AN6003 Group Project
Lawsuit against Houston College of Medicine

Presented by Group 4

Executive Summary

Background:

- Female doctors at Houston College of Medicine sued the college for discrimination.
- Plaintiff's claim: Women suffers from inequality in promotion and salary.

Fundamental Analysis Approach:

- Applied **Linear Regression**, **Logistic Regression**, and **CART** models to analyse promotion and salary data.

Key Findings

1. Promotion Criteria:

- Men have a higher full-professor ratio (45%) comparing to women (15%).
- Board certification contributes to higher professor ratios;
- Men generally have more experience and certification.
- Considering for promotion, experience matters the most (Logistic Regression & CART).

2. Salary Package:

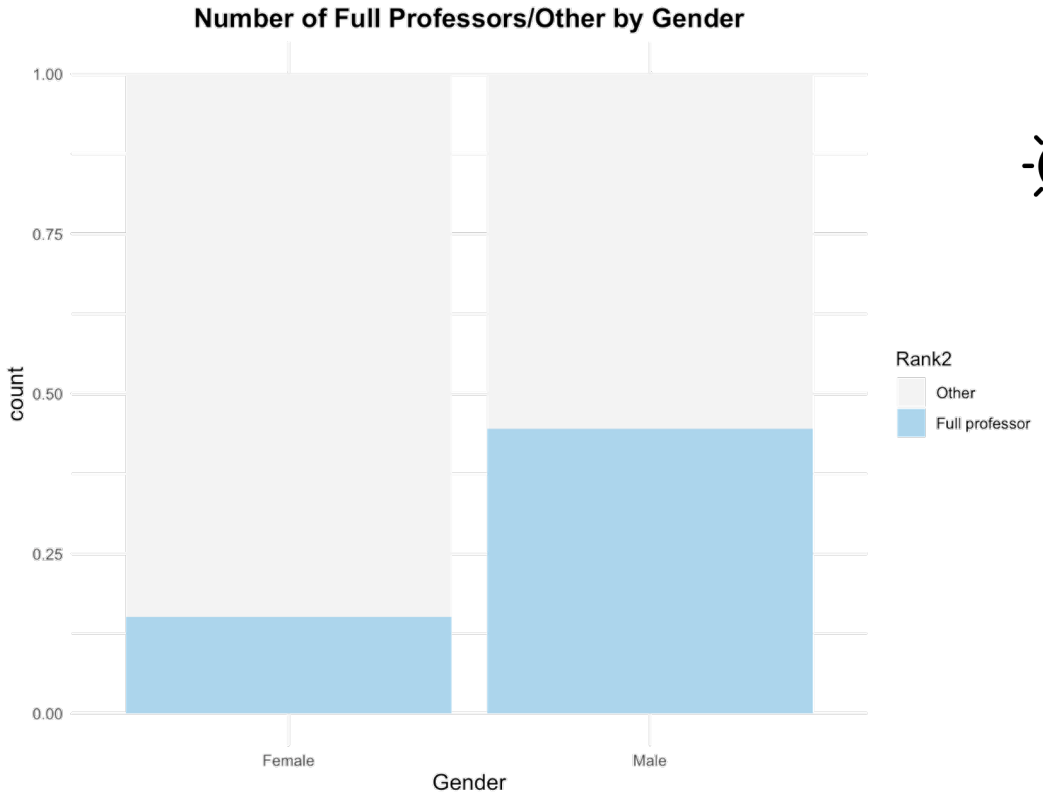
- Salary increases with experience, and men have more experience on average.
- After adjusting for experience, salary gaps between men and women diminish (Linear Regression).

Conclusion

- **No significant evidence** of discrimination in promotion and salary.
- **Experience** mainly contributes to salary and promotions, rather than gender.
- Additional exploratory required to fully comprehend the situation.

