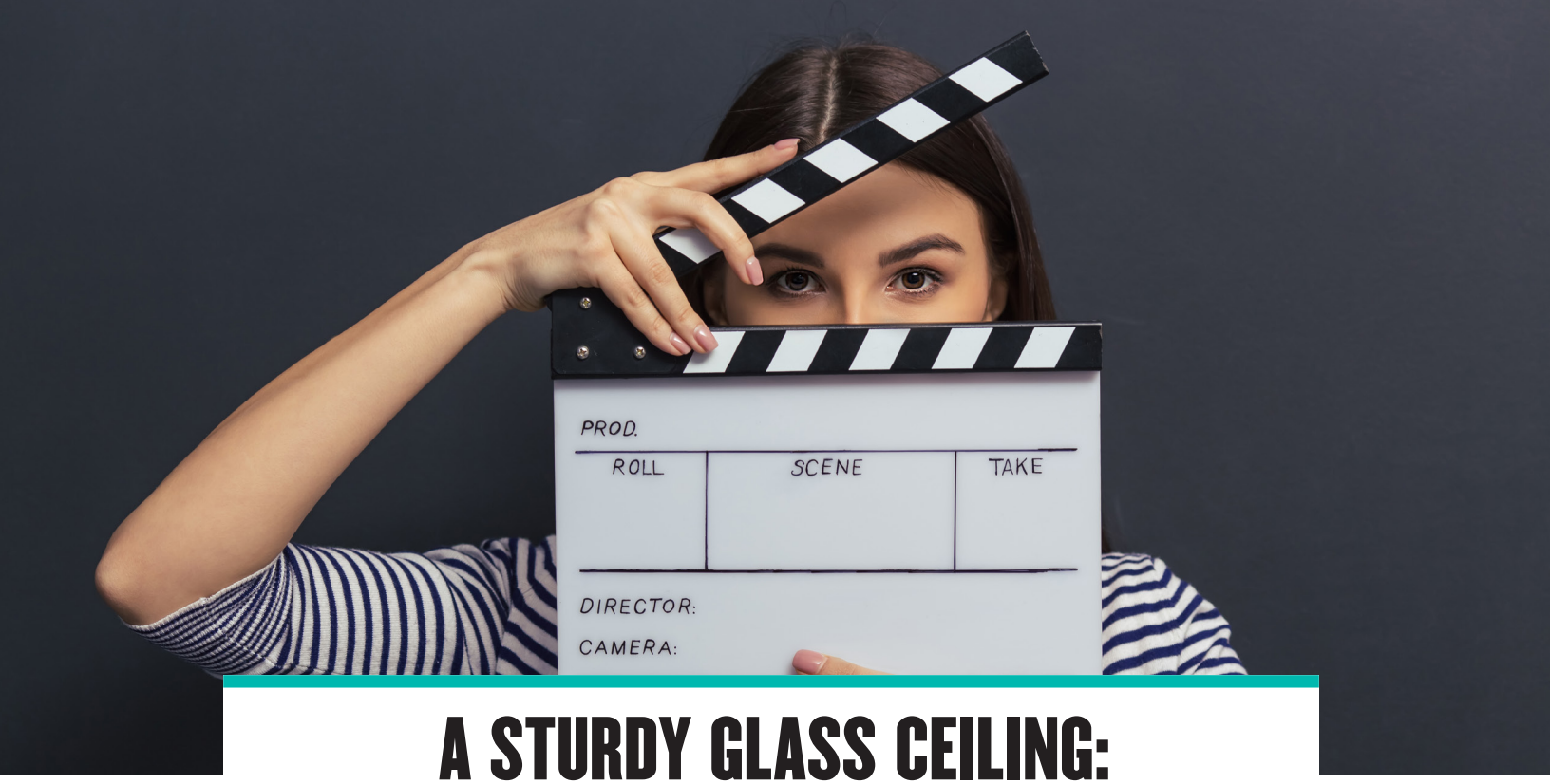

A STURDY GLASS CEILING:

Representation of Women on Screen and Behind the Scenes of Hollywood's Top 100 Films Throughout the Years

Student Author

Kara R. Miller is a senior in the Krannert School of Management studying marketing with a concentration in international business and a certificate of entrepreneurship. She is also pursuing minors in both communication studies and film and video studies. Immediately following her graduation from Purdue University in May 2018, she will attend the University of Southern California's Master of Science in Marketing program and will also pursue a Graduate Certificate in the Business of Entertainment.

