

# Faculty Salary Anomaly Review

OFFICE OF THE PROVOST & VICE-PRESIDENT ACADEMIC

## Introduction

The University of Guelph (U of G) is committed to creating a campus founded on the principles of equity and inclusion. As part of this commitment, the University has undertaken a review of salary equity among the faculty, with a particular focus on gender equity. In addition to gender equity, U of G attempted to identify salaries that were unusually low compared to what could be expected based on various characteristics of faculty members. The review was overseen by the Office of the Provost, with support from the Office of Institutional Analysis and Research, the Office of Faculty and Staff Relations, and the Office of Diversity and Human Rights.

Gender equity studies have been undertaken across Canada and the United States and most find a negative salary differential for female faculty. A study at the University of Victoria in 2014 found that males earned more than females and that this gap widened as years of experience increased. At Simon Fraser University, a study in 2015 found that after controlling for rank, department, and years of service, male faculty earned \$2,400 more than female faculty in 2013. In the US, a study at the University of Michigan in 2001 found that the salary difference due to gender was between 1% and 3%, while a study at the University of California, Berkeley in 2015 found that women earned 1.8% less than males even when controlling for rank.

In Ontario, over the recent past several peer universities conducted similar reviews of faculty salaries with similar outcomes. For example, McMaster University and Western University found salary differences favouring men of \$2,350 and ~\$2,100, respectively. The University of Waterloo conducted an in-depth study in 2016 to examine salary differences between males and females, as well as look for unusually low salaries among all faculty members. They found a systemic gender gap of \$2,905 in favour of male faculty members. In addition, Waterloo found that over 70 faculty members had uncommonly low salaries given what would be expected given the profile of the faculty member.

This paper outlines the methodology used to examine salary equity among faculty. These analyses provided background and information to support decisions for salary adjustments identified as anomalously low.

## Methodology

This study is based on administrative information about faculty as of October 2017. The salaries included were those at July 1, 2017 and adjusted for the latest settlement with UGFA as well as any retroactive individual adjustments affecting July 1 salary amounts. The total available sample was 790 faculty. Similar to previous salary equity studies, faculty who were deans or AVPs and those in secured appointments<sup>1</sup> at the time were removed. This left 777 faculty for the analyses below.

The analyses were based on available and reliable administrative data held about faculty. The initial intent was to also include information, such as ethnicity and gender identity, gathered via the *Diversity Matters Census* (faculty survey launched in July 2017); however, the resulting information was insufficient to allow meaningful analysis of salary differences related to these factors at this time. The major issue with the survey was a low response rate and the actual responses showed a fair amount of bias in who responded versus those who did not respond. Specifically, males and faculty at the assistant professor level were severely underrepresented. In addition, there was a fair amount of variation in response among Colleges. For example, faculty in OVC answered at the highest rate among Colleges, (85%), while faculty in OAC answered at the lowest rate (51%).

## Descriptive Information

Of the 777 faculty, there are 298 female faculty and 479 male faculty. There are 144 Assistant Professors, 366 Associate Professors, and 267 Full Professors.

Figure 1 shows the number of female and male faculty in each College. Both CSAHS and the College of Arts have more female than male faculty members, while all other Colleges have more male than female faculty. Figure 2 displays the rank of faculty in each College. For OAC, the number of Professors is greater than any other rank, while for every other College Associate Professors outnumber both Assistant Professors and Professors.

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<sup>1</sup> Secured appointee: An appointment resulting from an MOU signed prior to UGFA Union Certification that granted, on a without precedent basis, regular faculty status (i.e., full-time, without a probationary period, and without consideration for tenure) to a small group of then long-serving contractually limited faculty.