Promotion Criteria: Gender

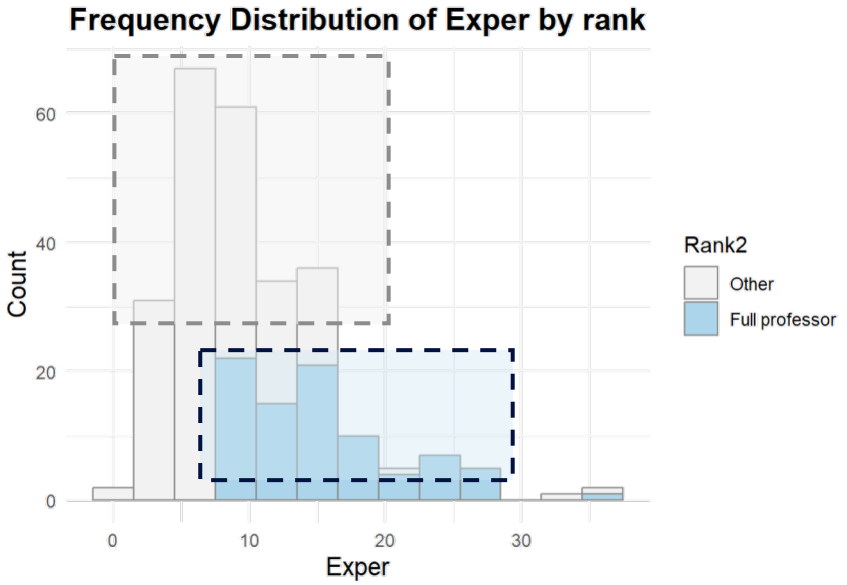
- **Male Group:** Nearly 50% are Full Professors.
- **Female Group:** Less than 25% are Full Professors.
- The overall proportion of men in Full Professor roles is higher than that of women.

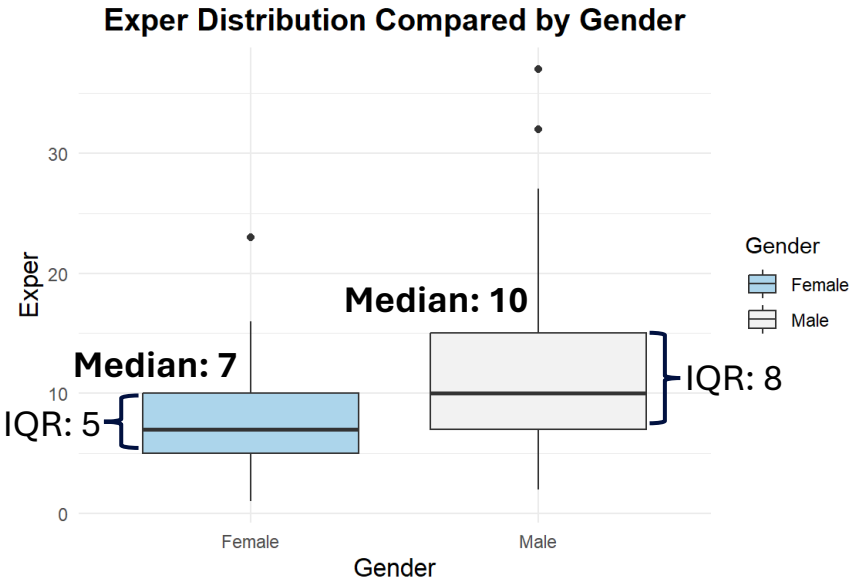


For the Full Professor level, does the gender gap really represent the existence of gender discrimination?