Mentors

Ben Lawton (PhD UCLA, 1976) was cofounder and, for many years, Director of the Interdisciplinary Film/Video Studies Program at Purdue. He is a recipient of the campus-wide Amoco (now Murphy) Best Undergraduate Teacher Award. He was visiting professor at Indiana University in 1987 and at Dartmouth College in 2000. He has published widely on Italian and Italian American cinema. His translation of Pier Paolo Pasolini's *Heretical Empiricism* (Indiana University Press, 1988, expanded, NAP, 2006) is widely cited. Most recently he coedited *Revisioning Terrorism: A Humanistic Perspective* (Purdue University Press, 2016). He is a retired veteran of the Persian Gulf War.

Gary Evans is a continuing lecturer in the Krannert School of Management, where he is the course coordinator and primary instructor for MGMT 30500, Business Statistics. He has a master's degree in Mathematics from Indiana University and a PhD in Statistics from UCLA. At UCLA, he was a statistics instructor and consultant and was named Most Outstanding Computational Statistician. His research interests are in survey sampling design and analysis, multivariate analysis, and optimization algorithms.

https://doi.org/https://doi.org/10.5703/1288284316736

Abstract

My research analyzed the representation of women in the film industry, both on screen and behind the scenes. Specifically, I compared the number of women on and off screen for the top 100 films of 2017 (as of September) to the data collected by Martha Lauzen for the top 100 films of 1980,1990, 2000, 2010, and 2015. This comparison graphically depicts the representation of women in film over the years. The positions analyzed were producers, executive producers, directors, cinematographers, writers, and editors.

In addition to researching representation in these roles, I examined what factors, if any, are more likely to influence the presence of women in other roles. The strongest statistical factor in determining the presence of women behind the scenes is the presence of a female lead.

I also compiled data on the top 30 films directed by men and compared the return on investment (ROI), budget allocation, box office earnings, and experience (quantified by number of films and television episodes they had directed prior to the film listed) to the top 30 films directed by women. Statistical analysis concluded that ROI was not significantly different between men and women directors. Interestingly, however, the two highest ROIs, by far, were from films directed by women.

The budget disparity for men and women directors of Hollywood films is often noted. Statistical tests also concluded that experience was not significant in determining budgets.

Miller, K. R. (2018). A sturdy glass ceiling: Representation of women on screen and behind the scenes of Hollywood's top 100 films throughout the years. *Journal of Purdue Undergraduate Research, 8,* 24–31. https://doi.org/10.5703/1288284316736

Keywords

gender, women's studies, Hollywood, film studies, pay gap, directors, glass cliff, glass ceiling, sexism

INTRODUCTION

In my research, I hope to expand awareness of the lack of representation of women across several decades within the film industry by providing new data that confirms it. This longitudinal look at underrepresentation brings light to the barrier women face when entering the industry. My research follows up on research conducted by Martha Lauzen (2015) on the representation of women in the roles of producer (associate and co-producers; line, supervising, and consulting producers were not included), executive producer, writer, editor, cinematographer, and director in 1980, 1990, 2000, 2010, and 2015. By comparing the data collected by Lauzen to the representation of women in 2017's top 100 films, we can determine any improvement or deterioration of female representation.

In addition to researching the historical representation of women in the industry, I conducted statistical research to determine which roles are most influential in determining the number of women present behind the scenes (BTS) on a film. For example, I analyzed the connection between having a female lead and the likelihood of hiring a female director. The purpose of this test is to determine which roles have the most influence. If we can determine links between roles, we can determine the most effective ways to combat lack of representation at each level.

