Examining the Effects of Centralizing RAS structure

Introduction

At Emory University, it has been observed that decentralized research support led to a lot of inconsistency in routines and variations across different academic divisions. In response to this issue, Research Administrative Services (RAS) was created to support faculties with the application and post-award management of research grants. Transition to the central RAS led to the establishment of standard operating procedures, causing many faculty to be frustrated by the organizational change in research support. It is hypothesized that there may be two reasons why this happened: First reason is that informal social ties between faculty and previously co-located support staff were broken in the process of adopting the centralized RAS structure, leading to performance failures. Second reason is that some previously privileged groups of faculty such as tenure-track faculty and male faculty experienced lower service levels as they had to share a fixed amount of support resources with other faculty.

In order to test these hypotheses, a task force formed to improve RAS performance designed a field experiment. Engagement schedules (created to reestablish the informal ties that had been disrupted by the organizational change) were created for most but not all faculty in two treatment RAS units: Basic Sciences and the Department of Medicine. Before the intervention (Fall 2017) took place, Emory Institutional Research Services surveyed faculty who had either submitted a grant proposal or received a grant award over the 2014-2016 period about their satisfaction levels with four aspects of research support at Emory: 1) Pre-award support, 2) Post-award support, 3) Departmental support, and 4) Institutional support. Similar data were collected again in March 2018 at the end of the intervention after two grant cycles.

Understanding Variables

There is a total of 218 faculty provided complete data at both time points allowing us to evaluate the effectiveness of the intervention. First, the variable *id* is the unique identifier of each faculty in the dataset. Next, there are four variables ***preaward(yr)***, ***postaward(yr)***, ***dept(yr)***, and ***inst(yr)*** for the year 2017 and 2018, making up a total of 8 variables. The values of these variables range from 1 (below expectation) to 2 (meets expectation) to 3 (exceeds expectation). Given the nature of these measurement, these variables are considered as ordinal variables and should be recoded accordingly. The variable ***chair*** is a binary variable indicating whether faculty is also a chair of their respective department or not. The variable ***rasunit*** indicates the association to which each faculty belong. There are 9 different departments ranging from *ABOSS (1)* to *Yerkes (9)*, which is currently encoded as numeric variable. This variable should be recoded as nominal variable. The variables ***awardnum*** is a count variable indicating the number of awards received, and the variable ***awardtotal*** is a numeric variable indicating total award received in dollar amount. The variable ***award*** is a binary dummy variable indicating whether a faculty had received award or not. Similarly, the variables ***proposalnum*** and ***proposaltotal*** indicate the number of proposal submission and total proposal submission in dollar amount, respectively. Given the nature of these variables, the variable *proposalnum* can be recoded into the discrete variables while *proposaltotal* can stay as the continuous variable. The variable ***proposal*** is a binary dummy variable indicating whether a faculty submitted a proposal (1) or not (0). Similarly, ***doctortype*** is a variable indicating the type of doctoral degree each faculty had received; this variable also needs to be recoded into a categorical variable. The variable ***age*** is continuous variable that indicates age of each faculty when the field experiment was conducted. The variable ***ethnicgrp*** is a categorical variable indicating the race of each faculty. The variable ***female*** is a binary dummy variable indicating that the faculty is female (1) or male (0). Similarly, both the variable ***white*** and ***asian*** are dummy variables indicating whether they are white/Asian (1) or not (0). The variable ***yos*** (year of service) is a continuous variable indicating each faculty's year of service. The variable ***nMtg*** (number of engagement meetings) is a count variable indicating the number of engagement meetings they had had. Lastly, the variables ***dMtg*** is a binary variable that indicates whether each faculty had received treatment/engagement schedule (1) or not (0). Similarly, the variable ***tenuretrack*** is also a binary dummy variable indicating whether each faculty is on tenure-track (1) or not (0). Please note that dummy variables (categorical variable with only two levels) were changed to continuous variable when running regression because of having better interpretability of the model as shown in **(Figure 1)**.

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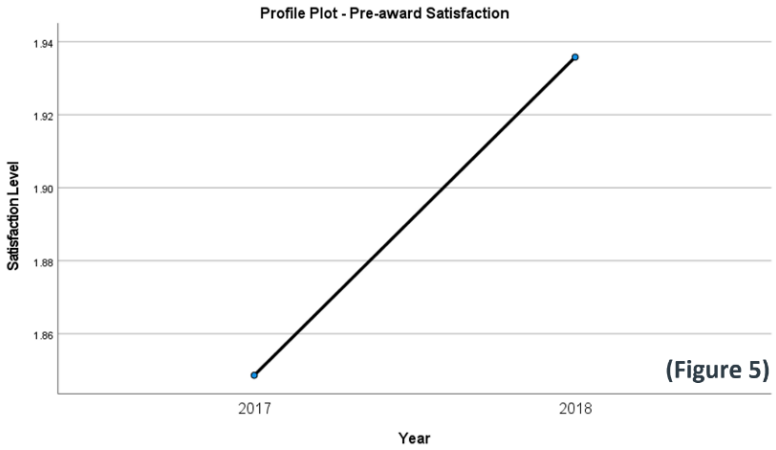
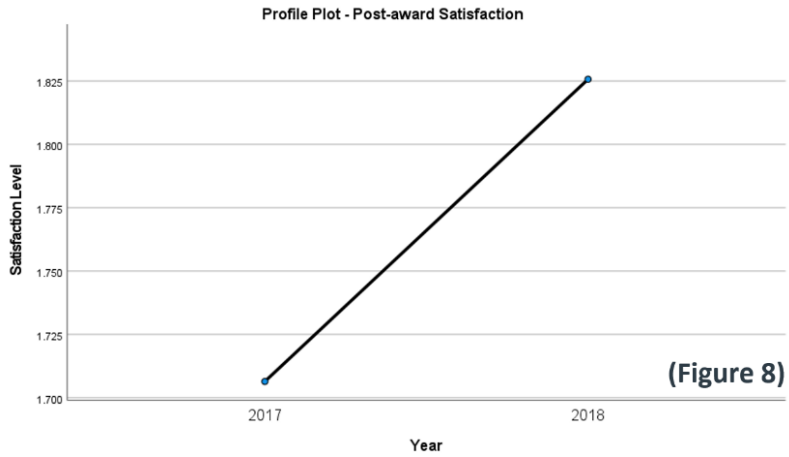
1. Do average levels of faculty satisfaction with the four dimensions of research support increase significantly from 2017 to 2018? Draw the profile plots for the overall differences across the two time periods. **(5 points)**

To answer this questions, average value of the faculty satisfaction encompassing four dimensions across two time period is compared as shown in the case processing summary **(Figure 2)**. It is noticeable that no case is excluded or censored from 218 data points, meaning number of data points did not change from 2017 to 2018. Thus, we can proceed with interpretation of each result and draw conclusion about change in each satisfaction level between 2017 and 2018.

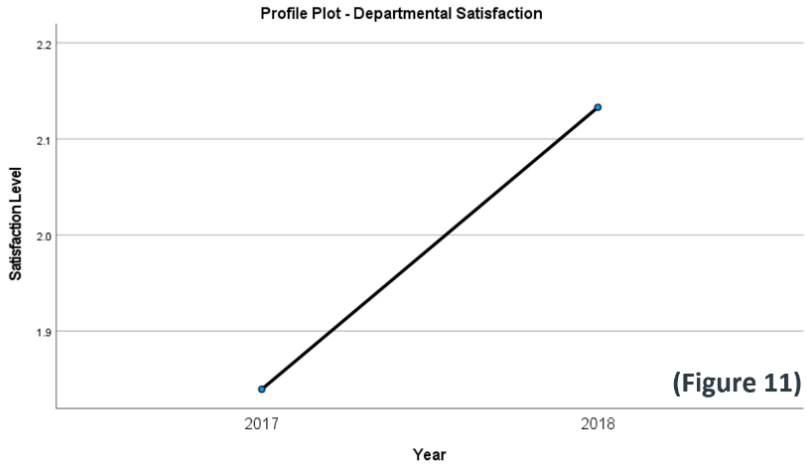
Since we are essentially interested in exploring changes in satisfaction level from the faculties over time, the paired sample t-test (also known as repeated sample t-test) can be used. With this test, two sets of data from the same individual can be obtained to conduct a simple analysis from which inferences are made to determine whether there exist any statistical differences between each faculty's satisfaction level over the two years, and thus whether there has been a significant change in the satisfaction levels between 2017 and 2018. (Predictive HR Analytics, page 348).