Promotion Criteria: Experience

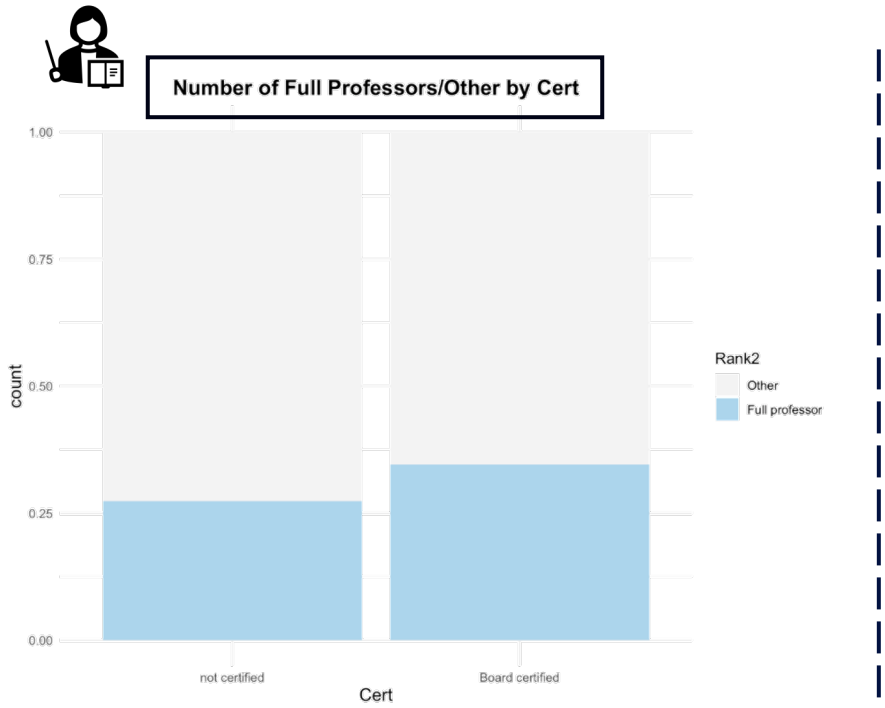
- The experience level of full professors converges at the range of 10~20 yrs., while the others which are more concentrated in the range of 5~10 yrs..
- Focusing on gender, **the male group shows a boarder range of experience years** -- specifically, through its higher median value -- indicating that men generally have more years of experience.
- In this regard, the less presence of females in the full professor position could be explained by their relatively lower experience levels.

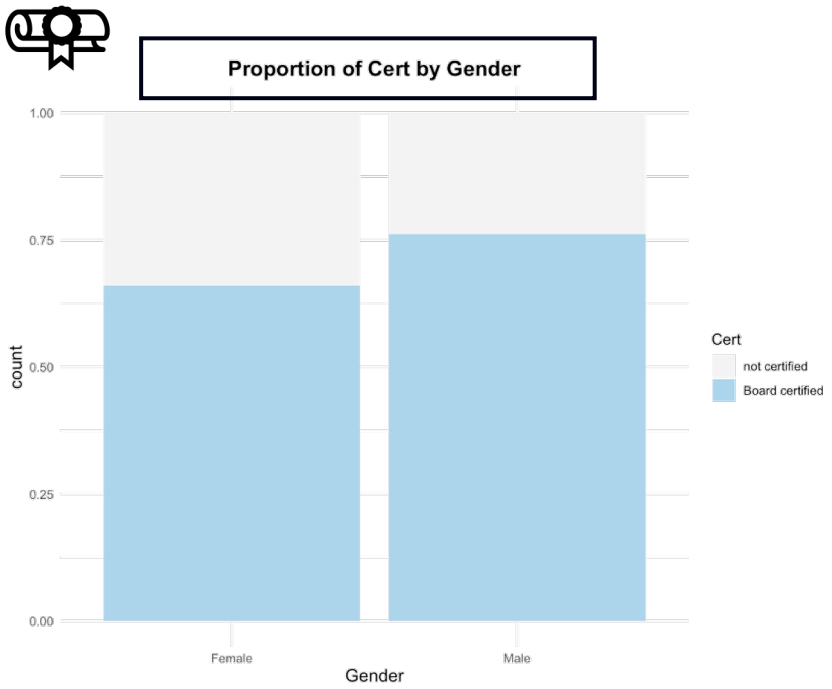




Promotion Criteria: Certification

- The proportion of Full Professors among board-certified doctors is higher compared to those who are not certified.
- Board certification enhances the likelihood of achieving Full Professor status.
- The lower board certification rate among **women** may explain their **reduced presence in Full Professor positions.**

