212,695	$17,897,728	$74,305
$731,738	$508,245	$1,758,306	$209,557	$17,400,000	$74,305
$731,418	$504,471	$1,725,406	$207,987	$17,325,000	$74,305
$730,734	$498,838	$1,718,314	$207,885	$17,307,693	$73,584
$724,850	$498,089	$1,636,664	$204,125	$17,259,999	$73,584
$723,362	$495,889	$1,628,489	$198,628	$17,116,279	$73,584
$721,938	$492,955	$1,603,203	$198,203	$17,000,000	$70,609
$720,322	$486,699	$1,597,911	$196,999	$17,000,000	$70,609
$717,906	$483,501	$1,581,951	$183,818	$17,000,000	$69,053
$686,554	$480,557	$1,564,357	$179,338	$16,875,000	$69,053
$686,281	$479,535	$1,558,381	$177,024	$16,847,826	$68,000
$683,258	$478,670	$1,513,390	$176,004	$15,860,000	$67,634
$676,107	$475,690	$1,474,780	$175,919	$15,740,741	$67,634
$673,900	$472,550	$1,451,971	$174,473	$15,681,818	$67,634
$670,153	$462,097	$1,450,898	$166,304	$15,669,643	$67,634

Figure 5: Salaries

8 Appendix



	A	B	C	D	E	F
107	$667,595	$459,771	$1,442,344	$166,275	$15,435,000	$65,304
108	$659,859	$450,612	$1,421,961	$163,111	$15,418,363	$64,657
109	$652,476	$437,930	$1,413,999	$149,574	$15,384,616	$64,657
110	$650,344	$430,016	$1,386,956	$149,165	$15,277,778	$64,657
111	$643,765	$427,602	$1,331,415	$144,998	$14,704,938	$62,675
112	$643,765	$424,865	$1,323,975	$141,034	$14,487,684	$62,285
113	$642,055	$422,705	$1,319,875	$139,919	$14,000,000	$62,285
114	$641,541	$417,515	$1,316,313	$139,093	$13,932,008	$62,285
115	$635,382	$416,487	$1,309,697	$134,919	$13,750,000	$60,736
116	$630,382	$409,678	$1,290,373	$133,436	$13,050,000	$48,460
117	$621,983	$407,342	$1,286,051	$129,471	$13,000,000	$34,934
118	$619,332	$402,501	$1,272,421	$121,554	$12,960,000	$31,014
119	$614,483	$399,081	$1,271,944	$119,200	$12,950,400	$27,622
120	$602,575	$397,767	$1,256,507	$118,333	$12,600,000	$23,289
121	$595,879	$388,747	$1,200,967	$114,762	$12,500,000	$20,040
122	$564,764	$386,462	$1,197,249	$113,683	$12,500,000	$17,467
123	$556,238	$386,309	$1,193,425	$113,569	$12,405,000	$16,248
124	$550,609	$382,802	$1,158,809	$112,747	$12,402,000	$13,569
125	$545,223	$382,179	$1,138,291	$112,394	$12,325,581	$12,999
126	$542,814	$377,558	$1,111,220	$112,082	$12,195,122	$12,186
127	$536,540	$375,420	$1,106,403	$110,676	$12,160,680	$10,176
128	$529,883	$374,903	$1,086,126	$108,671	$12,119,400	$9,749
129	$526,241	$374,638	$1,062,413	$94,355	$12,100,000	$9,207
130	$521,726	$370,409	$1,020,174	$94,126	$12,046,020	$8,723
131	$511,642	$368,954	$988,796	$90,742	$12,015,150	$8,530
132	$508,700	$368,836	$981,389	$90,556	$12,015,150	$8,529
133	$506,174	$367,296	$935,380	$87,907	$11,750,000	$7,582
134	$502,673	$362,414	$919,019	$87,392	$11,710,818	$7,431
135	$502,673	$359,507	$908,929	$83,621	$11,710,818	$4,361
136	$501,837	$354,267	$854,860	$83,081	$11,692,308	$2,843
137	$493,799	$353,423	$840,303	$78,668	$11,608,080	$2,031
138	$467,752	$351,284	$832,096	$78,422	$11,571,429	$1,625
139	$461,925	$348,149	$831,162	$78,414	$11,111,111	$1,454
140	$459,028	$344,932	$825,469	$73,821	$11,055,240	$1,219
141	$458,399	$341,602	$807,499	$72,161	$11,020,000	
142	$451,101	$337,058	$796,888	$70,631	$11,014,500	
143	$441,085	$336,795	$789,785	$69,388	$11,014,080	
144	$437,327	$336,261	$767,196	$68,984	$11,000,000	
145	$431,369	$334,972	$751,049	$65,882	$11,000,000	
146	$430,440	$331,013	$737,969	$65,674	$10,960,000	
147	$415,074	$323,740	$720,772	$65,023	$10,933,333	
148	$409,962	$322,351	$720,763	$62,449	$10,900,635	
149	$409,962	$319,248	$710,000	$59,339	$10,880,400	
150	$406,699	$314,778	$703,179	$58,867	$10,576,923	
151	$398,139	$312,490	$701,359	$58,519	$10,500,000	
152	$386,991	$311,596	$683,295	$57,238	$10,500,000	
153	$385,535	$310,693	$638,974	$56,130	$10,489,600	
154	$385,206	$309,392	$602,117	$55,893	$10,386,000	
155	$383,159	$303,051	$583,121	$54,271	$10,375,000	
156	$377,007	$300,613	$581,835	$54,247	$10,250,000	
157	$375,472	$297,052	$581,495	$53,722	$10,000,000	
158	$372,070	$295,532	$570,228	$52,116	$9,945,830	
159	$349,077	$293,404	$566,848	$45,937	$9,895,833	