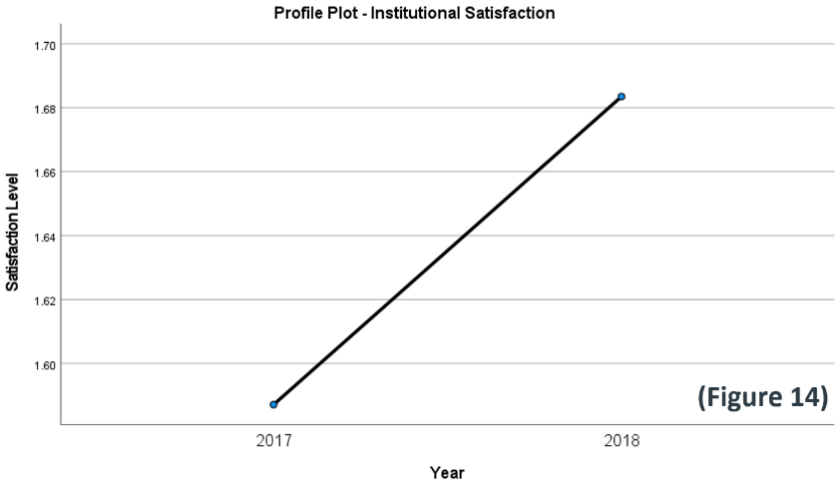
Paired-sampled t-tests are performed to compute the mean levels of satisfaction level in 2017 and 2018. Comparing average level of pre-award satisfaction from faculties between year 2017 and 2018 **(Figure 3)**, we can see that value increased from 1.85 (2017) to 1.94 (2018). However, sanity test was conducted to check whether these changes are significant or not as the textbook emphasizes (p.352). Looking at the key statistics such as t-value (-1.246) and df (217), the test is significant at the p=0.214 level **(Figure 4)**. Therefore, there is not enough statistical evidence to believe that treatment had increased pre-award satisfaction level from 2017 to 2018. The profile plot for pre-award satisfaction level is shown in **(Figure 5)**.



Similarly, comparing average level of post-award satisfaction from faculties between year 2017 and 2018 **(Figure 6)**, we can see that average level of post-award satisfaction increased from 1.71 (2017) to 1.83 (2018). Looking at the key statistics such as t-value (-1.644) and df (217), the test is significant at the p=0.102 level **(Figure 7)**. Therefore, there is not enough statistical evidence to suggest that treatment had increased post-award satisfaction level from 2017 to 2018. The profile plot for post-award satisfaction level is shown in **(Figure 8)**.



Next, average level of departmental satisfaction from faculties is computed **(Figure 9)**, we can see that average level of departmental satisfaction increased from 1.84 (2017) to 2.13 (2018). Looking at the key statistics such as t-value (-4.479) and df (217), the test is significant at the p<0.001 level **(Figure 10)**. Therefore, there is enough statistical evidence to suggest that treatment had increased departmental satisfaction level from 2017 to 2018. The profile plot for is shown in **(Figure 11)**.



Lastly, average level of institutional satisfaction from faculties is computed **(Figure 12)**, we can see that average level of institutional satisfaction increased from 1.59 (2017) to 1.68 (2018). Looking at the key statistics such as t-value (-1.449) and df (217), the test is significant at the p=0.149 level **(Figure 13)**. Therefore, there is not enough statistical evidence to suggest that treatment had increased institutional satisfaction level from 2017 to 2018. The profile plot for is shown in **(Figure 14)**.

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2. Do average levels of faculty satisfaction with the four dimensions of research support increase significantly from 2017 to 2018 (hint: these are repeated measures on the same variable) by the following groups **(5 points)**

Provide tests of within- and between-subjects effects, within-subject contrasts, estimate the marginal means by gender and tenure track status, and draw the associated profile plots.

a. Female Vs. Male
b. Tenure track Vs. Non tenure track

In the previous analysis, straightforward t-test is conducted to compare different dimensions of satisfaction levels across two time points. As the second example of the chapter 9 in the textbook (p.352) suggests, general linear model (GLM) can be used as statistical test to determine whether these observed differences in satisfaction levels occurs between two different groups.

Pre-award Satisfaction (by gender)

Estimated Marginal Means

1. Female

Measure: MEASURE_1

Female	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	1.843	.042	1.760	1.925
Female	1.987	.058	1.873	2.100

(Figure 15)

'1. Female' output **(Figure 15)** indicates the following: the average pre-award satisfaction level of male is 1.843 and 1.987 for females when combining two sets of satisfaction data together, which is also referred as a main effects of gender.

2. factor1

Measure: MEASURE_1

factor1	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	1.859	.048	1.764	1.955
2	1.970	.054	1.864	2.076

(Figure 16)

The second output, *'2. factor1'*, **(Figure 16)** indicates the average satisfaction rate at the first and second levels of the time irrespective of gender. The means indicate that satisfaction levels in general have gone up from time 1 (1.859 in 2017) to time 2 (1.970 in 2018).

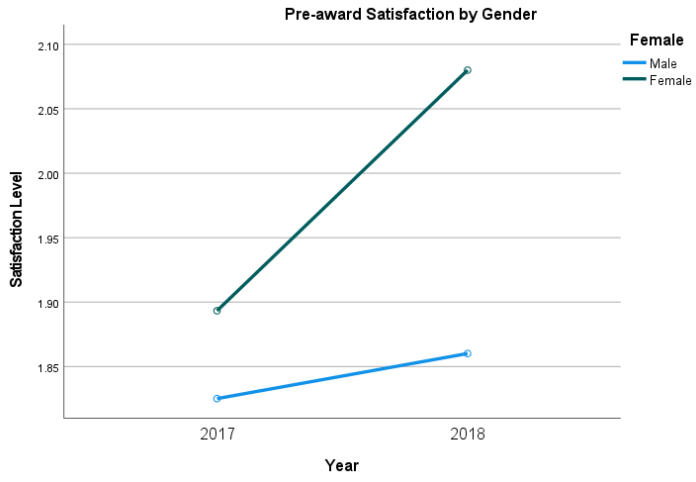
3. Female * factor1

Measure: MEASURE_1

Female	factor1	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Male	1	1.825	.057	1.713	1.937
	2	1.860	.063	1.736	1.984
Female	1	1.893	.078	1.739	2.048
	2	2.080	.087	1.908	2.252

(Figure 17)

The third output, *'3. Female*factor1'* **(Figure 17)**, separates the male and female and presents their average pre-award satisfaction levels at the two factor levels (year 2017 and 2018). As shown in the output, the average satisfaction levels of male increases slightly from 1.825 at time 1 (2017) to 1.860 at time 2 (2018), and for females the satisfaction level significantly increases from 1.893 at time 1 (2017) to 2.080 at time 2 (2018). It is noticeable that the extent to which the satisfaction increases is bigger in female than male.



(Figure 18)

These means are presented in the profile plot **(Figure 18)**. The plot visually depicts what had happened with faculties' pre-award satisfaction levels across time and between genders. As noted in the textbook (p.357), it is important that we check various aspects of these analysis results (gender differences in satisfaction levels in general, transient changes in satisfaction levels in general across time, and transient changes in satisfaction levels across time when comparing between genders).

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Sphericity Assumed	1.208	1	1.208	2.267	.134
	Greenhouse-Geisser	1.208	1.000	1.208	2.267	.134
	Huynh-Feldt	1.208	1.000	1.208	2.267	.134
	Lower-bound	1.208	1.000	1.208	2.267	.134
factor1 * female	Sphericity Assumed	.566	1	.566	1.062	.304
	Greenhouse-Geisser	.566	1.000	.566	1.062	.304
	Huynh-Feldt	.566	1.000	.566	1.062	.304
	Lower-bound	.566	1.000	.566	1.062	.304
Error(factor1)	Sphericity Assumed	115.106	216	.533		
	Greenhouse-Geisser	115.106	216.000	.533		
	Huynh-Feldt	115.106	216.000	.533		
	Lower-bound	115.106	216.000	.533		

(Figure 19)

Since there are only two time periods, *'Tests of Within-Subjects Effects'* **(Figure 19)** and the *'Tests of Within-Subjects Contrasts'* **(Figure 20)** will give the same result.