The second portion of my research concerns the directorial role specifically. I compiled a database of the top 30 films directed by men and the films' respective budget, gross box office earnings, return-on-investment (ROI), and the experience of the director (determined by number of past directed films and television episodes) and compared it to the same categories for the top 30 films directed by women. The purpose of this database was to determine if there was a significant difference in budget allocation, ROI, experience, and box office earnings between the genders. Various statistical analyses were undertaken to determine significance of differences. Specifically, ROI was tested to determine if female-directed films result in less return than male-directed films. Experience was tested as a factor in budget allocation to determine if men received higher budgets based on experience or on other factors.

PRIOR RESEARCH

The research collected and presented by Martha Lauzen (2015) covers 1980, 1990, 2000, 2010, and 2015. This data looks at the top 100, 250, and

500 films from each of those years. Lauzen has continuously collected this data annually as "the longest-running and most comprehensive study of women's behind-the scenes employment in film available"(Lauzen, 2015). The research shows that women have consistently been underrepresented across all fields in every year. Some numbers have improved slightly over time while others have remained stagnant. Women are most underrepresented in the roles of cinematographer, writer, and director. The fields with the highest representation of women are producer and executive producer. Overall, not one role saw more than 22% women in these fields from 1980 to 2015. Furthermore, the percentage of women editors has declined over the years from its high of 20%, in 2010 and 2016, to 13%. This is the lowest percentage of women editors since 1980. Women face the biggest disparity in the role of cinematographer, accounting for only 3% of cinematographers at their peak.

In 2017, representation in editing declined from the 2010–2015 high of 20% to 13% (Lauzen, 2015). Representation in directing increased from 7% in 2015 to 14% (Lauzen, 2015). However, the peak percentage for women directors was 20% in 2010 (Lauzen, 2015). In 2017, no role surpassed 26% for female representation. In addition to representation behind the scenes, the percentage of female-led movies was also calculated. In 2017, female-led films accounted for just 30% of the top 100 films. A common response to the discrepancy of male and female leads is based on the assertion that men make up a higher percentage of the movie-going population. However, the Motion Picture Association of America (2016) has concluded that females consistently make up a higher portion of theater patrons. Although the difference between the numbers of male and female moviegoers is quite small, the representation of on-screen leads ideally should be closer to 50/50 to reflect the actual population demographics of the United States and audiences.

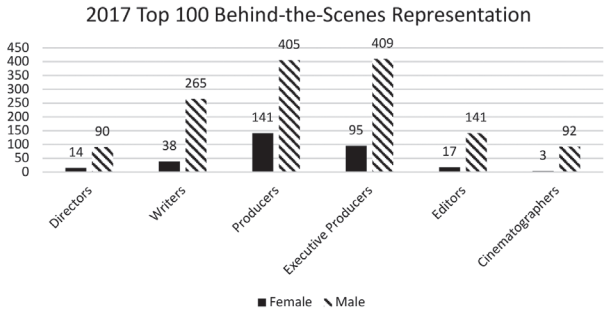

Figure 1. Disparity between men and women in the behind-the-scenes roles of the film industry. These numbers are from the top 100 films of 2017 (as of September).

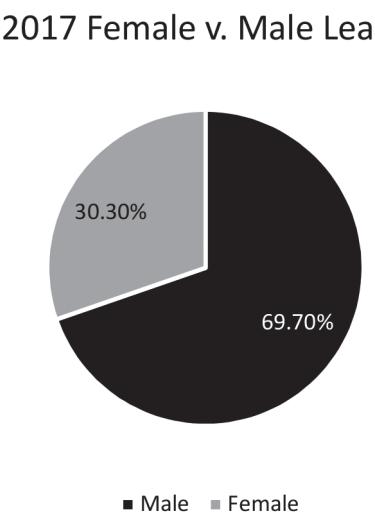

Figure 2. Number of male leads compared to female leads in 2017. These numbers are from the top 100 films of 2017 (as of September).