Salaries Randomized

	A	B	C	D	E	F
160	$348,398	$292,223	$553,962	$45,576	$9,891,480	
161	$336,271	$286,686	$528,807	$44,852	$9,835,881	
162	$330,309	$285,086	$527,745	$44,803	$9,800,926	
163	$329,126	$281,821	$527,487	$43,614	$9,770,880	
164	$328,815	$280,509	$508,239	$39,029	$9,625,000	
165	$326,946	$280,238	$502,467	$38,991	$9,600,000	
166	$326,724	$277,604	$499,632	$38,019	$9,500,000	
167	$323,192	$263,242	$494,935	$35,860	$9,460,000	
168	$323,090	$260,412	$482,078	$34,763	$9,450,000	
169	$322,211	$259,547	$480,296	$32,469	$9,423,869	
170	$322,080	$258,105	$461,407	$32,300	$9,326,520	
171	$320,804	$254,576	$456,642	$27,480	$9,245,121	
172	$319,861	$249,543	$455,617	$26,936	$9,219,512	
173	$317,713	$242,846	$454,006	$26,910	$9,219,512	
174	$316,045	$242,495	$449,238	$26,322	$9,108,387	
175	$313,591	$241,599	$441,745	$24,321	$8,925,000	
176	$311,802	$238,081	$438,817	$21,202	$8,920,795	
177	$310,797	$237,627	$437,066	$20,876	$8,882,760	
178	$310,131	$234,755	$422,239	$19,164	$8,809,320	
179	$309,986	$231,393	$414,206	$18,205	$8,800,000	
180	$306,006	$229,660	$382,836	$16,543	$8,715,000	
181	$305,011	$229,244	$376,420	$13,449	$8,700,000	
182	$302,679	$229,012	$375,361	$12,001	$8,409,000	
183	$301,822	$223,418	$374,000	$11,153	$8,195,122	
184	$301,492	$216,589	$370,303	$10,519	$8,109,063	
185	$298,399	$215,466	$368,577	$9,464	$8,008,560	
186	$296,693	$213,281	$360,757	$8,668	$8,000,000	
187	$292,926	$212,753	$360,301	$6,708	$8,000,000	
188	$290,922	$210,643	$359,875	$6,671	$8,000,000	
189	$290,427	$209,323	$350,609	$6,397	$8,000,000	
190	$284,761	$200,574	$344,239	$6,053	$8,000,000	
191	$283,746	$200,323	$343,382	$5,983	$7,977,480	
192	$283,145	$198,658	$322,026	$5,571	$7,921,301	
193	$281,894	$197,232	$319,796	$4,804	$7,723,000	
194	$278,764	$196,923	$316,795	$4,642	$7,723,000	
195	$278,157	$192,294	$309,436		$7,700,000	
196	$275,964	$191,466	$301,546		$7,641,480	
197	$275,673	$189,695	$300,546		$7,560,000	
198	$273,572	$189,377	$292,639		$7,500,000	
199	$272,306	$184,591	$280,741		$7,455,000	
200	$271,436	$182,728	$275,188		$7,413,955	
201	$266,361	$182,427	$275,188		$7,252,080	
202					$7,245,480	
203					$6,985,000	
204					$6,916,080	
205					$6,803,012	
206					$6,802,950	
207					$6,802,950	
208					$6,802,950	
209					$6,718,842	
210					$6,614,280	
211					$6,587,040	
212					$6,500,000	

