

## Update on Gender Equity in MUFA Faculty Salaries Analysis

### Background:

In April 2015, the McMaster University Joint Administration/Faculty Association Committee released a statement announcing the decision to apply an adjustment of \$3,515 to the base salary of each female faculty member on the CP/M scheme as of July 1, 2015. The decision was based on a study carried out by the Office of Institutional Research and Analysis with the input of the executive members of the McMaster University Faculty Association (MUFA) that revealed a gender pay gap in salaries of McMaster faculty. The original analysis considered two datasets: the MUFA CP/M dataset of full-time and part-time faculty and the University and College Academic Staff System (UCASS) dataset of full-time faculty. The results of both analyses showed that the salary differential between male and female faculty members was statistically significant at the 5% level. Follow-up studies were provided on September 2017 and September 2018 using UCASS data as of August 31, 2016 and August 31, 2017, respectively. Both studies showed that the adjustment of \$3,515 to the base salary of each female faculty member in 2015 resolved the average annual salary disparity between gender in the original study. In this report, we provide an update to this analysis using UCASS data for full-time faculty as of October 1, 2019 to see if the salary adjustment applied in 2015 continues to equalize salary between male and female full-time faculty at McMaster University.

### Results:

The characteristics of the sample of full-time MUFA faculty as of October 1, 2019 are shown in Tables 1-4. A comparison of the median and average salary of the 930 full-time MUFA faculty by gender suggested that female faculty are underpaid relative to male colleagues (Table 1). To explore the possibility of a full-time MUFA faculty gender pay gap, a multiple linear regression model was used to determine if gender accounts for the salary difference. The dependent variable was Annual Salary, and the independent variables were Gender, Rank, Years in Rank, Years in Rank Squared, Faculty, Appointment Stream, Canada Research Chair, Faculty, and Highest Degree earned (Table 5). The Student's *t*-test was used to test the null hypothesis that gender does not influence the salary of full-time MUFA faculty once other pay-determining variables are controlled for in the model. The results of the multiple linear regression model showed that 72.8% of the total variability in annual salary was accounted for by the variables in the model and that the null hypothesis could not be rejected at the 5% significance level (Table 6, *p* value=0.49, Adjusted  $R^2 = 0.7280$ ). Thus, the results of the analysis indicated that gender does not influence the salary of full-time MUFA faculty.

The result of no relationship between gender and salary was tested further using a *F*-test of the multiple linear regression models that differed by only the presence (full model) or absence (reduced model) of the gender variable. The null hypothesis for the *F*-test was that the model without gender (reduced model) explained annual salary as well as the full model. The results showed that the reduced model without gender accounted for 72.81% of the variability in annual salary and thus was not different from the full model in explaining annual salary (Table 7, Adjusted  $R^2 = 0.7281$ ). Moreover, the *F*-test revealed that there is insufficient evidence to reject the null hypothesis at the 5% significance level (Table 8, *p* value=0.4865) and that gender does not influence salary once other pay determining characteristics are taken into account. This analysis supports the result obtained using the Student's *t*-test (above) and the finding that any gap in pay for MUFA faculty as of October 1, 2019 may not be attributed to gender. It is also in keeping with the follow-up analyses conducted using data from August 31, 2016 and August 31, 2017, which showed that the adjustment of \$3,515 to the base salary of each female faculty member on the CP/M scheme in 2015 resolved the influence of gender on gaps in pay for full-time MUFA Faculty.

Table 1: Headcount, Median Salary and Average Salary of Full-time Faculty Members by Gender

Gender	Headcount	Median Salary (\$)	Female/Male Median Salary Ratio	Average Salary (\$)	Female/Male Average Salary Ratio
Male	570	182,065	0.86	176,056	0.87
Female	360	155,826		154,042	
<b>Total</b>	<b>930</b>	<b>172,658</b>		<b>167,535</b>	

Table 2: Headcount and Average Salary of Full-time Faculty Members by Rank and Gender

Rank	Gender	Headcount	% of Rank by Gender	% of Female	Average Salary (\$)	Female/Male Salary Ratio
Full	Male	292	51.2		204,017	0.95
	Female	102	28.3	25.9	194,083	
Associate	Male	159	27.9		164,264	0.97
	Female	125	34.7	44.0	159,883	
Assistant	Male	116	20.4		122,806	0.96
	Female	130	36.1	52.8	118,375	
Lecturer	Male	3	0.5		138,489	0.69
	Female	3	0.8	50.0	94,898	
Total	Male	570	100.0		176,056	0.87
	Female	360	100.0	38.7	154,042	

Table 3: Headcount by Appointment Stream, Gender and Rank

Appointment Stream	Gender	Total	% of Female	Rank			
				Full	Associate	Assistant	Lecturer
Tenure	Male	448		280	122	46	
	Female	231	34.02%	94	95	42	
Special	Male	45		9	24	12	
	Female	31	40.79%	8	11	12	
Teaching	Male	37		1	12	23	1
	Female	54	59.34%		19	35	
CLA	Male	40		2	1	35	2
	Female	44	52.38%			41	3