Figure 1 - Gender by College

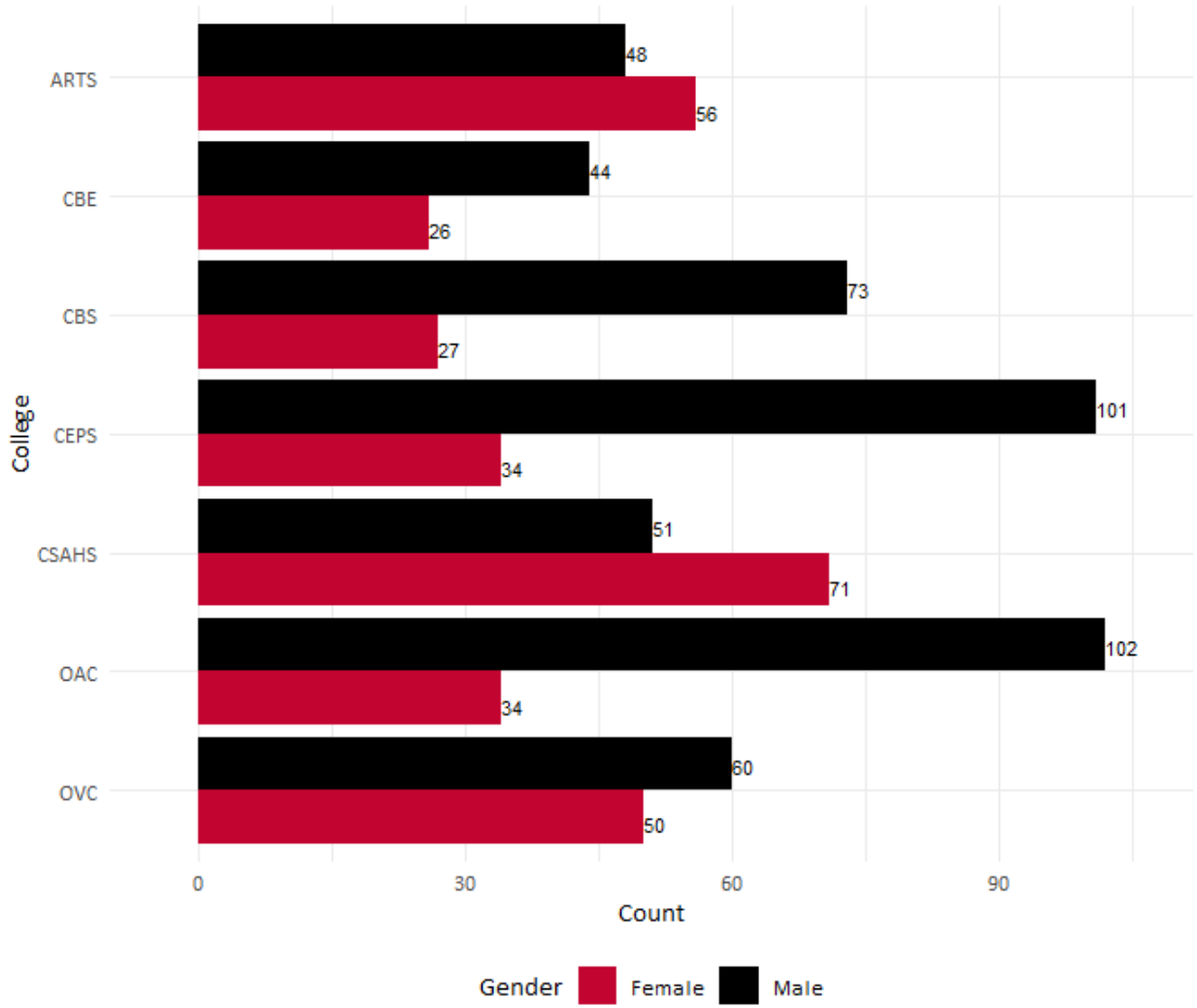


Figure 2 - Rank of Faculty by College