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	factor1	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear	1.208	1	1.208	2.267	.134
factor1 * female	Linear	.566	1	.566	1.062	.304
Error(factor1)	Linear	115.106	216	.533		

(Figure 20)

In *'Tests of Within-Subjects Contrasts'* table **(Figure 20)**, *'factor1 Linear'* row reports an F of 2.267 with a significance of p=0.134, which indicates that there is not enough evidence to suggest that the general change in pre-award satisfaction level over time is significant. Additionally, the *'factor1*female'* row has an F of 1.062 and this is significant at the p=0.304 level. Even though profile plot indicates that female faculties show a significant increase in pre-award satisfaction level than male faculties between 2017 and 2018 at a significantly greater level of change than the increase in satisfaction levels that male faculties showed between 2017 and 2018, there is no significant interaction between gender and change in satisfaction levels across 2017 and 2018.

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1442.830	1	1442.830	2901.972	<.001
female	2.041	1	2.041	4.104	.044
Error	107.393	216	.497		

(Figure 21)

The *'Test of Between-Subjects Effects'* results **(Figure 21)** show that the *'female'* row has an F value of 4.104, which is significant to the level of p=0.044. This indicates that in general (when combining year 2017 and 2018 results), female faculties report significantly more pre-award satisfaction levels than male faculties.

Post-award Satisfaction (by gender)

Estimated Marginal Means

1. Female

Measure: MEASURE_1

Female	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Male	1.745	.040	1.666	1.824
Female	1.807	.055	1.697	1.916

(Figure 22)

'1. Female' output **(Figure 22)** indicates the main effects of gender: the average post-award satisfaction level of male is 1.745 and 1.807 for females when combining two sets of satisfaction data together.

2. factor1

Measure: MEASURE_1

factor1	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	1.691	.049	1.595	1.787
2	1.861	.053	1.756	1.966

(Figure 23)

The second output, *'2. factor1'*, **(Figure 23)** indicates the average satisfaction rate at the first and second levels of the time irrespective of gender. The means indicate that satisfaction levels in general have gone up from time 1 (1.691 in 2017) to time 2 (1.861 in 2018).

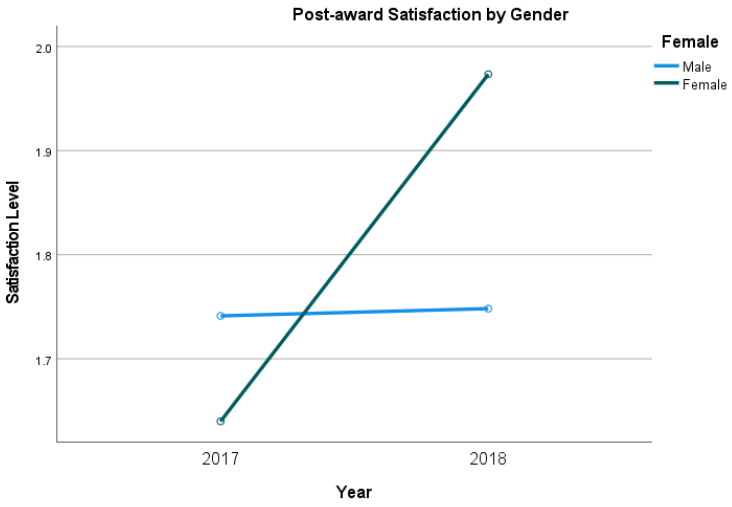
3. Female * factor1

Measure: MEASURE_1

Female	factor1	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Male	1	1.741	.057	1.629	1.854
	2	1.748	.063	1.625	1.872
Female	1	1.640	.079	1.485	1.795
	2	1.973	.086	1.803	2.144

(Figure 24)

The third output, *'3. Female*factor1'* **(Figure 24)**, separates the male and female and presents their average post-award satisfaction levels at the two factor levels (year 2017 and 2018). As shown in the output, the average satisfaction levels of male increases slightly from 1.741 at time 1 (2017) to 1.748 at time 2 (2018), and for females the satisfaction level significantly increases from 1.640 at time 1 (2017) to 1.973 at time 2 (2018). It is noticeable that the extent to which the satisfaction increases is bigger in female than male.



(Figure 25)

These means are presented in the profile plot **(Figure 25)**. The plot visually depicts what had happened with faculties' post-award satisfaction levels across time and between genders.

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
factor1	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + female
Within Subjects Design: factor1

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

(Figure 26)

When looking at the particular combination of time data, the Mauchly's test of Sphericity **(Figure 26)** explores whether the variance patterns of the differences between the sets of time-point data look different (p.365). Since we are only concerned with using two time points in the data, sphericity assumption is not important in this case.

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	factor1	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear	2.849	1	2.849	5.051	.026
factor1 * female	Linear	2.620	1	2.620	4.645	.032
Error(factor1)	Linear	121.830	216	.564		

(Figure 28)

In both *'Test of Within-Subjects Effects'* table **(Figure 27)** and *'Tests of Within-Subjects Contrasts'* table **(Figure 28)**, *'factor1 Linear'* row reports an F of 5.051 with a significance of p=0.026, which indicates that there is enough evidence to suggest that the general change in post-award satisfaction level over time is significant. Additionally, the *'factor1*female'* row has an F of 4.465, and this is significant at the p=0.032 level. As profile plot indicates that female faculties show a significant increase in post-award satisfaction level than male faculties between 2017 and 2018 at a significantly greater level of change, there is significant interaction between gender and change in satisfaction levels across 2017 and 2018.

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1241.010	1	1241.010	2687.018	<.001
female	.377	1	.377	.817	.367
Error	99.760	216	.462		

(Figure 29)

The *'Test of Between-Subjects Effects'* results **(Figure 29)** show that the *'female'* row has an F value of 0.817, which is significant to the level of p=0.367. This indicates that there is not enough evidence to say that female faculties report significantly more pre-award satisfaction levels than male faculties when combining time 1 and time 2 results.

Departmental Satisfaction (by gender)

Estimated Marginal Means

1. Female

Measure: MEASURE_1

Female	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	1.927	.037	1.853	2.000
Female	2.100	.052	1.998	2.202

(Figure 30)

'1. Female' output **(Figure 30)** indicates the main effects of gender: the average departmental satisfaction level of male is 1.927 and 2.100 for females when combining two sets of satisfaction data together.

2. factor1

Measure: MEASURE_1

factor1	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	1.843	.046	1.752	1.933
2	2.184	.048	2.090	2.277

(Figure 31)

The second output, *'2. factor1'*, **(Figure 31)** indicates the average satisfaction rate at the first and second levels of the time irrespective of gender. The means indicate that satisfaction levels in general have gone up from time 1 (1.843 in 2017) to time 2 (2.184 in 2018).

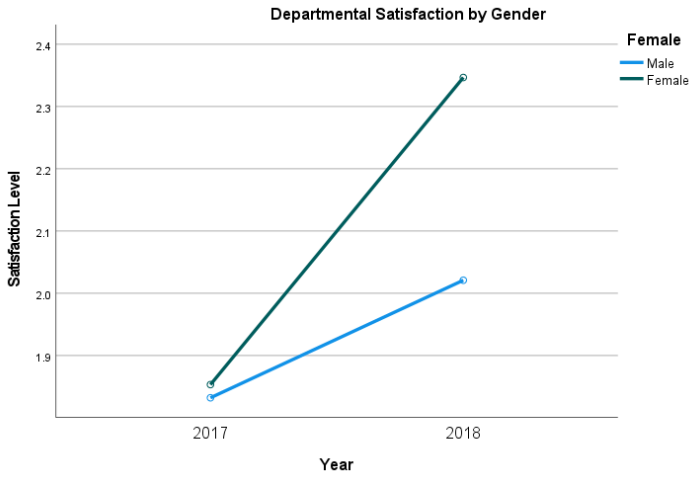
3. Female * factor1

Measure: MEASURE_1

Female	factor1	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Male	1	1.832	.054	1.726	1.938
	2	2.021	.056	1.911	2.131
Female	1	1.853	.074	1.707	2.000
	2	2.347	.077	2.195	2.498

(Figure 32)

The third output, *'3. Female*factor1'* **(Figure 32)**, separates the male and female and presents their average departmental satisfaction levels at the two factor levels (year 2017 and 2018). As shown in the output, the average satisfaction levels of male increases slightly from 1.832 at time 1 (2017) to 2.021 at time 2 (2018), and for females the satisfaction level significantly increases from 1.853 at time 1 (2017) to 2.347 at time 2 (2018). It is noticeable that the extent to which the satisfaction increases is bigger in female than male.