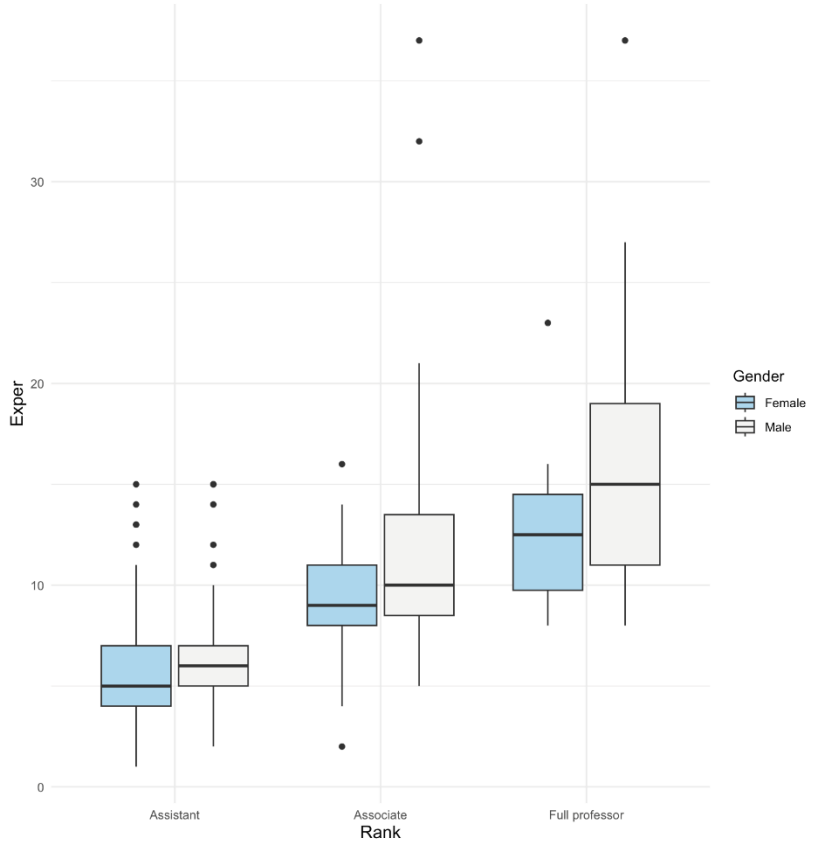




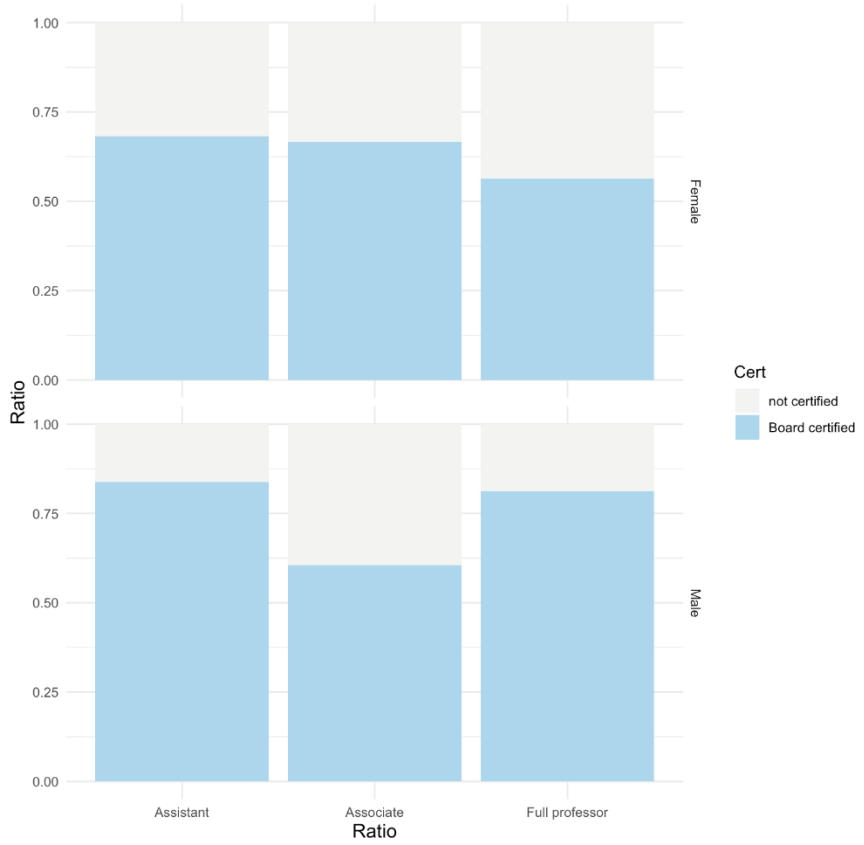
Promotion Threshold: Experience/ Certification Differences by Gender

