In 2020, published an article claiming that "**Women in Singapore earn 6% less than men for similar work: MOM study"**. This indicates that women are getting S$342 less in median monthly salary than men who are holding similar jobs. However, the 6% gap was after adjustment such as worker's industry, occupation, age and education. Prior to adjustment, the median pay difference between man and woman is 16.3%. Hence, the reason for the 6% gap was assumed due to factors such as firm type, position within the industry, work experience, caregiving responsibilities and discrimination.

Therefore, is there a gender pay gap in Singapore, considering both genders are full time employees, in similar industry, position and holds the same educational level?

As this would be a sensitive subject, all data collection will be done through official government websites and based on two different sets of data.

Hypothesis

Let $\mu male$ be the mean income for male
Let $\mu female$ be the mean income for female

H0: $\mu male - \mu female = 0$ H1: $\mu male - \mu female > 0$

Data Criteria:

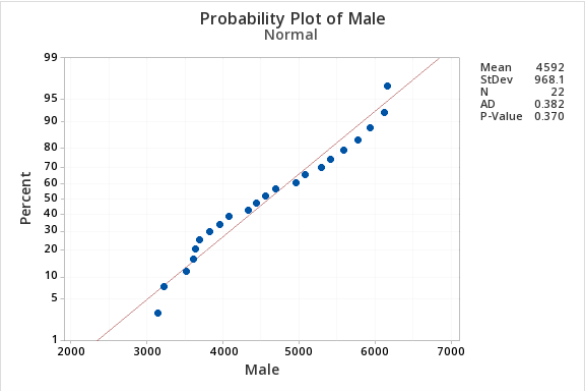
1) Population: Working adults in Singapore at the age of 25 – 64 old working adults
2) Sample: Employed working adults in Singapore at the age of 25 – 64, split between both genders
3) Sampling Method: Simple random sampling
4) Sample Size: 100 different samples across each gender, different occupations and position
5) Data Types: Quantitative Data Sets
6) Hypothesis Test: Two sample independent T-Test
7) Possible Errors: Type II

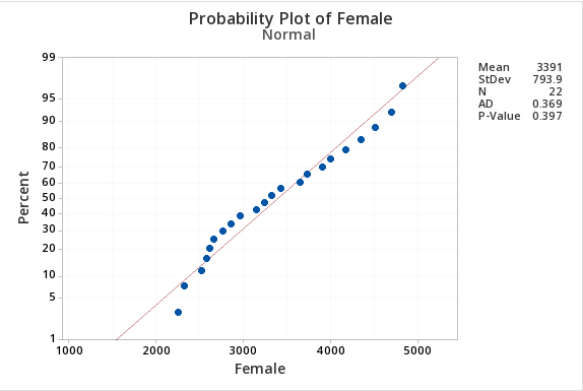
Data Sets:

1) Average Mean Salary by Gender year on year regardless of occupation
2) Median Salary Breakdown by Occupation and Gender regardless of timeline

Performing Normality Test on Average Mean Salary by Gender

H0: Data follow a normal distribution
H1: Data do not follow a normal distribution





Both samples have P-values more than 0.05, hence the Null Hypothesis is not rejected and the data follows a normal distribution.

Testing for Equal Variance on Average Mean Salary by Gender

Descriptive Statistics

Variable	N	StDev	Variance	95% CI for σ²
Male	22	968.108	937233.041	(554749.646, 1914041.575)
Female	22	793.902	630281.076	(373064.317, 1287176.326)

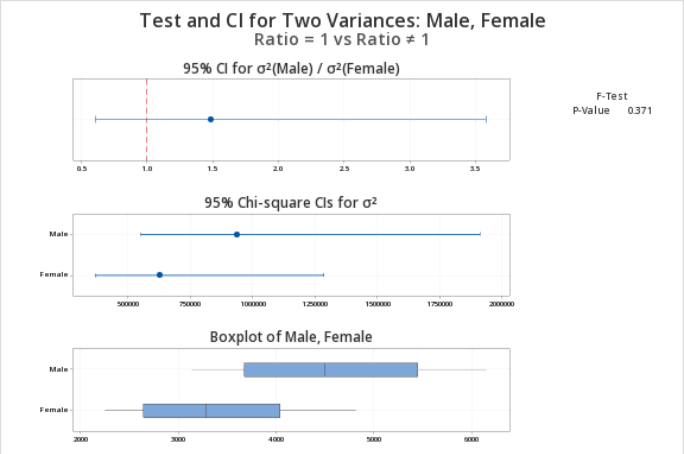
Ratio of Variances

Estimated Ratio	95% CI for Ratio using F
1.48701	(0.617, 3.582)

Test

Null hypothesis $H_0: \sigma_1^2 / \sigma_2^2 = 1$
Alternative hypothesis $H_1: \sigma_1^2 / \sigma_2^2 \neq 1$
Significance level $\alpha = 0.05$

Method	Test Statistic	DF1	DF2	P-Value
F	1.49	21	21	0.371



P-value of *F*-test = 0.371 > α = 5%

Also, the 95% confidence interval for the ratio of variances is 0.617 < μ < 3.582, which includes 1. Therefore, do not reject H_0 and the variances of control and treatment groups are equal.