Salaries Randomized

Figure 6: Salaries

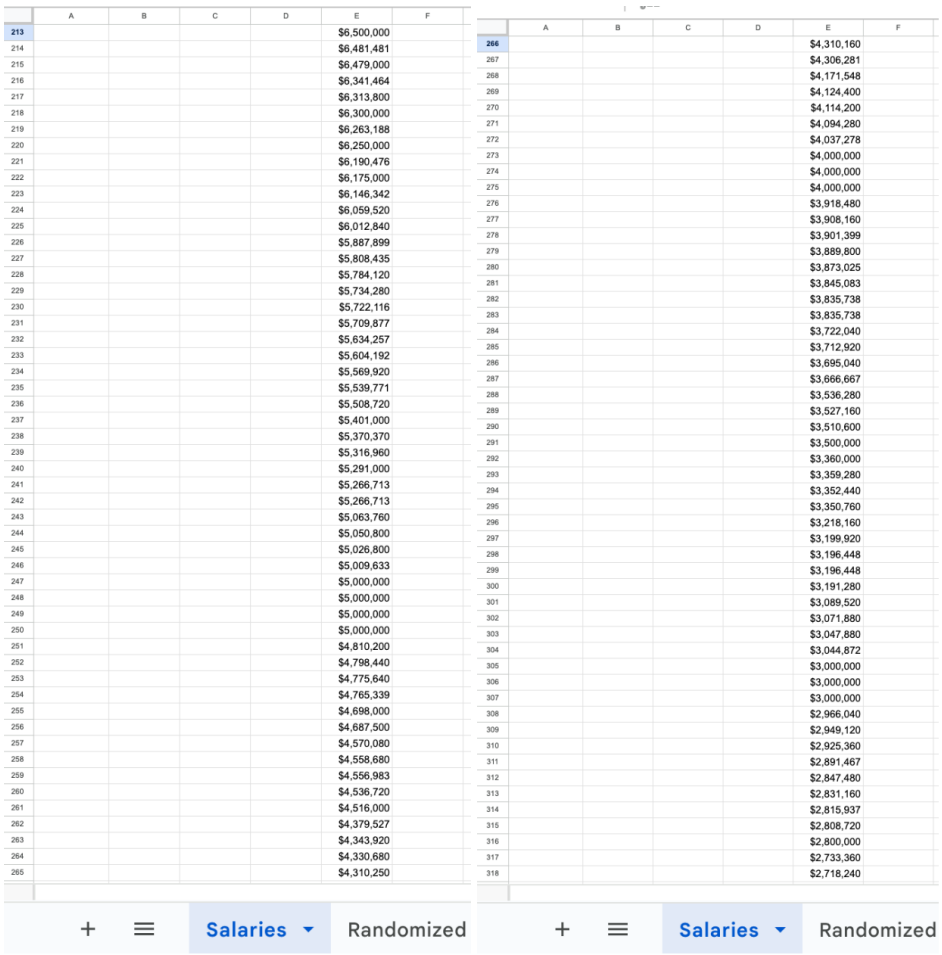