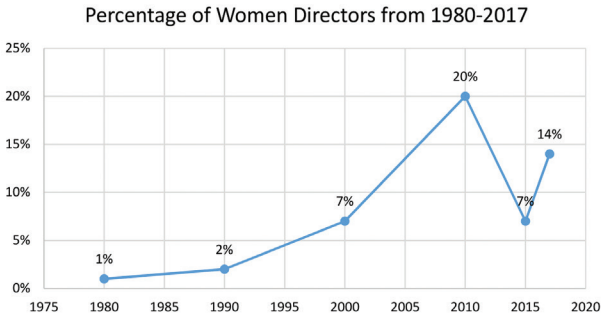

Figure 3. Representation of women in the role of director 1980–2017.

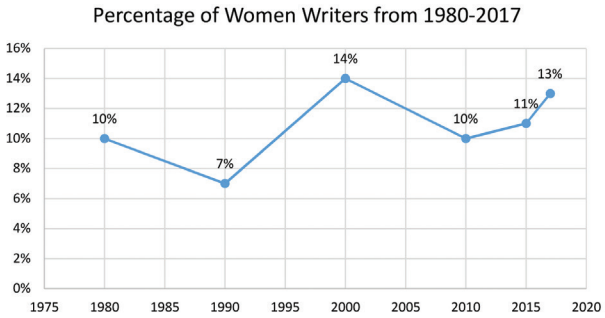

Figure 4. Representation of women in the role of writer 1980–2017.

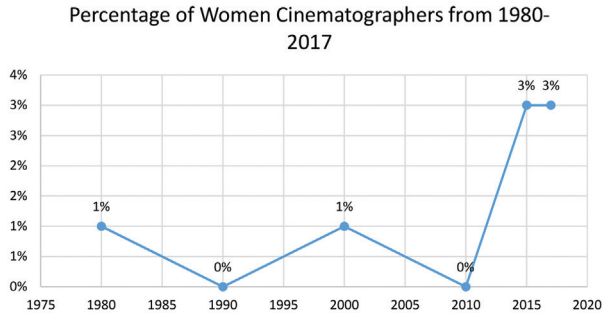

Figure 5. Representation of women in the role of cinematographer 1980–2017.

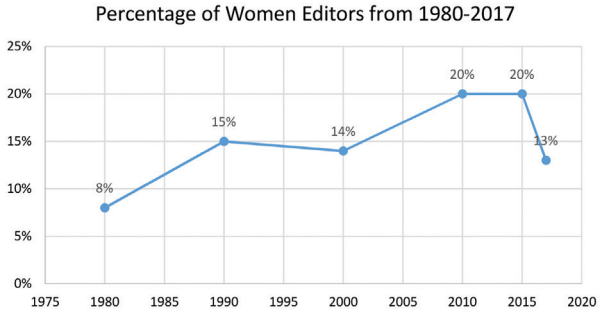

Figure 6. Representation of women in the role of editor 1980–2017.

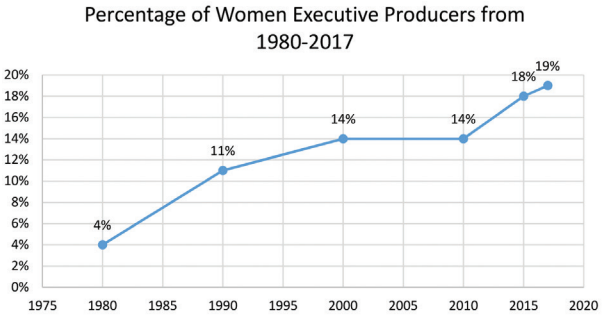

Figure 7. Representation of women in the role of executive producer 1980–2017.