Two Sample T-Test on Average Mean Salary by Gender

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
Male	22	4592	968	206
Female	22	3391	794	169

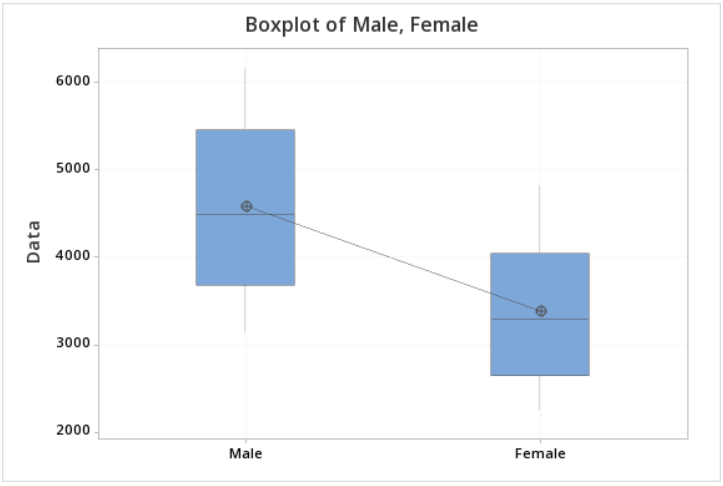
Estimation for Difference

Difference	Pooled StDev	95% Lower Bound for Difference
1201	885	752

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$
Alternative hypothesis $H_1: \mu_1 - \mu_2 > 0$

T-Value	DF	P-Value
4.50	42	0.000



$\bar{x}_1 = 4592$ $\bar{x}_2 = 3391$ $\bar{x}_1 - \bar{x}_2 = 1201$ d.f. ≈ 42. Test statistic = 4.50 P-value = 0.000

The 95% confidence bound for $\mu_1 - \mu_2$ is: > 752

Conclusion

Since P-value = 0.000 < α = 5%, it is rare to get a difference of sample mean Salary as extreme as 1201, if the population mean difference is 0.

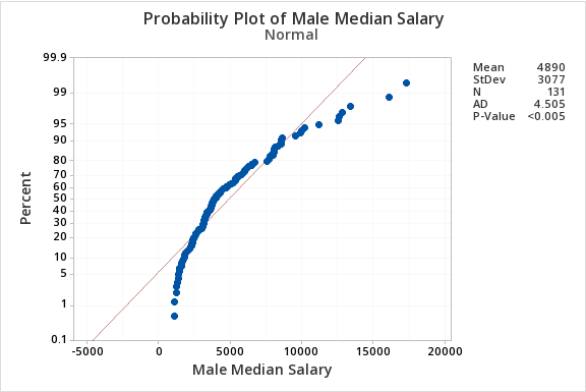
We are 95% confident that the population mean difference falls above 752, which does not inlude the claimed difference of 0.

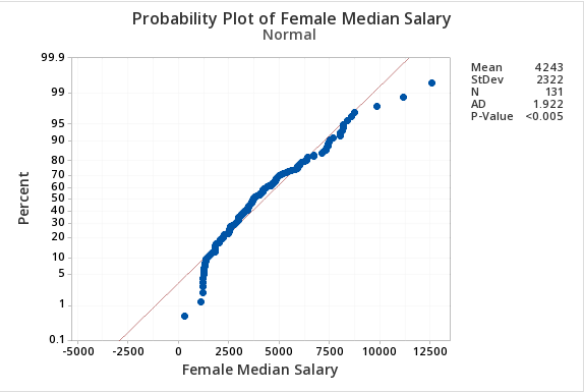
Therefore, we reject H0 at α = 5%.

Hence, we can conclude that there is a difference in the average salary between male and female.