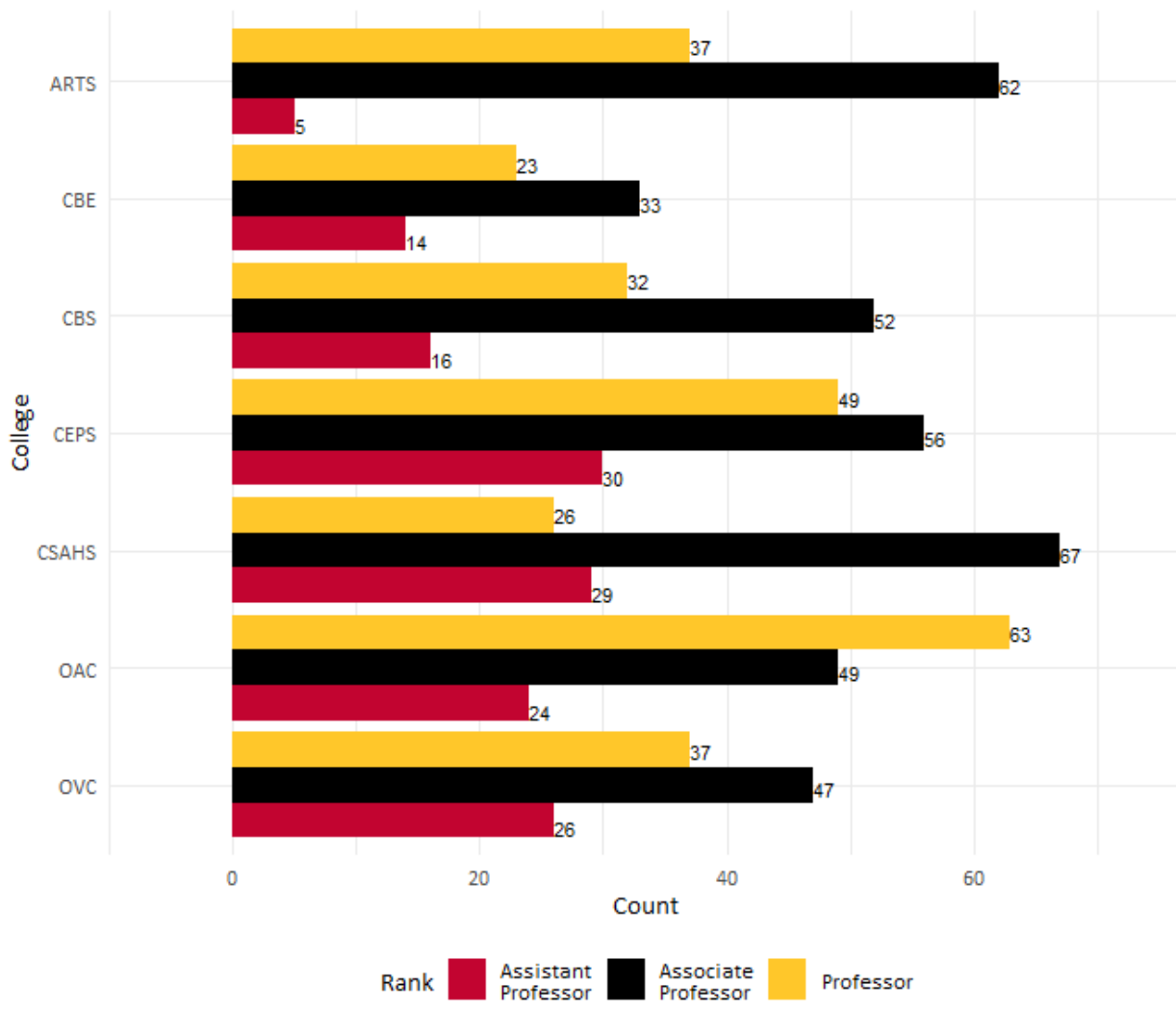
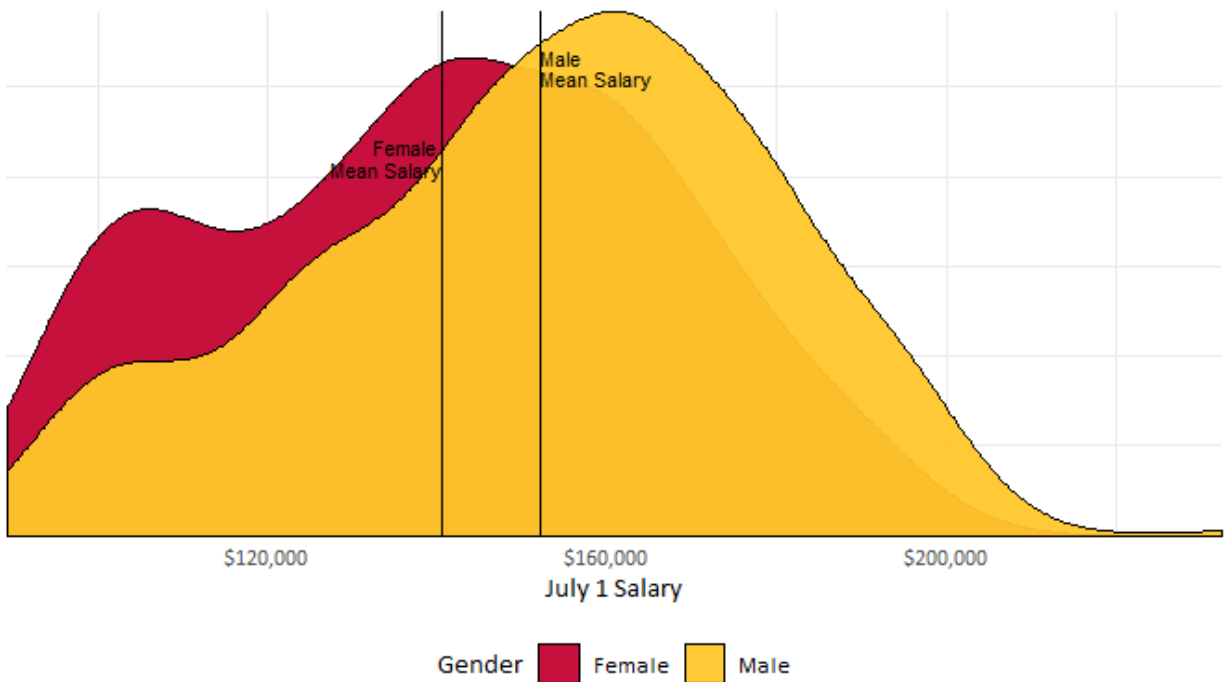