Lauzen and Dozier present a hypothesis for the lack of representation: perhaps women do not pursue these fields as heavily as men do and therefore cannot reach equal representation. In order to evaluate this hypothesis, Lauzen requested the enrollment statistics for the top six film schools in the United States. Female students were underrepresented only at three of those schools (Lauzen & Dozier, 1999).

If women make up 50% of the United States' population and are not underrepresented in film programs around the country, it is reasonable to conclude that representation of women should be higher than the representation presented in the data.

GENDER DISPARITY BY ROLE

Influence of Women in Different Roles on Other Roles

With my research on 2017's top 100 films, I sought to analyze any links between women in one role to the presence of women in other roles. Using regression analysis, I looked at the connections between female directors, female leads, and the total number of women behind the scenes. First, I generated a binary logistic regression on female directors versus women behind the scenes. A binary logistic regression is used to "predict the relationship between independent and dependent variables where the dependent variable is binary" (Statistics Solutions, n.d.). The regression estimates that if there are 0 women behind the scenes, the probability that a female director will be chosen is 5.1%; if there is 1 other woman behind the scenes, the probability increases to 6.7%. These results are considered statistically significant, but only slightly. However, a binary logistic regression of Female Director versus Female Lead and Women BTS shows that when controlling for a female lead, the impact of women behind the scenes on the assignment of a female director is not significant (regression table omitted). Taking this into account, it was determined that having a female lead is the most significant factor when choosing a female director.

I conducted another binary logistic regression specifically to isolate the relationship that having a female lead has on having a female director. Using the regression equations, the probability of having a

Model Summary			
Deviance R-Sq 10.92%	Deviance R-Sq(adj) 9.68%	AIC 75.88	
Coefficients			
Term	Coef	SE Coef	VIF
Constant	–2.927	0.546	
Women BTS	0.296	0.105	1.00
Odds Ratios for Continuous Predictors			
	Odds Ratio	95% CI	
Women BTS	1.3447	(1.0939, 1.6531)	
Regression Equation			
P(1) = exp(Y')/(1 + exp(Y')) Y' = –2.927 + 0.296 Women BTS			

Table 1. Binary logistic regression: Female director versus Women BTS.

Model Summary			
Deviance R-Sq 27.52%	Deviance R-Sq(adj) 26.28%	AIC 62.49	
Coefficients			
Term Constant Female Lead	Coef –3.512 3.106	SE Coef 0.718 0.809	VIF 1.00
Odds Ratios for Continuous Predictors			
	Odds Ratio	95% CI	
Female Lead	22.3333	(4.5781, 108.9490)	
Regression Equation			
P(1) = exp(Y′)/(1 + exp(Y′)) Y′ = –3.512 + 3.106 Female Lead			

Table 2. Binary logistic regression: Female director versus female lead.

female director with a male lead is 0.03. However, the probability of having a female director with a female lead is 0.40.

In addition to the logistic regressions, I conducted Poisson regressions (Brilliant n.d.) to analyze the relationships in detail. Poisson regression is a type of count regression used when the dependent variable is a whole number. I computed three Poisson regressions: Women BTS versus Female Lead, Women BTS versus Female Director, and Women BTS versus Female Director and Female Lead. The relationships of these variables are comparable to the earlier logistic regressions. The regression does show a noteworthy relationship between women behind the scenes and female leads. However, the fit for the model is not good and therefore determinate statements about statistical significance cannot be made, although the effect does appear to be strong. In particular, having a female lead is predicted to increase women behind the scenes by 2.17.

Model Summary			
Deviance R-Sq 20.81%	Deviance R-Sq(adj) 20.35%	AIC 430.12	
Coefficients			
Term Constant Female Lead	Coef 0.8348 0.775	SE Coef 0.0793 0.114	VIF 1.00
Regression Equation			
Women BTS = exp(Y′) Y′ = 0.8348 + 0.775 Female Lead			

Table 3. Poisson regression analysis: Women BTS versus female lead.