Figure 7: Salaries

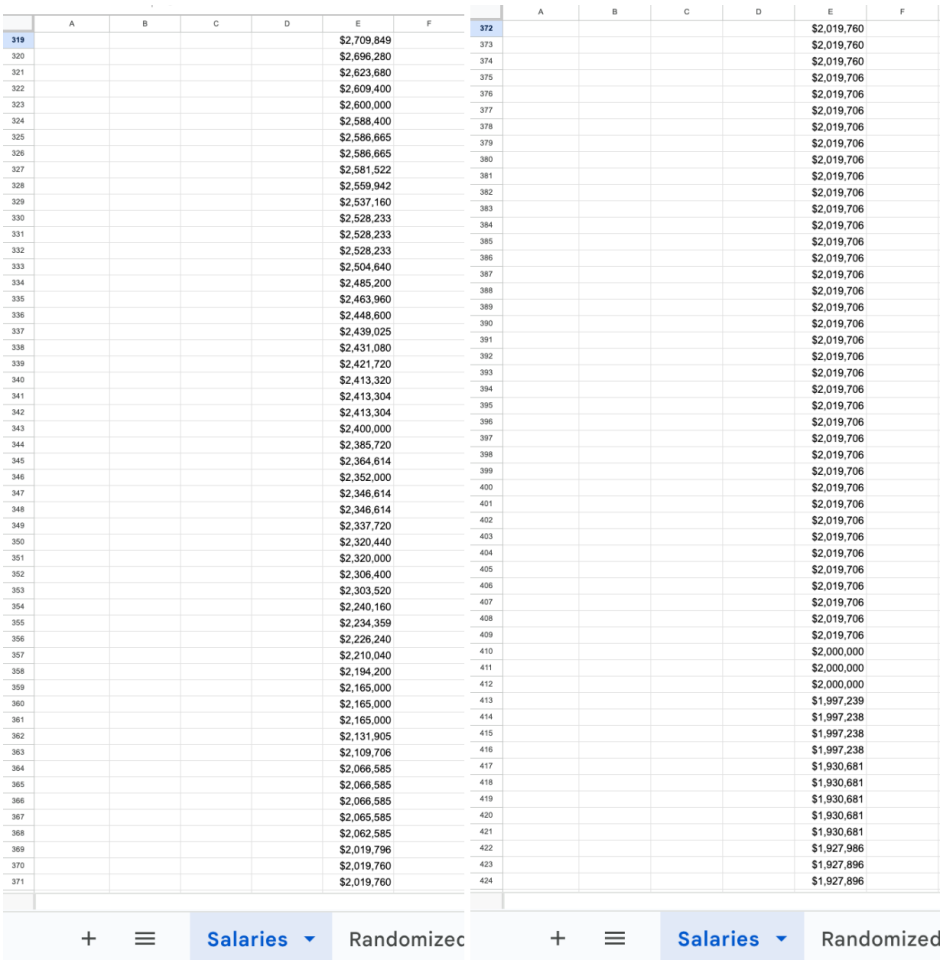