(Figure 33)

These means are presented in the profile plot **(Figure 33)**. The plot visually depicts what had happened with faculties' departmental satisfaction levels across time and between genders.

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	factor1	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear	11.446	1	11.446	24.892	<.001
factor1 * female	Linear	2.281	1	2.281	4.961	.027
Error(factor1)	Linear	99.324	216	.460		

(Figure 35)

In both *'Test of Within-Subjects Effects'* table **(Figure 34)** and *'Tests of Within-Subjects Contrasts'* table **(Figure 35)**, *'factor1 Linear'* row reports an F of 24.892 with a significance of p<0.001, which indicates that there is more than enough evidence to suggest that the general change in departmental satisfaction level over time is significant. Additionally, the *'factor1*female'* row has an F of 4.961 and this is significant at the p=0.027 level. As profile plot indicates that female faculties show a significant increase in departmental satisfaction level than male faculties between 2017 and 2018 at a significantly greater level of change, there is significant interaction between gender and change in satisfaction levels across 2017 and 2018.

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1595.299	1	1595.299	4008.753	<.001
female	2.959	1	2.959	7.437	.007
Error	85.958	216	.398		

(Figure 36)

The *'Test of Between-Subjects Effects'* results **(Figure 36)** show that the *'female'* row has an F value of 7.473, which is significant to

the level of p=0.007. This indicates when combining time 1 and time 2 results, there is enough evidence to say that female faculties report significantly more departmental satisfaction levels than male faculties.

Institutional Satisfaction (by gender)

Estimated Marginal Means

1. Female

Measure: MEASURE_1

Female	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	1.605	.037	1.533	1.677
Female	1.693	.051	1.594	1.793

(Figure 37)

'1. Female' output **(Figure 37)** indicates the main effects of gender: the average institutional satisfaction level of male is 1.605 and 1.693 for females when combining two sets of satisfaction data together.

2. factor1

Measure: MEASURE_1

factor1	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	1.565	.043	1.481	1.649
2	1.733	.049	1.636	1.831

(Figure 38)

The second output, *'2. factor1'*, **(Figure 38)** indicates the average institutional satisfaction rate at the first and second levels of the time irrespective of gender. The means indicate that satisfaction levels in general have gone up from time 1 (1.565 in 2017) to time 2 (1.733 in 2018).

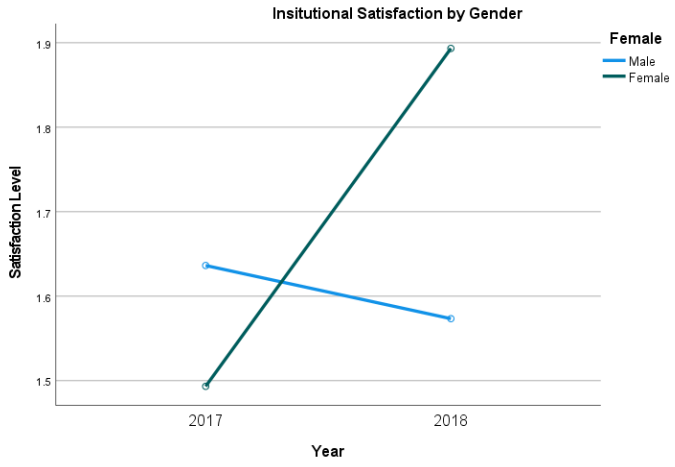
3. Female * factor1

Measure: MEASURE_1

Female	factor1	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Male	1	1.636	.050	1.537	1.735
	2	1.573	.058	1.459	1.688
Female	1	1.493	.069	1.357	1.630
	2	1.893	.080	1.735	2.051

(Figure 39)

The third output, *'3. Female*factor1'* **(Figure 32)**, separates the male and female and presents their average institutional satisfaction levels at the two factor levels (year 2017 and 2018). As shown in the output, the average institutional satisfaction levels of male had gone down from 1.636 at time 1 (2017) to 1.573 at time 2 (2018), and for females the satisfaction level significantly increases from 1.493 at time 1 (2017) to 1.893 at time 2 (2018). Thus, female satisfaction levels increases while male satisfaction levels decrease when looking at institutional satisfaction by gender across two time period.



(Figure 40)

These means are presented in the profile plot **(Figure 40)**. The plot visually depicts what had happened with faculties' institutional satisfaction levels across time and between genders.

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	factor1	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear	2.795	1	2.795	6.084	.014
factor1 * female	Linear	5.272	1	5.272	11.477	<.001
Error(factor1)	Linear	99.217	216	.459		

(Figure 42)

In both *'Test of Within-Subjects Effects'* table **(Figure 41)** and *'Tests of Within-Subjects Contrasts'* table **(Figure 42)**, *'factor1 Linear'* row reports an F of 6.084 with a significance of p=0.014, which indicates that there is enough evidence to suggest that the general change in institutional satisfaction level over time is significant. Additionally, the *'factor1*female'* row has an F of 11.477 and this is significant at the p<0.001 level. As profile plot indicates that female faculties show a significant increase in institutional satisfaction level while male faculties show a decrease between 2017 and 2018, there is significant interaction between gender and change in institutional satisfaction levels across 2017 and 2018.

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1070.366	1	1070.366	2794.065	<.001
female	.770	1	.770	2.009	.158
Error	82.746	216	.383		

(Figure 43)

The *'Test of Between-Subjects Effects'* results **(Figure 43)** show that the *'female'* row has an F value of 2.009, which is significant to the level of p=0.158. This indicates that there is NOT enough evidence to say that female faculties report significantly more departmental award satisfaction levels than male faculties when combining time 1 and time 2 results.

Pre-award Satisfaction (by Tenure)

Estimated Marginal Means

1. factor1

Measure: MEASURE_1

factor1	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1	1.843	.046	1.752	1.933
2	1.942	.051	1.840	2.043

(Figure 44)

'1. factor1' output **(Figure 44)** indicates the main effects of tenure: the average pre-award satisfaction level of non-tenure faculties is 1.843 and 1.942 for tenure faculties when combining two sets of satisfaction data together.

2. Tenure track

Measure: MEASURE_1

Tenure track	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
0	1.891	.050	1.792	1.990
1	1.893	.047	1.801	1.985

(Figure 45)

The second output, *'2. Tenure track'*, **(Figure 45)** indicates the average pre-award satisfaction rate at the first and second levels of the time irrespective of tenure track status. The means indicate that satisfaction levels in general had gone slightly up from time 1 (1.891 in 2017) to time 2 (1.893 in 2018).

3. Tenure track * factor1

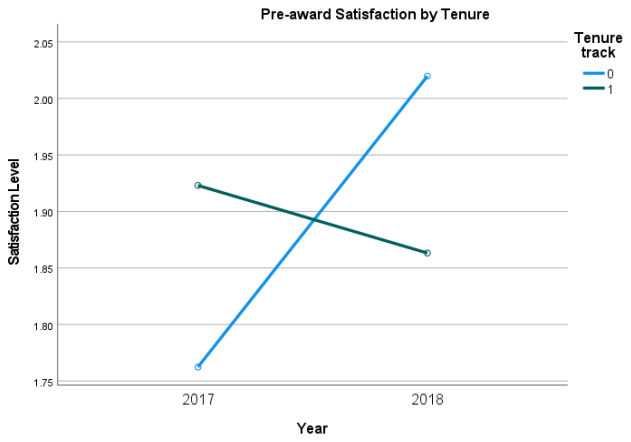
Measure: MEASURE_1

Tenure track	factor1	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
0	1	1.762	.067	1.630	1.895
	2	2.020	.075	1.871	2.168
1	1	1.923	.062	1.800	2.046
	2	1.863	.070	1.725	2.001

(Figure 46)

The third output, *'3. Female*factor1'* **(Figure 46)**, separates based on tenure status and presents their average pre-award

satisfaction levels at the two factor levels (year 2017 and 2018). As shown in the output, the average satisfaction levels of non-tenure status had gone up from 1.726 at time 1 (2017) to 2.020 at time 2 (2018), and for tenure status the satisfaction level significantly decreases from 1.923 at time 1 (2017) to 1.863 at time 2 (2018). Thus, non-tenure faculties' satisfaction levels increases while tenure faculties' satisfaction levels decrease when looking at pre-award satisfaction by tenure status across two time period.