Figure 3 - Distribution of Male and Female Salaries



The distribution of salaries as at July 1, 2017 for males and females is shown in Figure 3. As can be seen, the average wage for female faculty (~\$140,450) is lower than for male faculty (~\$152,180). Also of note is that the distribution of salaries of male faculty are skewed to the right more than those for females, meaning that a greater percent of males earn above \$150,000.

While these raw differences in salary provide suggestive evidence of gender inequity, there may be other factors influencing these salaries other than gender. Previous studies of salary equity have suggested that both time from completion of PhD and time from appointment at the university have an effect on salary. Across the university, the median time from appointment is 14 years, while the median time from PhD is 18. Both of these measures are graphed in Figures 4 and 5 by gender. A larger proportion of females have lower time from completion of PhD as well as less time spent at the University. These differences in other factors that might affect salary lead us to conduct a multivariate analysis to control for these (and other) factors.

Figure 4 - Time from PhD by Gender

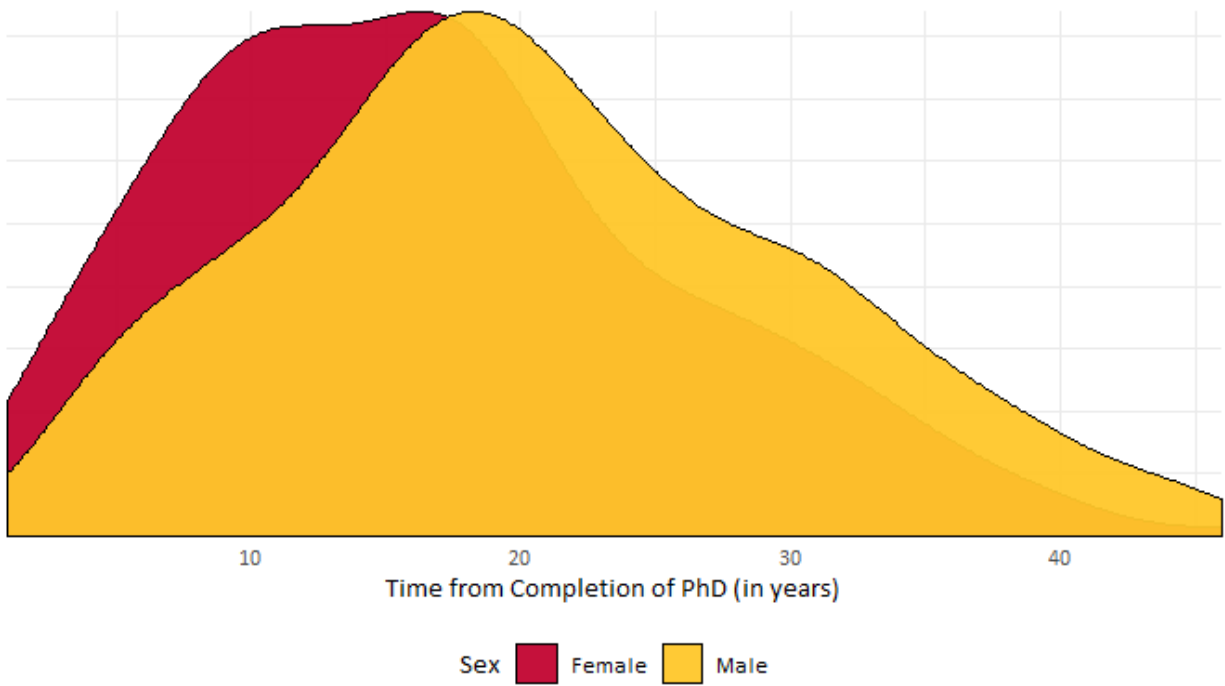
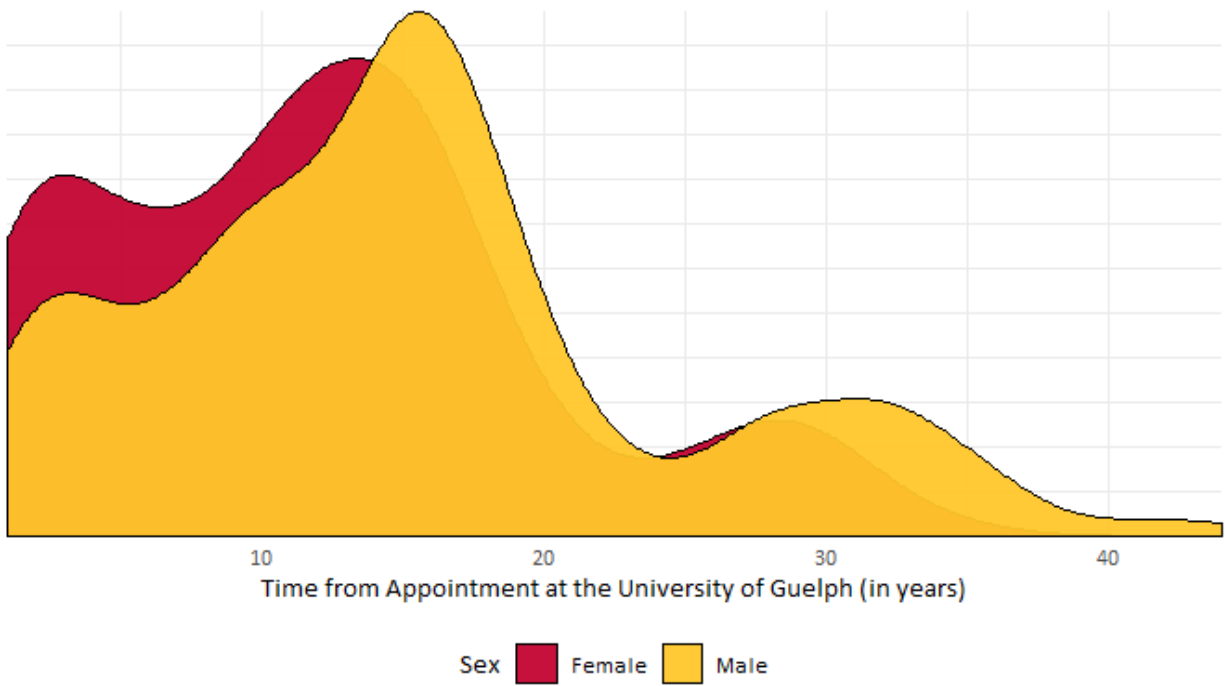


Figure 5 - Time from Appointment at U of G



## Multiple Regression: Model Description

Several variables known to influence salary were considered for inclusion in the model. Inclusion in the model was based on 1) environmental scan and review of the literature and available salary reviews from other universities, and 2) administrative data that was complete and reliable. For the multivariate analysis, we use the following predictors:

1. Gender – Male or Female (where Female is the reference group)
2. Rank - Assistant, Associate or Full Professor (where Assistant Professor is the reference group)
3. Time from hire – number of years since hired at the U of G
4. Time from PhD<sup>2</sup> – number of years since receiving a PhD
5. Performance Ranking<sup>3</sup> – assigned to a group based on the 2016 performance rating of either Unsatisfactory, Improvement Required/Developmental, Good, Very Good or Outstanding (where Unsatisfactory is the reference group). A point of note, two additional groups were added to this predictor to capture faculty without 2016 performance rankings (i.e., new faculty and those in an administrative position in 2016).