Figure 8: Salaries

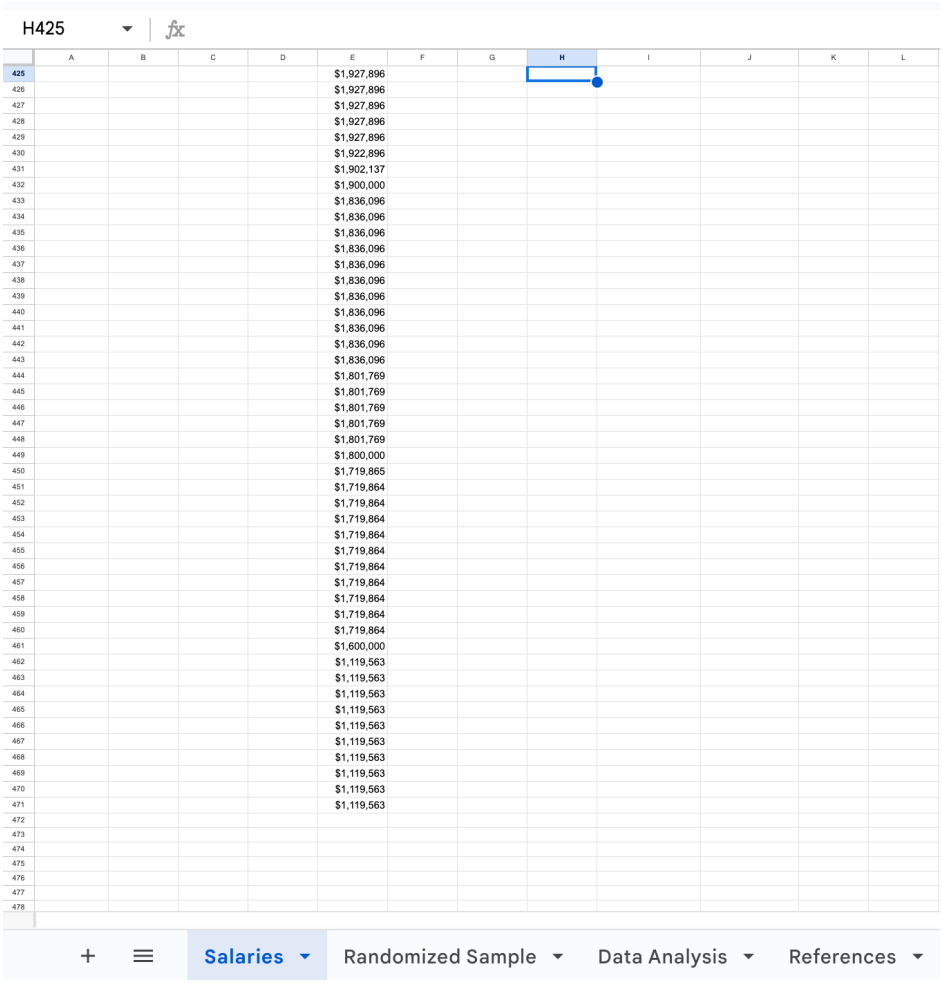