(Figure 47)

These means are presented in the profile plot **(Figure 47)**. The plot visually depicts what had happened with faculties' pre-award satisfaction levels across time and between tenure status.

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	factor1	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear	1.058	1	1.058	2.024	.156
factor1 * tenuretrack	Linear	2.728	1	2.728	5.217	.023
Error(factor1)	Linear	112.944	216	.523		

(Figure 49)

In both *'Test of Within-Subjects Effects'* table **(Figure 48)** and *'Tests of Within-Subjects Contrasts'* table **(Figure 49)**, *'factor1 Linear'* row reports an F of 2.024 with a significance of p=0.156, which indicates that there is NOT enough evidence to suggest that the general change in pre-award satisfaction level over time is significant. Additionally, the *'factor1*tenuretrack'* row has an F of 5.217 and this is significant at the p=0.023 level. As profile plot indicates, non-tenure faculties show a significant increase in pre-award satisfaction level than tenure faculties between 2017 and 2018 at a significantly greater level of change and that there is significant interaction between tenure status and change in pre-award satisfaction levels across 2017 and 2018.

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1552.533	1	1552.533	3064.404	<.001
tenuretrack	.000	1	.000	.001	.976
Error	109.433	216	.507		

(Figure 50)

The *'Test of Between-Subjects Effects'* results **(Figure 50)** show that the *'tenuretrack'* row has an F value of 0.001, which is significant to the level of p=0.976. This indicates when combining time 1 and time 2 results, there is NOT enough evidence to say that non-tenure faculties report significantly more pre-award satisfaction levels than tenure faculties.

Post-award Satisfaction (by Tenure)

Estimated Marginal Means

1. factor1

Measure: MEASURE_1

factor1	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	1.703	.046	1.612	1.795
2	1.834	.051	1.734	1.934

(Figure 51)

'1. factor1' output **(Figure 51)** indicates the main effects of tenure: the average post-award satisfaction level of non-tenured faculties is 1.703 and 1.834 for tenured faculties when combining two sets of satisfaction data together.

2. Tenure track

Measure: MEASURE_1

Tenure track	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
0	1.807	.048	1.713	1.901
1	1.731	.044	1.643	1.818

(Figure 52)

The second output, *'2. Tenure track'*, **(Figure 52)** indicates the average post-award satisfaction rate at the first and second levels of the time irrespective of tenure track status. The mean values here indicate that satisfaction levels in general have gone down from time 1 (1.807 in 2017) to time 2 (1.713 in 2018).

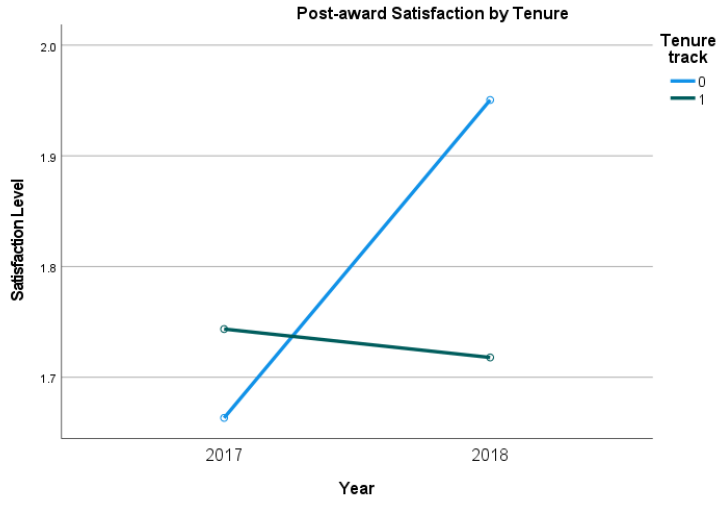
3. Tenure track * factor1

Measure: MEASURE_1

Tenure track	factor1	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
0	1	1.663	.068	1.529	1.797
	2	1.950	.074	1.804	2.097
1	1	1.744	.063	1.619	1.868
	2	1.718	.069	1.582	1.854

(Figure 53)

The third output, *'3. Female*factor1'* **(Figure 53)**, separates based on tenure status and presents their average post-award satisfaction levels at the two factor levels (year 2017 and 2018). As shown in the output, the average post-award satisfaction levels of non-tenure status had gone up from 1.663 at time 1 (2017) to 1.950 at time 2 (2018), and for tenure status the satisfaction level slightly had gone down from 1.744 at time 1 (2017) to 1.718 at time 2 (2018). Thus, non-tenure faculties' satisfaction levels increases while tenure faculties' satisfaction levels decrease when looking at post-award satisfaction by tenure status across two time period.



(Figure 54)

These means are presented in the profile plot **(Figure 54)**. The plot visually depicts what had happened with faculties' post-award satisfaction levels across time and between tenure status.

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	factor1	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear	1.853	1	1.853	3.287	.071
factor1 * tenuretrack	Linear	2.651	1	2.651	4.702	.031
Error(factor1)	Linear	121.798	216	.564		

(Figure 56)

In both *'Test of Within-Subjects Effects'* table **(Figure 55)** and *'Tests of Within-Subjects Contrasts'* table **(Figure 56)**, *'factor1 Linear'* row reports an F of 3.287 with a significance of p=0.071, which indicates that there is not enough evidence to suggest that the general change in post-award satisfaction level over time is significant. Additionally, the *'factor1*tenuretrack'* row has an F of 4.702 and this is significant at the p=0.031 level. As profile plot indicates that non-tenure faculties show a significant increase in post-award satisfaction level while tenure faculties show a slight decrease between 2017 and 2018, there is significant interaction between tenure status and change in pre-award satisfaction levels across 2017 and 2018.

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1356.822	1	1356.822	2945.203	<.001
tenuretrack	.629	1	.629	1.365	.244
Error	99.509	216	.461		

(Figure 57)

The *'Test of Between-Subjects Effects'* results **(Figure 57)** show that the *'tenuretrack'* row has an F value of 1.365, which is significant to the level of p=0.224. This indicates when combining time 1 and time 2 results, there is NOT enough evidence to say that non-tenure faculties report significantly more post-award satisfaction levels than tenure faculties.

Departmental Satisfaction (by Tenure)

Estimated Marginal Means

1. factor1

Measure: MEASURE_1

factor1	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	1.834	.043	1.749	1.920
2	2.142	.046	2.052	2.232

(Figure 58)

'1. factor1' output **(Figure 58)** indicates the main effects of tenure: the average departmental satisfaction level of non-tenured faculties is 1.834 and 2.142 for tenured faculties when combining two sets of satisfaction data together.

2. Tenure track

Measure: MEASURE_1

Tenure track	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
0	2.015	.045	1.926	2.104
1	1.962	.042	1.879	2.044

(Figure 59)

The second output, *'2. Tenure track'*, **(Figure 59)** indicates the average departmental satisfaction rate at the first and second levels of the time irrespective of tenure track status. The means indicate that satisfaction levels in general had gone slightly down from time 1 (2.105 in 2017) to time 2 (1.962 in 2018).

3. Tenure track * factor1

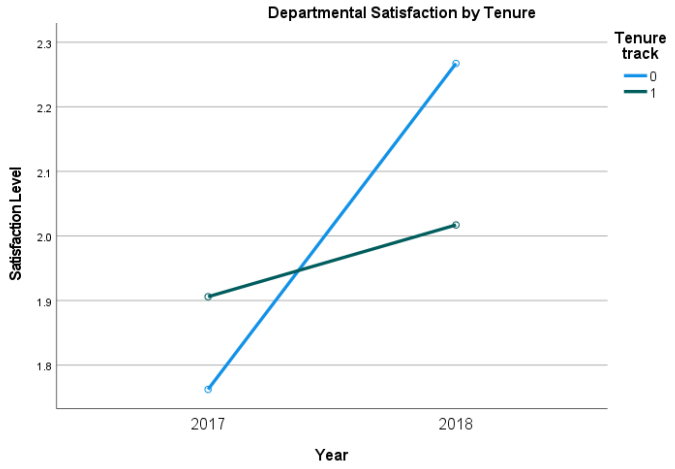
Measure: MEASURE_1

Tenure track	factor1	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
0	1	1.762	.064	1.637	1.888
	2	2.267	.067	2.135	2.399
1	1	1.906	.059	1.790	2.022
	2	2.017	.062	1.895	2.140

(Figure 60)

The third output, *'3. Female*factor1'* **(Figure 60)**, separates based on tenure status and presents their average departmental satisfaction levels at the two factor levels (year 2017 and 2018). As shown in the output, the average departmental satisfaction

levels of non-tenure status had significantly gone up from 1.762 at time 1 (2017) to 2.267 at time 2 (2018), and for tenure status the satisfaction level slightly had slightly gone up from 1.906 at time 1 (2017) to 2.017 at time 2 (2018). Thus, the extent to which satisfaction levels increased from 2017 to 2018 is bigger for non-tenure faculties than tenure faculties.