Performing Normality Test on Median Salary Breakdown by Occupation and Gender

H0: Data follow a normal distribution
H1: Data do not follow a normal distribution





Both samples have P-values more than 0.05, hence the Null Hypothesis is rejected and the data follows a non normal distribution. However, due to the sample size more than 30, Central Limit Theorem applies, therefore we are able to proceed with the T-Test.

Testing for Equal Variance on Median Salary Breakdown by Occupation and Gender

Descriptive Statistics

Variable	N	StDev	Variance	95% CI for σ²
Male Median Salary	131	3076.503	9464868.930	(6459279.351, 1.42935E+07)
Female Median Salary	131	2322.194	5392582.719	(4103140.490, 7304170.195)

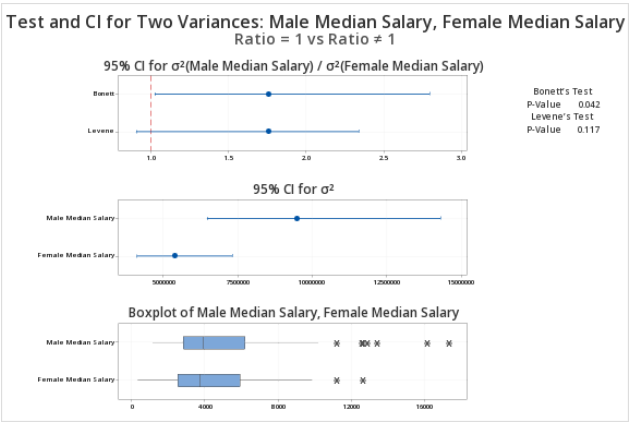
Ratio of Variances

Estimated Ratio	95% CI for Ratio using Bonett	95% CI for Ratio using Levene
1.75516	(1.022, 2.793)	(0.903, 2.336)

Test

Null hypothesis	$H_0: \sigma_1^2 / \sigma_2^2 = 1$
Alternative hypothesis	$H_1: \sigma_1^2 / \sigma_2^2 \neq 1$
Significance level	$\alpha = 0.05$

Method	Test Statistic	DF1	DF2	P-Value
Bonett	4.12	1		0.042
Levene	2.48	1	260	0.117



P-value of Levene's *F*-test = 0.117 > α = 5%

Also, the 95% confidence interval for the ratio of variances is 0.903 < μ < 2.336, which includes 1. Therefore, do not reject H_0 and the variances of control and treatment groups are equal.

Two Sample T-Test on Median Salary Breakdown by Occupation and Gender

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
Male Median Salary	131	4890	3077	269
Female Median Salary	131	4243	2322	203

Estimation for Difference

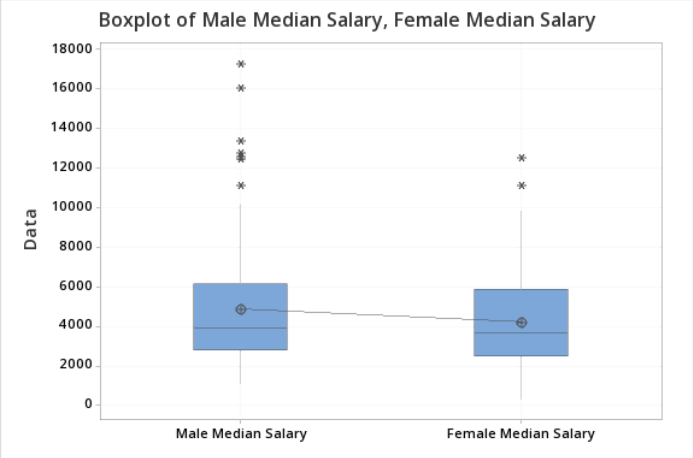
Difference	Pooled StDev	95% Lower Bound for Difference
648	2726	92

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 > 0$

T-Value	DF	P-Value
1.92	260	0.028



$\overline{x}_1 = 4890$ $\overline{x}_2 = 4243$ $\overline{x}_1 - \overline{x}_2 = 648$ d.f. ≈ 260 Test statistic = 1.92 P-value = 0.028

The 95% confidence bound for $\mu_1 - \mu_2$ is: > 92

Conclusion

Since P-value = 0.028 < α = 0.05, it is rare to get a difference of sample median Salary as extreme as 648, if the population mean difference is 0.

We are 95% confident that the population mean difference falls above 92, which does not inlude the claimed difference of 0.

Therefore, we reject H0 at α = 5%.

Hence, we can conclude that there is a difference in the average salary between male and female.

In summary, we are conclude that there is a gender income gap between male and female working adults. Despite government initiative to work on closing the gap, there is still room for improvement.

Reference:

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