In terms of capturing the variance among and between faculty disciplines, we chose to use discipline rather than department. The initial intent was to use the department of the faculty member however the range in size of departments is great; range from a minimum of 1 (3 departments) to a maximum of 55. Disciplines were treated as a random effect in the model to account for the variance in salaries explained both within and between the various disciplines.

More on the model selection can be found in the appendix.

## Multiple Regression: Results

The model fits the data well, with an  $R^2$  of .82; indicating that the model explains 82% of the variance in faculty salaries. Table 1 below shows a summary of the regression results:

Table 1 - Regression Results

Explanatory Variables	Coefficients (p-value)
(Intercept)	147,149.90 (<.001)**
Male	2,051.02 (0.011)*
Associate Professor	9,799.86 (<.001)**
Professor	23,413.5 (<.001)**
Time from hire	8,130.02 (<.001)**
Time from hire Squared	-2,153.93 (<.001)**
Time from PhD	13,015.52 (<.001)**

<sup>2</sup> For both *Time from Hire* and *Time from PhD*, polynomials were added for both of these predictors because the relationship between salary and the predictor variables follows a polynomial relationship.

<sup>3</sup> Due to the change in policy in 2011, in which performance ranking was no longer added to the base salary, most recent performance was included as a proxy for performance over the years.



Time from PhD Squared	-568.17 (0.212)
<b>Performance Rankings:</b>	
Good	-9,811.78 (0.19)
Improvement	-19,421.81 (0.024)*
No Ranking - Admin	-5,984.72 (0.438)
No Ranking - New Appt	-7,089.58 (0.354)
Outstanding	-10,808.28 (0.147)
Very Good	-11,009.06 (0.139)

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\*Significant at  $p < .05$   
\*\*Significant at  $p < .001$

As is seen in the table, the explanatory variable of male is statistically significant. The value of the coefficient is the difference in salary between male and female salaries; thus, showing male faculty make approximately \$2,050 more than female faculty on average.

All other results from the model are what can be expected: associate professors make more than assistant professors, and full professors make more than both associate and assistant professors. The coefficients on time from hire suggest that salary increases as a faculty member is at U of G longer, and that this increase happens more quickly in the first few years of appointment; a similar pattern also exists from time from PhD. Perhaps somewhat counter intuitively, all of the performance coefficients are negative. This means that, with respect to the reference group (unsatisfactory), on average, everyone else has lower salaries.

Figure 6 shows what one would expect a faculty member's salary to be given all the characteristics known about them (the fitted salary) for the above random effects model, versus a faculty member's actual salary.

Figure 6 - Actual vs Fitted Salary



### Anomalous Low Salaries

To determine whether a faculty member's actual salary was unusually too low from what would be expected given the person's relevant characteristics, a threshold was determined. Typically, there are two types of low anomalous salaries. The first type is **absolute dollar difference**, which is the difference between the actual salary and the fitted salary. The second type is the **proportional difference**, which is defined as follows:

$$\frac{\text{observed}_i}{\text{fitted}_i}$$

An examination of faculty salary reviews yielded very few references in establishing a threshold. We adopted the approach used by the University of Waterloo as it combined using both an absolute dollar difference and a proportional difference. Specifically, the threshold adopted from the University of Waterloo was:

1. The actual salary is \$5,000 less than the fitted salary, **and**
2. The proportional difference between actual and fitted is less than 90%.

Using this threshold, it was determined that 35 individuals had anomalously lower salaries than what would be expected. Below is the number of anomalously low salaries by gender and College. As one can see, the breakdown is not consistent across the Colleges yet is evenly split, in absolute numbers, between gender.

*Table 2 - Low anomalous salary count by College*

College	Female	Male
	N (% of gender in College)	N (% of gender College)
ARTS	3 (5.45%)	3 (6.25%)
CBE	2 (7.69%)	0
CBS	1 (3.70%)	0
CEPS	2 (5.88%)	3 (2.97%)
CSAHS	6 (8.45%)	3 (5.88%)
OAC	1 (2.94%)	8 (7.84%)
OVC	2 (4.00%)	1 (1.67%)
<b>Total</b>	<b>17 (5.70%)</b>	<b>18 (3.76%)</b>