(Figure 61)

These means are presented in the profile plot **(Figure 61)**. The plot visually depicts what had happened with faculties' departmental satisfaction levels across time and between tenure status.

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	factor1	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear	10.287	1	10.287	22.812	<.001
factor1 * tenuretrack	Linear	4.204	1	4.204	9.323	.003
Error(factor1)	Linear	97.402	216	.451		

(Figure 63)

In both *'Test of Within-Subjects Effects'* table **(Figure 62)** and *'Tests of Within-Subjects Contrasts'* table **(Figure 63)**, *'factor1 Linear'* row reports an F of 22.812 with a significance of p<0.001, which indicates that there is more than enough evidence to suggest that the general change in departmental satisfaction level over time is significant. Additionally, the *'factor1*tenuretrack'* row has an F of 9.323 and this is significant at the p=0.003 level. As profile plot indicates that non-tenure faculties show a significant increase in departmental satisfaction level than tenure faculties between 2017 and 2018 at a significantly greater level of change, there is significant interaction between tenure status and change in departmental satisfaction levels across 2017 and 2018.

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1714.189	1	1714.189	4178.623	<.001
tenuretrack	.308	1	.308	.751	.387
Error	88.609	216	.410		

(Figure 64)

The *'Test of Between-Subjects Effects'* results **(Figure 64)** show that the *'tenuretrack'* row has an F value of 0.751, which is significant to the level of p=0.387. This indicates when combining time 1 and time 2 results, there is NOT enough evidence to say that non-tenure faculties report significantly more departmental satisfaction levels than tenure faculties.

Institutional Satisfaction (by Tenure)

Estimated Marginal Means

1. factor1

Measure: MEASURE_1

factor1	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1	1.582	.041	1.501	1.662
2	1.696	.047	1.603	1.788

(Figure 65)

'1. factor1' output **(Figure 65)** indicates the main effects of tenure: the average institutional satisfaction level of non-tenure faculty is 1.582 and 1.696 for tenured faculty when combining two sets of satisfaction data together.

2. Tenure track

Measure: MEASURE_1

Tenure track	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
0	1.683	.044	1.597	1.769
1	1.594	.040	1.514	1.674

(Figure 66)

The second output, *'2. Tenure track'*, **(Figure 66)** indicates the average pre-award satisfaction rate at the first and second levels of the time irrespective of tenure track status. The means indicate that satisfaction levels in general had gone slightly down from time 1 (1.683 in 2017) to time 2 (1.594 in 2018).

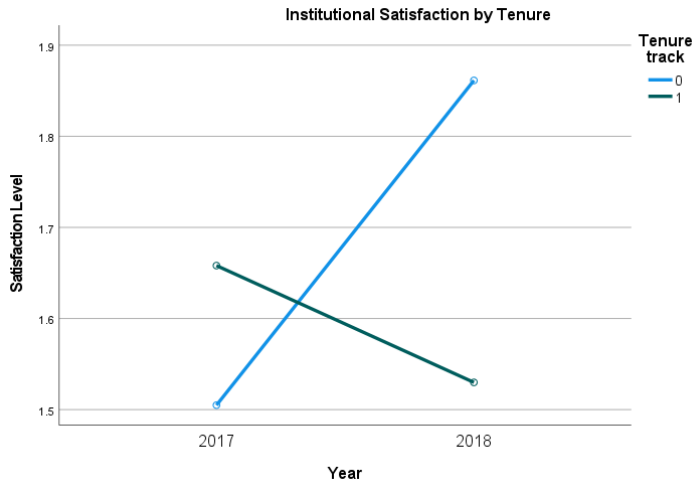
3. Tenure track * factor1

Measure: MEASURE_1

Tenure track	factor1	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
0	1	1.505	.060	1.387	1.622
	2	1.861	.069	1.726	1.997
1	1	1.658	.055	1.549	1.767
	2	1.530	.064	1.404	1.656

(Figure 67)

The third output, *'3. Female*factor1'* **(Figure 67)**, separates based on tenure status and presents their average institutional satisfaction levels at the two factor levels (year 2017 and 2018). As shown in the output, the average institutional satisfaction levels of non-tenure status had gone up from 1.505 at time 1 (2017) to 1.861 at time 2 (2018), and for tenure status the satisfaction level slightly had gone down from 1.658 at time 1 (2017) to 1.530 at time 2 (2018). Thus, non-tenure faculties' satisfaction levels increases while tenure faculties' satisfaction levels decrease in terms of intuitional satisfaction across two time period.



(Figure 68)

These means are presented in the profile plot **(Figure 68)**. The plot visually depicts what had happened with faculties' institutional satisfaction levels across time and between tenure status.

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	factor1	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	Linear	1.412	1	1.412	3.108	.079
factor1 * tenuretrack	Linear	6.366	1	6.366	14.013	<.001
Error(factor1)	Linear	98.123	216	.454		

(Figure 70)

In both *'Test of Within-Subjects Effects'* table **(Figure 69)** and *'Tests of Within-Subjects Contrasts'* table **(Figure 70)**, *'factor1 Linear'* row reports an F of 3.108 with a significance of p=0.079, which indicates that there is not enough evidence to suggest that the general change in institutional satisfaction level over time is significant. Additionally, the *'factor1*tenuretrack'* row has an F of 14.013 and this is significant at the p<0.001 level. As profile plot indicates that non-tenure faculties show a significant increase in institutional satisfaction level while tenure faculties show a decrease between 2017 and 2018, there is significant interaction between tenure status and change in institutional satisfaction levels across 2017 and 2018.

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1164.348	1	1164.348	3042.780	<.001
tenuretrack	.862	1	.862	2.252	.135
Error	82.654	216	.383		

(Figure 71)

The *'Test of Between-Subjects Effects'* results **(Figure 71)** show that the *'tenuretrack'* row has an F value of 2.252, which is significant to the level of p=0.135. This indicates when combining time 1 and time 2 results, there is NOT enough evidence to say that non-tenure faculties report significantly more institutional satisfaction levels than tenure faculties.

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3. Use a regression model to evaluate whether the treatment (dMtg=1) led to an increase in faculty satisfaction in the 4 aspects of research support from 2017 to 2018. Consider the nature of the outcome variable, faculty satisfaction, before you choose a statistical model. Use the control variables, *female, white, asian, yos, chair, and tenuretrack* in all of your models. **(10 points)**

Conditional panel regression models are used to access change in metrics between two groups (one that has experienced treatment versus one that has not) while controlling for other factors (Predictive HR Analytics p.383). Hence, we use multiple regression analysis to predict our Time 2 (2018) satisfaction rate whilst controlling for our baseline Time 1 (2017) satisfaction rate, predicting *'change'* in satisfaction rate.

When we have two satisfaction levels data per faculty at two different time points (2017 satisfaction levels versus 2018 satisfaction levels), we can set the latter satisfaction level as a dependent variable and insert the earlier satisfaction level as an independent variable. Assuming that individual differences are an important factor accounting for satisfaction levels (if someone has a high levels of satisfaction at time 1, then they are also likely to have high satisfaction levels at time 2), faculties' satisfaction level at time 1 (2017) is likely to predict the time 2 (2018) satisfaction levels. Most importantly, we would need to use ordinal logistic regression to proceed with these analyses given that dependent variable is ordinal variable in nature.

a. What is the main effect of treatment?

Pre-award (main effect)

'Categorical Variable Information' and *'Continuous Variable Information'* for pre-award satisfaction are shown in **(Figure 72)** and **(Figure 73)**, respectively.