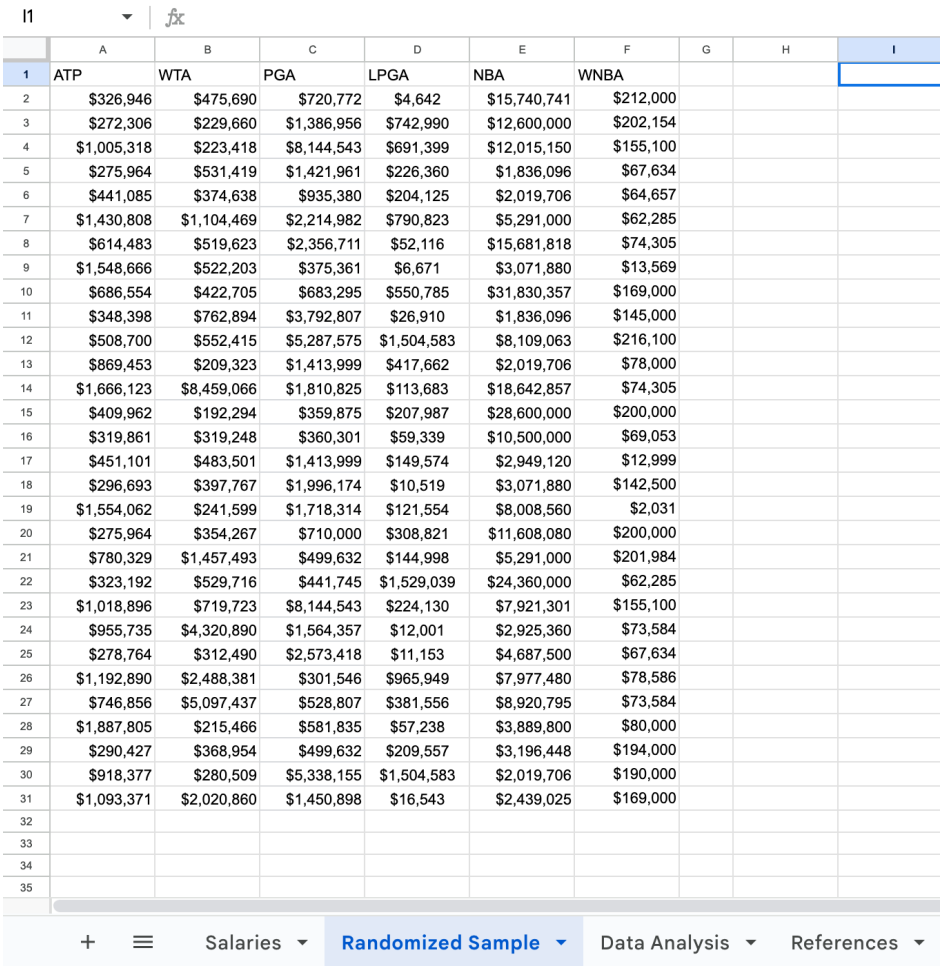
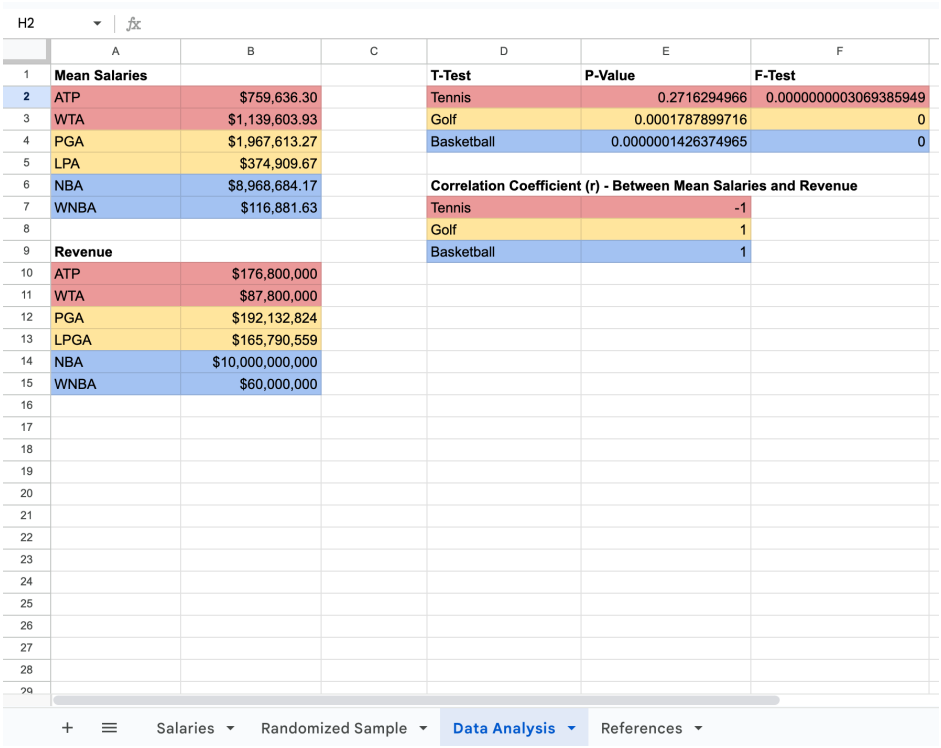