Model Summary			
Deviance R-Sq 9.13%	Deviance R-Sq(adj) 8.66%	AIC 455.32	
Coefficients			
Term Constant Female Director	Coef 1.0212 0.630	SE Coef 0.0651 0.134	VIF 1.00
Regression Equation			
Women BTS = exp(Y′) Y′ = 1.0212 + 0.630 Female Director			

Table 4. Poisson regression analysis: Women BTS versus female director.

Next, female directors appear to have a fairly strong, noteworthy relationship to women behind the scenes; the model predicts that, with a female director, women behind the scenes increases by 1.88.

However, the third model shows that when both female lead and female director are accounted for, and female lead is controlled, the effect of female directors is minor and likely not statistically significant for women behind the scenes. Thus I conclude that the apparent female director effect is actually masking or working through association with the female lead effect and, therefore, having a female lead is by far the strongest factor in having a female director and women in other behind-the-scenes roles.

Model Summary			
Deviance R-Sq 21.60%	Deviance R-Sq(adj) 20.68%	AIC 430.41	
Coefficients			
Term Constant Female Director Female Lead	Coef 0.8283 0.202 0.695	SE Coef 0.0795 0.153 0.130	VIF 1.31 1.31
Regression Equation			
Women BTS = exp(Y′) Y′ = 0.8283 + 0.202 Female Director + 0.695 Female Lead			

Table 5. Poisson regression analysis: Women BTS versus female director and female lead.

BUDGETARY ALLOTMENT GAP BETWEEN MALE AND FEMALE DIRECTORS

In 2017, 14 films were directed by women, including the second highest grossing film of the year (*Wonder Woman*). Also, female directors were, and continuously are, consistently paid less than their male counterparts. As part of my research, I analyzed several possible explanations behind this discrepancy. In order to accurately represent the experiences of men and women in directing, I created a database of the top 30 films directed by men and women. First, to determine if men were actually paid more than women in the directing role, I conducted a two-sample T-test. The results determined that men were, in fact, given significantly higher budgetary allotments.

After determining that men received higher budgets, I conducted a two-sample t-test to determine if ROI was significantly different between genders. If this were the case, one could argue that female directors are paid less due to their lack of returns at the box office. However, the test determined that men and women return similar amounts even when controlling for outliers. This suggests that despite women receiving lower budgets for their films, they return similar amounts as men.

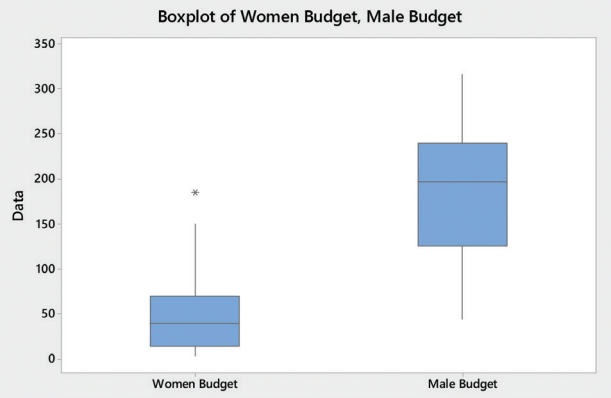

Figure 8. Differences in the allocated budgets for male and female directors. The star point represents an outlier.

	N	Mean	StDev	SE Mean
Male Budget	30	184.0	75.1	14
Women Budget	30	51.8	48.4	8.8

Difference = μ (Male Budget) - μ (Women Budget)
Estimate for difference: 132.2
95% CI for difference: (99.4, 165.0)
T-Test of difference = 0 (vs ≠): T-Value = 8.10 P-Value = 0.000 DF = 49

Table 6. Two-sample T-test and CI: Male budget versus female budget.