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Preaward satisfaction - 2018=1]	-.775	.6176	-1.985	.436	1.573	1	.210	.461
	[Preaward satisfaction - 2018=2]	1.194	.6214	-.024	2.412	3.694	1	.055	3.301
[Preaward satisfaction - 2017=1]		.224	.3774	-.515	.964	.353	1	.552	1.252
[Preaward satisfaction - 2017=2]		-.079	.3478	-.761	.602	.052	1	.820	.924
[Preaward satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
Female		.419	.2796	-.129	.967	2.245	1	.134	1.520
White		-.046	.4756	-.978	.886	.009	1	.922	.955
Asian		.332	.5930	-.830	1.495	.314	1	.575	1.394
Years of service		-.012	.0148	-.041	.017	.634	1	.426	.988
Chair		-.057	.6099	-1.252	1.138	.009	1	.926	.945
Tenure track		-.215	.2763	-.757	.326	.606	1	.436	.806
Engagement (treatment)		1.216	.3236	.582	1.850	14.122	1	<.001	3.374
(Scale)		1[b]							

Dependent Variable: Preaward satisfaction - 2018
Model: (Threshold), Preaward satisfaction - 2017, Female, White, Asian, Years of service, Chair, Tenure track, Engagement (treatment)

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 74)

As seen in the *'Parameter Estimates'* table **(Figure 74)**, engagement (treatment) was a significant predictor ($p<0.001$) of pre-award satisfaction as main effect. If a faculty was treated (engaged), it will increase the odds of having higher pre-award satisfaction levels by a multiplicative factor of 3.374 while the other variables in the model are held constant.

Post-award (main effect)

'Categorical Variable Information' and *'Continuous Variable Information'* for post-award satisfaction are shown in **(Figure 75)** and **(Figure 76)**, respectively.

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Postaward satisfactoin - 2018=1]	-.283	.6594	-1.575	1.010	.184	1	.668	.754
	[Postaward satisfactoin - 2018=2]	1.842	.6757	.518	3.167	7.431	1	.006	6.310
[Postaward satisfactoin - 2017=1]		.681	.4338	-.170	1.531	2.460	1	.117	1.975
[Postaward satisfactoin - 2017=2]		.070	.4214	-.757	.896	.027	1	.869	1.072
[Postaward satisfactoin - 2017=3]		0[a]	.	.	.	.	.	.	1
Female		.396	.2818	-.156	.948	1.975	1	.160	1.486
White		-.284	.4880	-1.241	.672	.339	1	.560	.753
Asian		.795	.6052	-.391	1.982	1.727	1	.189	2.215
Years of service		-.006	.0153	-.036	.024	.138	1	.710	.994
Chair		-.656	.6162	-1.863	.552	1.132	1	.287	.519
Tenure track		-.433	.2843	-.990	.124	2.323	1	.128	.648
Engagement (treatment)		1.686	.3365	1.026	2.345	25.090	1	<.001	5.396
(Scale)		1[b]							

Dependent Variable: Postaward satisfactoin - 2018
Model: (Threshold), Postaward satisfactoin - 2017, Female, White, Asian, Years of service, Chair, Tenure track, Engagement (treatment)

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 77)

Based on *'Parameter Estimates'* table **(Figure 77)**, engagement (treatment) was a significant predictor ($p<0.001$) of post-award satisfaction as main effect. If a faculty was treated (engaged), it will increase the odds of having higher post-award satisfaction levels by a multiplicative factor of 5.396 while the other variables in the model are held constant.

Departmental (main effect)

'Categorical Variable Information' and *'Continuous Variable Information'* for departmental satisfaction are shown in **(Figure 78)** and **(Figure 79)**, respectively.

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Departmental satisfaction - 2018=1]	-1.433	.6889	-2.783	-.083	4.326	1	.038	.239
	[Departmental satisfaction - 2018=2]	1.334	.6866	-.012	2.680	3.776	1	.052	3.797
[Departmental satisfaction - 2017=1]		.386	.4490	-.494	1.266	.739	1	.390	1.471
[Departmental satisfaction - 2017=2]		.066	.4120	-.741	.874	.026	1	.872	1.069
[Departmental satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
Female		.873	.2934	.298	1.448	8.857	1	.003	2.394
White		-.611	.4976	-1.587	.364	1.509	1	.219	.543
Asian		.000	.6145	-1.205	1.204	.000	1	1.000	1.000
Years of service		.016	.0157	-.015	.047	1.058	1	.304	1.016
Chair		-.350	.6390	-1.602	.903	.299	1	.584	.705
Tenure track		-.614	.2951	-1.192	-.036	4.331	1	.037	.541
Engagement (treatment)		1.815	.3664	1.097	2.533	24.539	1	<.001	6.142
(Scale)		1[b]							

Dependent Variable: Departmental satisfaction - 2018
Model: (Threshold), Departmental satisfaction - 2017, Female, White, Asian, Years of service, Chair, Tenure track, Engagement (treatment)

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 80)

Based on *'Parameter Estimates'* table **(Figure 80)**, engagement (treatment) was a significant predictor (p<0.001) of departmental satisfaction as main effect. If a faculty was treated (engaged), it will increase the odds of having higher departmental satisfaction levels by a multiplicative factor of 6.142 while the other variables in the model are held constant. In this model, it is also observed that the variable *Female* (p=0.003) and *Tenure track* (p=0.037) are statistically significant; thus, the following interpretation can be made: If a faculty is female, it will increase the odds of having higher departmental satisfaction rate by a multiplicative factor of 2.394 while the other variables in the model are held constant. For a faculty who is on a tenure track, it will decrease the odds of having departmental satisfaction by a multiplicative factor of 0.541.

Institutional (main effect)

'Categorical Variable Information' and *'Continuous Variable Information'* for Institutional satisfaction are shown in **(Figure 81)** and **(Figure 82)**, respectively.

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Institutional satisfaction - 2018=1]	-.152	.8090	-1.738	1.433	.035	1	.851	.859
	[Institutional satisfaction - 2018=2]	2.218	.8316	.588	3.848	7.114	1	.008	9.190
[Institutional satisfaction - 2017=1]		.681	.6217	-.538	1.899	1.199	1	.274	1.975
[Institutional satisfaction - 2017=2]		.434	.6211	-.783	1.651	.488	1	.485	1.543
[Institutional satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
Female		.630	.2873	.067	1.194	4.814	1	.028	1.878
White		-.227	.5003	-1.207	.754	.206	1	.650	.797
Asian		.235	.6100	-.961	1.431	.148	1	.700	1.265
Years of service		-.020	.0158	-.051	.011	1.644	1	.200	.980
Chair		-1.094	.6661	-2.399	.212	2.695	1	.101	.335
Tenure track		-.602	.2933	-1.177	-.027	4.211	1	.040	.548
Engagement (treatment)		1.642	.3421	.971	2.312	23.026	1	<.001	5.163
(Scale)		1[b]							

Dependent Variable: Institutional satisfaction - 2018
Model: (Threshold), Institutional satisfaction - 2017, Female, White, Asian, Years of service, Chair, Tenure track, Engagement (treatment)

a. Set to zero because this parameter is redundant.

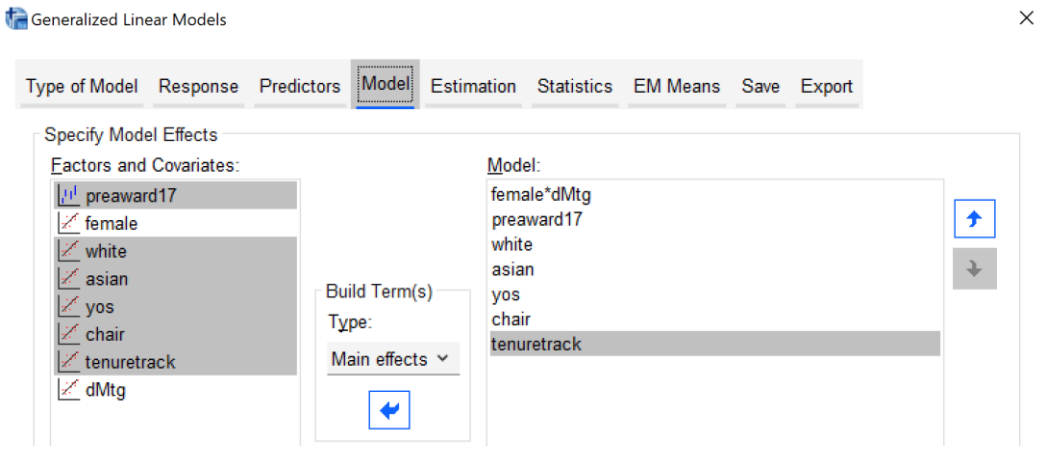
b. Fixed at the displayed value.