- Across all positions, **women tend to have less experience compared to men**, indicating that the promotion threshold in terms of experience is lower for women.
- **In the position of full professor, women have a lower board-certified ratio** compared to men, suggesting that the promotion system might be more stringent for men.

Boxplot of Exper by Rank Compared in Gender

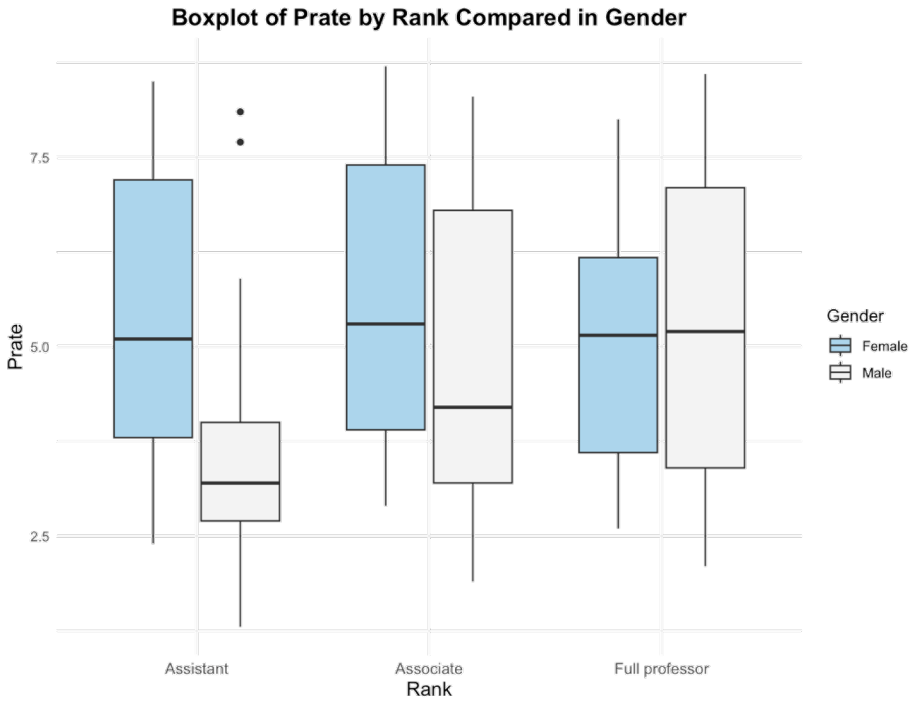


Barchart of Cert by Rank Compared in Gender



Fluctuations Discovered in Prate Across Gender

- At the Assistant and Associate Professor levels, women have a relatively higher publication rate compared to men.
- However, the publication rate for women drops when they reach the Full Professor position.
- In contrast, **the publication rate of men generally has increased with promotion in positions**.



Key Takeaways

- Men's publication efficiency[1] increases with promotion, while female's publication efficiency shows a narrowing trend.
- The discrepancy might explain the preference of promoting male as a prior.

Note: 1. assuming similar quality across gender.