### Resolve salary difference

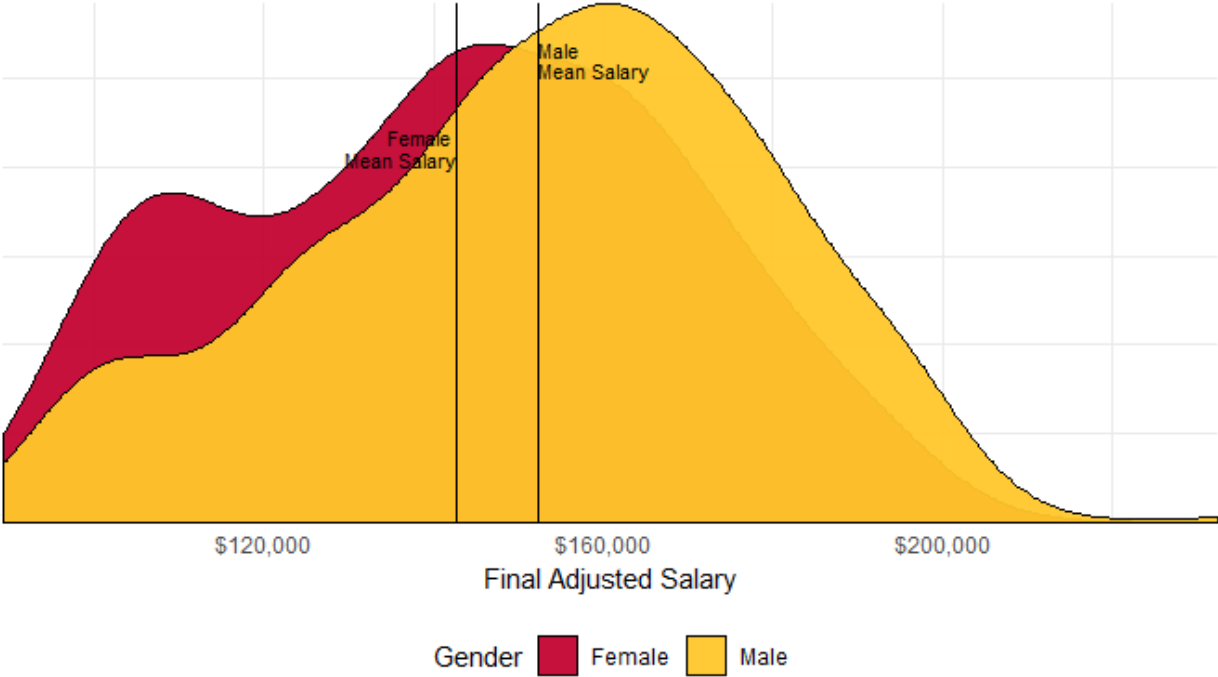
The above analyses helped to uncover salary discrepancies between men and women and identify individuals with unusually low salaries. As a next step, the analyses were used to support decisions to close these discrepancies. A two-part approach to resolve the salary differences was taken by the Provost.

1. Resolve all 35 anomalous salaries up to 90% of their fitted salary, and then round to the nearest \$500, at an estimated cost of approximately \$164,500.
2. Resolve the gender gap. Increase updated salaries of females by \$2,050, regardless of whether the faculty member was anomalous or not, at a cost is approximately \$610,900.

The final base salary cost to the U of G is approximately \$775,400.

Figure 7 is an illustration of the change in salary distributions by gender should all the salary adjustments to women and those with unusually low salaries be applied. There is still a difference between female and male faculty salaries (\$142,270 vs \$152,400, respectively), but this difference can now be better explained by rank, performance rating, time from hire, and time from PhD of the faculty member, rather than gender itself.

Figure 7 - Distribution of Final Adjusted Salary by Gender



### Choice of Model and Dependent Variable

Several models were tested and a random effects model was chosen. The University of Guelph's faculty data are hierarchical. Individual professors are appointed within departments, which are within Colleges. A random effects model allows us to measure the variation within subject areas and between subject areas. A fixed effects model would only allow us to measure the difference within subjects. Some subject areas may hire at a higher starting salary because of market effects. This is a between subject area effect, and random effects control for this. Using this model also allows us to control for any within subject area effects.

Previous literature has used both salary and the log of salary, which is used to correct for a skewed distribution. However, as we can see below in Figure A1, the distribution of salary is close to normally distributed. Furthermore, the adjusted  $R^2$  is higher using salary.

*Figure A1 - Distribution of Salary and Log of Salary*