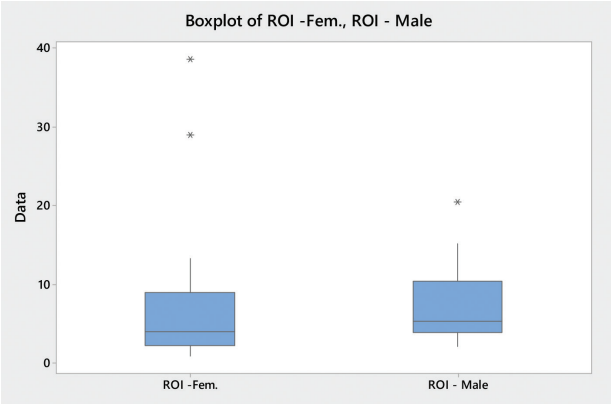

Figure 9. Differences in the ROI between male and female directors.

	N	Mean	StDev	SE Mean
ROI	30	7.07	8.12	1.5
ROI 1	30	6.97	4.37	0.80

Difference = μ (ROI) - μ (ROI_1)
Estimate for difference: 0.10
95% CI for difference: (-3.29, 3.50)
T-Test of difference = 0 (vs ≠): T-Value = 0.06 P-Value = 0.951 DF = 44

Table 7. Two-sample T-test and CI: ROI-male versus ROI-female.

	N	Mean	StDev	SE Mean
ROI-Male (Outlier Del)	29	6.50	3.61	0.67
ROI-Fem (Outliers Del.)	28	5.16	3.53	0.67

Difference = μ (ROI-Male (Outlier Del)) - μ (ROI-Fem (Outliers Del.))
Estimate for difference: 1.340
95% CI for difference: (-0.555, 3.234)
T-Test of difference = 0 (vs ≠): T-Value = 1.42 P-Value = 0.162 DF = 54

Table 8. Two-sample T-test and CI: ROI-male (outliers del.), ROI-Female (outliers del.).

The last test conducted was a multiple regression analysis to determine if experience was a significant factor in determining budgetary allotment. A common justification to the budgetary gap between male and female directors is that male directors simply have more experience and therefore deserve to be given a higher budget. The regression analyses, which had quite good model fit, found that experience is not statistically significant in determining budgetary allotment even considering possible interaction. The results show that gender is such a strong predictor of budgetary allotment that experience essentially has no effect.

Model Summary					
S 63.6488	R-sq 53.24%	R-sq(adj) 51.60%	R-sq(pred) 48.43%		
Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	47.8	14.5	3.30	0.002	
Male Dir	131.4	16.5	7.95	0.000	1.01
Prior Exp	0.66	1.44	0.46	0.646	1.01
Regression Equation					
Budget ($Mil) = 47.8 + 131.4 Male Dir + 0.66 Prior Exp					

Table 9. Model 1—no interaction effect.

Model Summary					
S 63.7551	R-sq 53.91%	R-sq(adj) 51.44%	R-sq(pred) 46.27%		
Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	53.1	15.6	3.39	0.001	
Male Dir	112.4	26.8	4.19	0.000	2.65
Prior Exp	–0.22	1.74	–0.12	0.902	1.48
Male Dir:Exp	2.79	3.10	0.90	0.372	3.29
Regression Equation					
Budget ($Mil) = 53.1 + 112.4 Male Dir - 0.22 Prior Exp + 2.79 Male Dir:Exp					

Table 10. Model 2—with interaction.

OVERALL SUGGESTIONS AND CONCLUSION

This research shows that women are underrepresented in the roles of producer, executive producer, cinematographer, writer, director, editor, and lead for every year analyzed. Some roles have shown an increase in representation, albeit a miniscule one. There is also evidence that some roles have seen declining representation or stagnant representation throughout the past 38 years. The roles of cinematographer, writer, and editor see the lowest percentage of women.

This study also demonstrates that female directors are statistically more likely to receive a lower budget compared to their male counterparts. However, even when controlling for outliers, women and men have comparable ROIs. This shows that men and women make similar returns given their different budgetary allotments. The research also shows that experience is not a statistically significant factor in determining budget. This counters the popular idea that budget is based on prior directorial experience.