Analysis on the Discrepancy of Promotion Efficiency

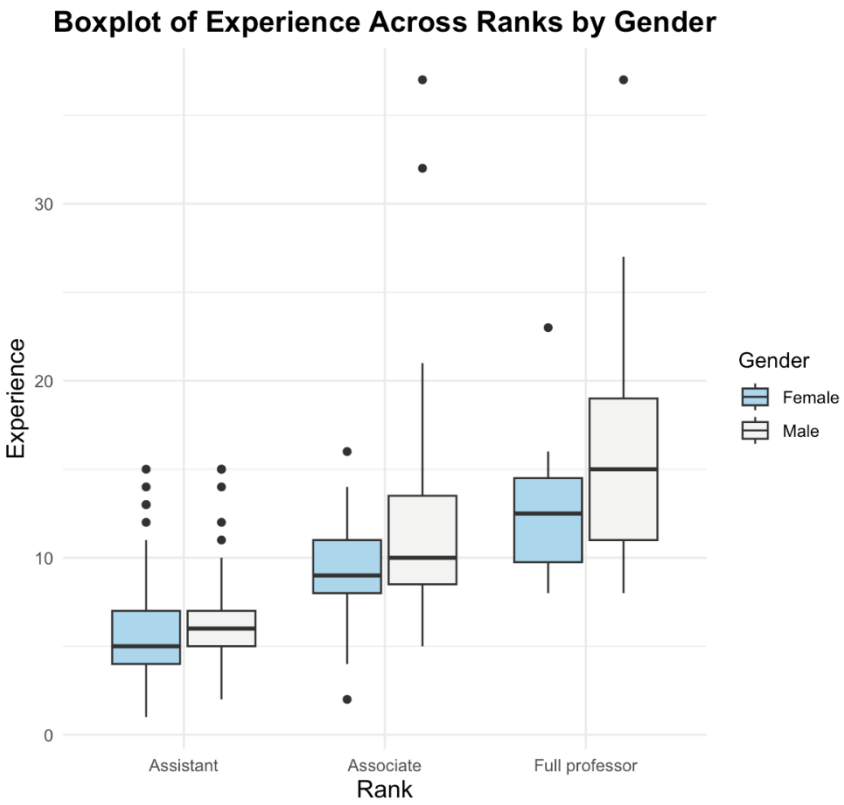
- Based on our analysis, **men generally tend to have more years of experience**.
- And the coefficient for the 'experience' factor is higher for females, suggesting that **females tend to achieve promotions to higher ranks more quickly than males**.

Logistic regression for promotion, by gender[1]

glm(Rank2~Dept+Cert+Exper,family = binomial)

Gender	Factor	Coe.**	Std. Err	P-Value
Male	(Intercept)	-2.73	0.715	0.0001***
	Exper	**0.214**	0.043	7.75e07***
Female	(Intercept)	-9.74	2.456	7.38e05***
	Exper	**0.748**	0.1863	6.00e05***

Notes: Control variables: Cert, Dept, Exper



CART Model Analysis on Promotion

- **Experience** is the most important predictor of promotion, accounting for **98%** of the model's predictive power. Prate contributes only 2%.
- **Gender** is **not a significant variable** in predicting promotion.

CART Model on promotion

```
CART_Model<- rpart(Rank2 ~ Dept + Gender + Clin + Cert + Prate + Exper,
                   data =df , method = 'class',
                   control = rpart.control(minsplit = 5, cp = 0))
```

Variable importance for CART (%)