Figure 9: Salaries



	A	B	C	D	E	F	G	H	I
1	ATP	WTA	PGA	LPGA	NBA	WNBA			
2	$326,946	$475,690	$720,772	$4,642	$15,740,741	$212,000			
3	$272,306	$229,660	$1,386,956	$742,990	$12,600,000	$202,154			
4	$1,005,318	$223,418	$8,144,543	$691,399	$12,015,150	$155,100			
5	$275,964	$531,419	$1,421,961	$226,360	$1,836,096	$67,634			
6	$441,085	$374,638	$935,380	$204,125	$2,019,706	$64,657			
7	$1,430,808	$1,104,469	$2,214,982	$790,823	$5,291,000	$62,285			
8	$614,483	$519,623	$2,356,711	$52,116	$15,681,818	$74,305			
9	$1,548,666	$522,203	$375,361	$6,671	$3,071,880	$13,569			
10	$686,554	$422,705	$683,295	$550,785	$31,830,357	$169,000			
11	$348,398	$762,894	$3,792,807	$26,910	$1,836,096	$145,000			
12	$508,700	$552,415	$5,287,575	$1,504,583	$8,109,063	$216,100			
13	$869,453	$209,323	$1,413,999	$417,662	$2,019,706	$78,000			
14	$1,666,123	$8,459,066	$1,810,825	$113,683	$18,642,857	$74,305			
15	$409,962	$192,294	$359,875	$207,987	$28,600,000	$200,000			
16	$319,861	$319,248	$360,301	$59,339	$10,500,000	$69,053			
17	$451,101	$483,501	$1,413,999	$149,574	$2,949,120	$12,999			
18	$296,693	$397,767	$1,996,174	$10,519	$3,071,880	$142,500			
19	$1,554,062	$241,599	$1,718,314	$121,554	$8,008,560	$2,031			
20	$275,964	$354,267	$710,000	$308,821	$11,608,080	$200,000			
21	$780,329	$1,457,493	$499,632	$144,998	$5,291,000	$201,984			
22	$323,192	$529,716	$441,745	$1,529,039	$24,360,000	$62,285			
23	$1,018,896	$719,723	$8,144,543	$224,130	$7,921,301	$155,100			
24	$955,735	$4,320,890	$1,564,357	$12,001	$2,925,360	$73,584			
25	$278,764	$312,490	$2,573,418	$11,153	$4,687,500	$67,634			
26	$1,192,890	$2,488,381	$301,546	$965,949	$7,977,480	$78,586			
27	$746,856	$5,097,437	$528,807	$381,556	$8,920,795	$73,584			
28	$1,887,805	$215,466	$581,835	$57,238	$3,889,800	$80,000			
29	$290,427	$368,954	$499,632	$209,557	$3,196,448	$194,000			
30	$918,377	$280,509	$5,338,155	$1,504,583	$2,019,706	$190,000			
31	$1,093,371	$2,020,860	$1,450,898	$16,543	$2,439,025	$169,000			
32									
33									
34									
35									

Figure 10: Randomized Sample



	A	B	C	D	E	F
1	**Mean Salaries**			**T-Test**	**P-Value**	**F-Test**
2	ATP	$759,636.30		Tennis	0.2716294966	0.0000000003069385949
3	WTA	$1,139,603.93		Golf	0.0001787899716	0
4	PGA	$1,967,613.27		Basketball	0.0000001426374965	0
5	LPA	$374,909.67				
6	NBA	$8,968,684.17		**Correlation Coefficient (r) - Between Mean Salaries and Revenue**		
7	WNBA	$116,881.63		Tennis	-1	
8				Golf	1	
9	**Revenue**			Basketball	1	
10	ATP	$176,800,000				
11	WTA	$87,800,000				
12	PGA	$192,132,824				
13	LPGA	$165,790,559				
14	NBA	$10,000,000,000				
15	WNBA	$60,000,000				

Figure 11: Data Analysis