Table 4: Average Years in Rank by Faculty, Gender and Rank

Faculty	Gender	Average Years in Rank	Rank			
			Full	Associate	Assistant	Lecturer
Business	Male	9.3	13.5	9.4	2.4	1.0
	Female	4.4	6.0	5.4	2.8	
Engineering	Male	7.6	9.7	8.2	3.6	10.0
	Female	4.2	8.2	4.6	1.8	7.0
Health Sciences	Male	8.5	12.0	7.0	3.6	
	Female	5.1	6.1	4.1	5.0	
Humanities	Male	9.5	13.9	7.9	4.3	
	Female	6.7	6.2	9.1	2.9	
Science	Male	11.0	12.8	9.4	2.1	
	Female	7.5	10.6	4.9	2.9	
Social Sciences	Male	9.0	11.6	9.0	4.8	
	Female	5.2	4.2	6.3	4.6	0.0
Total	Male	9.1	11.9	8.4	3.4	4.0
	Female	5.6	7.4	6.0	4.0	2.3

Table 5: Dataset Variables

Variable	Description
<b>Dependent variable (response):</b>	
Annual Salary	Annual rate of salary. Not reduced by sabbatical or other leaves. Excluded administrative stipends.
<b>Independent variable (predictor):</b>	
Gender	Male=0, Female=1
Canada Research Chair	No=0, Yes=1
Years in Rank	Years since staff member attained their current rank
Highest Degree	Highest degree earned
Faculty	Faculty of the individual staff member
Appointment Stream	Tenure, Special, Teaching, CLA
Rank	Full, Associate, Assistant, Lecturer

Table 6: Summary of Regression on Annual Salaries (Full Model)

Variable	Label	Parameter Estimate	Standard Error	t value	p-value	Variance Inflation
Intercept	INTERCEPT	174792.00	2914.63	59.97	<.0001	0.00
Gender (base=Male)	GENDER	-1188.98	1708.00	-0.70	<b>0.49</b>	1.24
Canada Research Chair	CRC	17378.00	3222.91	5.39	<.0001	1.06
Years in Rank	YAPRANK	3138.47	300.22	10.45	<.0001	9.12
Years in Rank2	YAPRANK2	-57.50	10.59	-5.43	<.0001	8.52
Highest degree (base=PhD)	DEG_PRO	-6898.12	6842.91	-1.01	0.31	1.07
	DEG_MAS	4942.40	3968.22	1.25	0.21	1.30
	DEG_BAC	-12823.00	13261.00	-0.97	0.33	1.02
Faculty (base=Social Science)	FAC_BUS	32239.00	3238.69	9.95	<.0001	1.53
	FAC_ENG	5543.31	2698.17	2.05	0.04	2.05
	FAC_HUM	-6857.40	2909.53	-2.36	0.02	1.70
	FAC_SCI	-3818.67	2644.09	-1.44	0.15	2.15
	FAC_HSCI	5150.13	2859.45	1.80	0.07	2.59
Appointment Stream (base=Tenure-stream)	APTP_SPECIAL	-7991.46	3410.23	-2.34	0.02	1.57
	APTP_CLA	-12272.00	3269.82	-3.75	0.00	1.58
	APTP_TEACH	10165.00	2957.08	3.44	0.00	1.39
Rank (base=Full professor)	RANK_ASOC	-33561.00	1922.79	-17.45	<.0001	1.41
	RANK_ASST	-66532.00	2508.15	-26.53	<.0001	2.20
	RANK_LECT	-75000.00	10517.00	-7.13	<.0001	1.27

R<sup>2</sup> = 0.7332

Adjusted R<sup>2</sup> = 0.7280

Table 7: Summary of Regression on Annual Salaries (reduced Model)

Variable	Label	Parameter Estimate	Standard Error	t value	p-value	Variance Inflation
Intercept	INTERCEPT	174206.00	2789.80	62.44	<.0001	0
Canada Research Chair	CRC	17413.00	3221.61	5.41	<.0001	1.06
Years in Rank	YAPRANK	3153.15	299.39	10.53	<.0001	9.08
Years in Rank2	YAPRANK2	-57.54	10.59	-5.43	<.0001	8.52
Highest degree (base=PhD)	DEG_PRO	-6964.84	6840.31	-1.02	0.31	1.07
	DEG_MAS	4954.84	3967.06	1.25	0.21	1.30
	DEG_BAC	-13290.00	13240.00	-1.00	0.32	1.01
Faculty (base=Social Science)	FAC_BUS	32471.00	3220.63	10.08	<.0001	1.52
	FAC_ENG	5928.59	2640.04	2.25	0.03	1.96
	FAC_HUM	-6936.32	2906.49	-2.39	0.02	1.69
	FAC_SCI	-3654.73	2632.84	-1.39	0.17	2.13
	FAC_HSCI	4957.87	2845.28	1.74	0.08	2.57
Appointment Stream (base=Tenure-stream)	APTP_SPECIAL	-7669.60	3377.79	-2.27	0.02	1.54
	APTP_CLA	-12256.00	3268.82	-3.75	0.00	1.58
	APTP_TEACH	10038.00	2950.57	3.40	0.00	1.38
Rank (base=Full professor)	RANK_ASOC	-33666.00	1916.40	-17.57	<.0001	1.40
	RANK_ASST	-66699.00	2496.05	-26.72	<.0001	2.18
	RANK_LECT	-75264.00	10507.00	-7.16	<.0001	1.27

$R^2 = 0.7331$   
Adjusted  $R^2 = 0.7281$

Table 8: F-test Results for Full Model vs. Reduced Model

Source	DF	Mean Square	F Value	Pr > F
Numerator: $(SSE_R - SSE_F) / df_1$	1	250834477	0.48	0.4865
Denominator: $SSE_F / df_2$	911	517626228		

$SSE_R$  = Sum of Squares of the Error, Reduced Model

$SSE_F$  = Sum of Squares of the Error, Full Model