Experience	Publication Rate
98	2

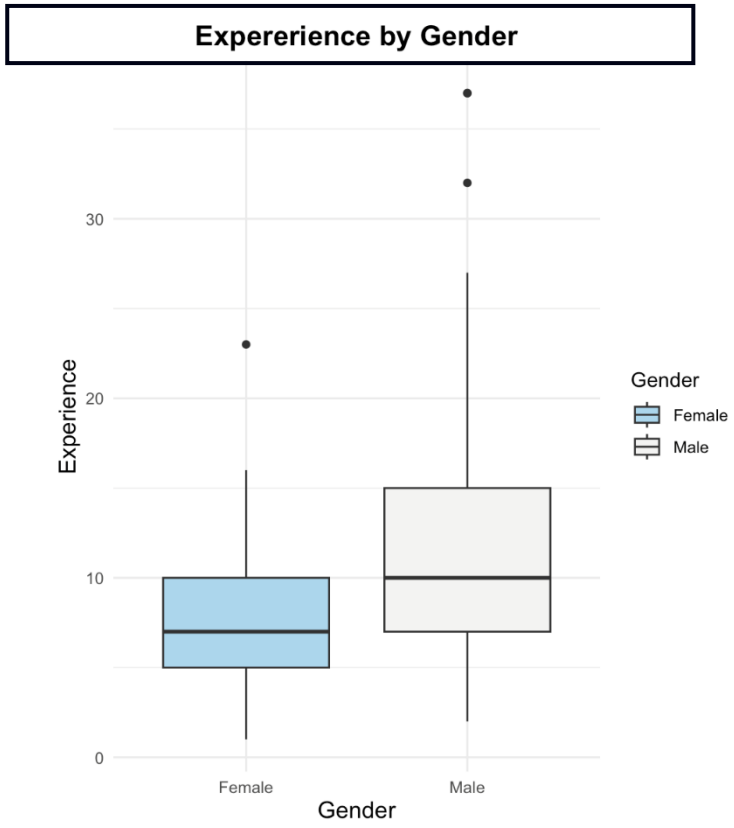
CART result[1]

	CP	nsplit	rel error	xerror	xstd
1	0.565	0	1	1.224	0.0748
2	0.141	1	0.435	0.435	0.0633

Notes: Root node error: 85/170 = 0.5, n= 170

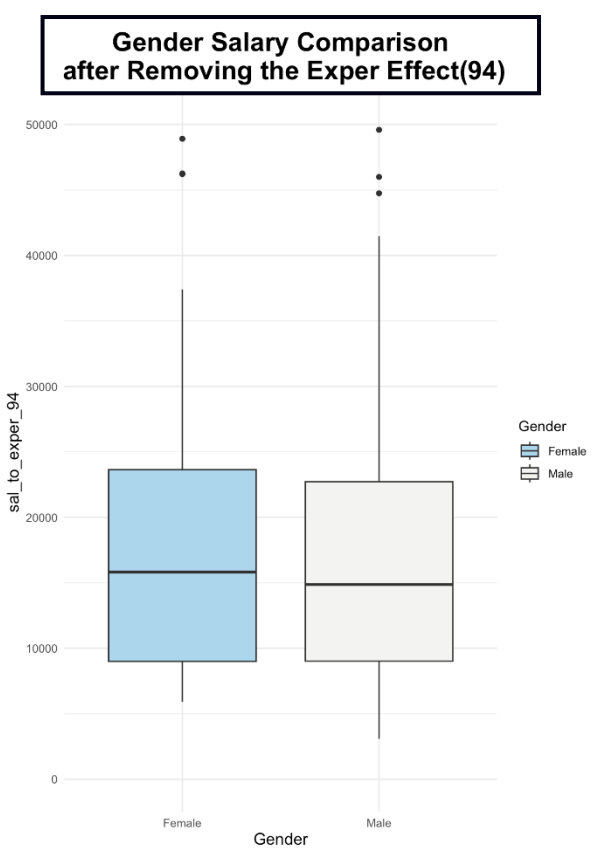
Relationship between Salary and Experience