Finally, the research shows that although female directors do have some effect on the presence of other women behind the scenes, the strongest determinant is having a female lead. When accounting for a female lead, a female director has almost no effect. One could conclude that we simply need more female-lead movies in order to solve the representation gap. However, that would be acceding to standard sexist ideology. If we say that having more female-lead movies is the solution, it puts us on a slippery slope to implying women should work only on female-lead films and men should work only on male-lead films.

Over the years, women have been fighting for their chance at creating, producing, and developing stories to be shown on the big screen. Successes from certain women in Hollywood were thought to have shattered any potential glass ceiling by the 2000s. However, with this data and the data collected continuously by Martha Lauzen (2015), we see the same picture we have been seeing since 1980. Women simply are not given the same opportunities in Hollywood as men are. Even when women are

given the opportunity, they are frequently underpaid compared to male counterparts.

In 2017 alone, several film and television producers were castigated for their pay disparities between female and male costars. Mark Wahlberg reportedly received "1,500 times" the salary of costar Michelle Williams for the reshoot of *All the Money in the World* (O'Connor, 2018), and petitions were drafted requesting that actor Matt Smith donate the difference in salary he made on *The Crown*, despite actress Claire Foy being the star character, to the Times-Up Legal Defense Fund (Clarke, 2018). It is through continued research that we can begin to understand and analyze the prejudices that affect women in the film industry.

Going forward, further research studies should be conducted on the way the presence of women behind the scenes, or lack thereof, affects the portrayal of women on screen and vice versa.

This article cites information acquired on the top 100 films of 2017 (as of September) (determined by gross box office earnings) and the top 30 films directed by men and women throughout history. This information comes from the respective film pages listed on IMDB and Wikipedia.

ACKNOWLEDGMENTS

I would like to thank Professor Benjamin Lawton, Interim Director of the Film and Video Studies Program of the School of Interdisciplinary Studies in the College of Liberal Arts, for giving me the opportunity to conduct this research as my faculty advisor through Purdue University's WILKE Undergraduate Research Scholarship. I would also like to thank Dr. Gary Evans of the Krannert School of Management for his continued assistance in the statistical analysis of the data presented and providing mentorship throughout the project.

REFERENCES

Brilliant. n.d. Poisson distribution. Retrieved from https://brilliant.org/wiki/poisson-distribution/

Clarke, S. (2018, March 18). Petition calls on Matt Smith to donate part of his salary from 'The Crown' to Time's Up. *Variety*. Retrieved from http://variety.com/2018/tv/news/petition-matt-smith-the-crown-salary-times-up-1202729883/

Lauzen, M. (2015). *The celluloid ceiling: Behind-the-scenes employment of women on the top 100, 250, and 500 films of 2015.* Retrieved from https://womenintvfilm.sdsu.edu/files/2015_Celluloid_Ceiling_Report.pdf

Lauzen, M., & Dozier, D. (1999). The role of women on screen and behind the scenes in the television and film industries: Review of a program of research. *Journal of Communication Inquiry,* 23(4), 355–372. http://journals.sagepub.com/doi/abs/10.1177/0196859999023004004#articleCitationDownloadContainer

Motion Picture Association of America. (2016). *MPAA theatrical market statistics 2016.* Retrieved from https://www.mpaa.org/wp-content/uploads/2018/03/MPAA-Theatrical-Market-Statistics-2016_Final-1.pdf

O'Connor, R. (2018, January 11). Michelle Williams and Mark Walberg pay disparity investigated by the Screen Actors Guild. *Independent*. Retrieved from https://www.independent.co.uk/arts-entertainment/films/news/mark-walhberg-michelle-williams-pay-all-the-money-in-the-world-reshoots-ridley-scott-screen-actors-a8153571.html

Statistics Solutions. (n.d.). Binary logistic regression. Retrieved from http://www.statisticssolutions.com/binary-logistic-regression/