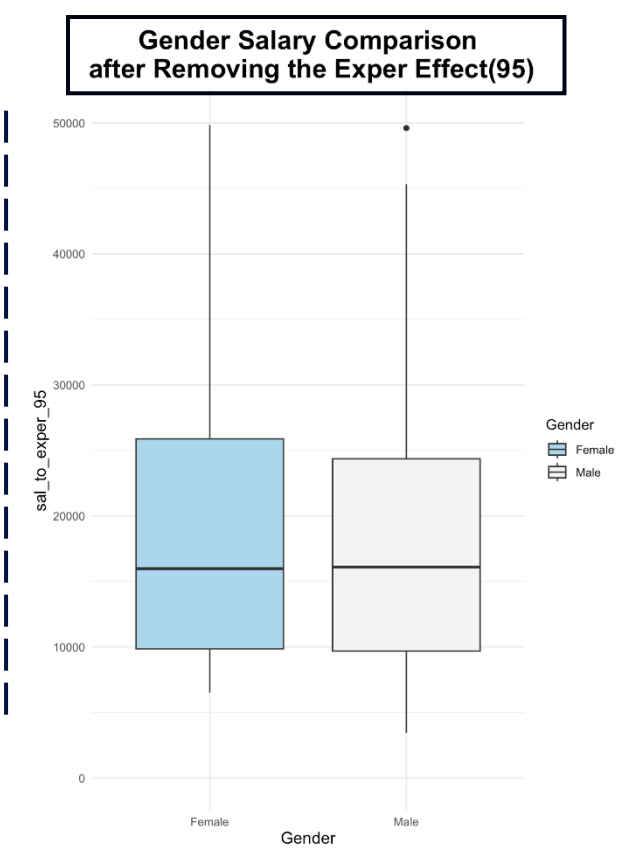
- Experience is strongly positively correlated with Salary.
- Females generally have less experience than males.
- This suggests that the reason for females earning less than males could be due to insufficient experience rather than gender discrimination.

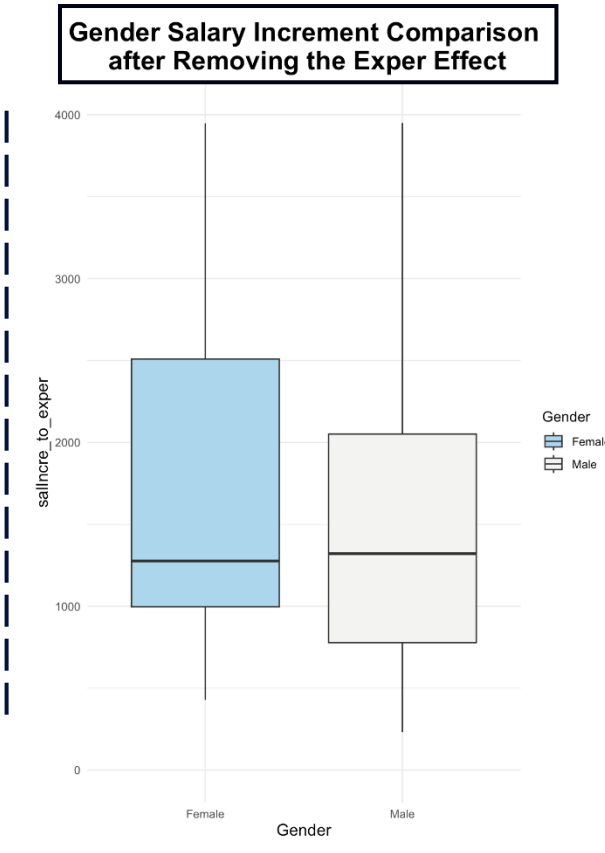


Remove Effect of Experience

- To eliminate the impact of experience differences between genders on salary, we constructed three tool variables, dividing salary by experience and comparing the resulting ratios.







Regression Results for Salary

- After controlling for relevant factors, **gender is not a significant determinant of salary or salary increment**, suggesting that the observed salary differences between males and females are likely driven by factors other than gender itself.

Linear regression for salary[1]

- lm(Sal95~Gender+Exper+Cert+Dept+Rank1+Clin)
- lm(Sal94~Gender+Exper+Cert+Dept+Rank1+Clin)
- lm(Sal_increment~Gender+Exper+Cert+Dept+Rank1+Clin)

Y	Factor	Coe.	P-Value	R^2
Sal95	(Intercept)	28353.7	1.55E-06***	**0.8998**
:	Gender	-2482.8	0.547823	
Sal94	(Intercept)	26063.3	1.17E-06***	**0.8994**
:	Gender	-1856.8	0.62058	
Sal_increment	(Intercept)	2290.37	0.00795***	**0.781**
:	Gender	-626.06	0.30827	

Notes: Control variables: Exper, Cert, Dept, Rank1, Clin