(Figure 83)

Based on *'Parameter Estimates'* table **(Figure 83)**, engagement (treatment) was a significant predictor (p<0.001) of institutional

satisfaction as main effect. If a faculty was treated (engaged), it will increase the odds of having higher institutional satisfaction levels by a multiplicative factor of 5.163 while the other variables in the model are held constant. Also, it is observed that the variables *Female* (p=0.028) and *Tenure track* (p=0.040) are also statistically significant; thus, the following interpretation can be made: For a faculty who is on a tenure track, it will decrease the odds of having higher institutional satisfaction by a multiplicative factor of 0.548. For a faculty who is female, it will increase the odds of having higher institutional satisfaction by a multiplicative factor of 1.878.

b. Does the effect of treatment on faculty satisfaction vary with gender?



Interaction between gender and treatment is, for example, defined as shown above.

Pre-award (interaction with gender)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Preaward satisfaction - 2018=1]	-.989	.6055	-2.176	.198	2.667	1	.102	.372
	[Preaward satisfaction - 2018=2]	.999	.6058	-.188	2.187	2.721	1	.099	2.716
Female * Engagement (treatment)		2.382	.5478	1.308	3.456	18.909	1	<.001	10.826
[Preaward satisfaction - 2017=1]		.127	.3783	-.614	.869	.113	1	.737	1.136
[Preaward satisfaction - 2017=2]		-.145	.3488	-.828	.539	.172	1	.678	.865
[Preaward satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
White		-.021	.4761	-.955	.912	.002	1	.964	.979
Asian		.261	.5988	-.912	1.435	.191	1	.662	1.299
Years of service		-.009	.0149	-.038	.021	.335	1	.563	.991
Chair		.167	.5995	-1.008	1.342	.077	1	.781	1.182
Tenure track		-.268	.2758	-.809	.272	.947	1	.331	.765
(Scale)		1[b]							

Dependent Variable: Preaward satisfaction - 2018
Model: (Threshold), Female * Engagement (treatment), Preaward satisfaction - 2017, White, Asian, Years of service, Chair, Tenure track

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 84)

As seen in **(Figure 84)**, *'Parameter Estimates'* are calculated for interaction between *gender* and *treatment* (*female* dMtg*) to estimate faculties' pre-award satisfaction level. Based on the p-value (p<0.001), *'Female*Engagement (treatment)'* was a significant predictor of pre-award satisfaction. Therefore, the following interpretation can be made: If a faculty was treated (engaged) and also a female, it will increase the odds of having higher pre-award satisfaction levels by a multiplicative factor of 10.826 while the other variables in the model are held constant.

Post-award (interaction with gender)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Postaward satisfactoin - 2018=1]	-.472	.6491	-1.744	.800	.529	1	.467	.624
	[Postaward satisfactoin - 2018=2]	1.664	.6622	.366	2.962	6.315	1	.012	5.281
Female * Engagement (treatment)		3.049	.6072	1.859	4.240	25.225	1	<.001	21.104
[Postaward satisfactoin - 2017=1]		.620	.4327	-.228	1.468	2.051	1	.152	1.858
[Postaward satisfactoin - 2017=2]		.000	.4214	-.826	.825	.000	1	.999	1.000
[Postaward satisfactoin - 2017=3]		0[a]	.	.	.	.	.	.	1
White		-.292	.4857	-1.244	.660	.360	1	.548	.747
Asian		.769	.6044	-.416	1.953	1.617	1	.203	2.157
Years of service		.001	.0154	-.029	.031	.003	1	.958	1.001
Chair		-.280	.5981	-1.453	.892	.220	1	.639	.756
Tenure track		-.456	.2827	-1.010	.098	2.605	1	.107	.634
(Scale)		1[b]							

Dependent Variable: Postaward satisfactoin - 2018
Model: (Threshold), Female * Engagement (treatment), Postaward satisfactoin - 2017, White, Asian, Years of service, Chair, Tenure track

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 85)

As seen in **(Figure 85)**, similar *'Parameter Estimates'* are calculated for interaction between *gender* and *treatment* (*female* dMtg*) to estimate faculties' post-award satisfaction level. Based on the p-value (p<0.001), *'Female*Engagement (treatment)'* was a significant predictor of post-award satisfaction. Therefore, the following interpretation can be made: If a faculty was treated (engaged) and also a female, it will increase the odds of having higher post-award satisfaction levels by a multiplicative factor of 21.104 while the other variables in the model are held constant.

Departmental (interaction with gender)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Departmental satisfaction - 2018=1]	-2.038	.6753	-3.362	-.715	9.111	1	.003	.130
	[Departmental satisfaction - 2018=2]	.642	.6588	-.650	1.933	.948	1	.330	1.899
Female * Engagement (treatment)		4.085	1.0479	2.031	6.139	15.194	1	<.001	59.425
White		-.639	.4840	-1.587	.310	1.741	1	.187	.528
Asian		-.052	.6050	-1.238	1.134	.007	1	.932	.950
Years of service		.022	.0159	-.009	.053	1.886	1	.170	1.022
Chair		-.060	.6384	-1.312	1.191	.009	1	.925	.941
Tenure track		-.700	.2985	-1.285	-.115	5.508	1	.019	.496
[Departmental satisfaction - 2017=1]		.021	.4563	-.873	.916	.002	1	.963	1.022
[Departmental satisfaction - 2017=2]		-.240	.4162	-1.056	.576	.333	1	.564	.787
[Departmental satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
(Scale)		1[b]							

Dependent Variable: Departmental satisfaction - 2018
Model: (Threshold), Female * Engagement (treatment), White, Asian, Years of service, Chair, Tenure track, Departmental satisfaction - 2017

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 86)

Next, As shown in **(Figure 86)**, similar *'Parameter Estimates'* are calculated for interaction between *gender* and *treatment* (*female* dMtg*) to estimate faculties' departmental satisfaction level. Based on the p-value (p<0.001), *'Female*Engagement (treatment)'* was a significant predictor of departmental satisfaction. Therefore, the following interpretation can be made: If a faculty was treated (engaged) and also a female, it will increase the odds of having higher departmental satisfaction levels by a multiplicative factor of 59.425 while the other variables in the model are held constant. It is also observed that the variable *Tenure track* is also statistically significant (p=0.019); thus, the following interpretation can be made: for a faculty who is in a tenure track, it will decrease the odds of having higher departmental satisfaction by a multiplicative factor of 0.496.

Institutional (interaction with gender)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Institutional satisfaction - 2018=1]	-.677	.8063	-2.258	.903	.706	1	.401	.508
	[Institutional satisfaction - 2018=2]	1.829	.8238	.214	3.443	4.927	1	.026	6.225
Female * Engagement (treatment)		3.391	.5857	2.243	4.539	33.512	1	<.001	29.684
[Institutional satisfaction - 2017=1]		.432	.6186	-.780	1.645	.488	1	.485	1.541
[Institutional satisfaction - 2017=2]		.156	.6151	-1.049	1.362	.065	1	.799	1.169
[Institutional satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
White		-.257	.4978	-1.232	.719	.266	1	.606	.774
Asian		.092	.6180	-1.119	1.304	.022	1	.881	1.097
Years of service		-.014	.0160	-.046	.017	.799	1	.371	.986
Chair		-.657	.6291	-1.890	.576	1.091	1	.296	.518
Tenure track		-.701	.2943	-1.277	-.124	5.667	1	.017	.496
(Scale)		1[b]							

Dependent Variable: Institutional satisfaction - 2018
Model: (Threshold), Female * Engagement (treatment), Institutional satisfaction - 2017, White, Asian, Years of service, Chair, Tenure track

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 87)

Lastly, in **(Figure 87)**, similar *'Parameter Estimates'* are calculated for interaction between *gender* and *treatment* (*female* dMtg*) to estimate faculties' institutional satisfaction level. Based on the p-value (p<0.001), *'Female*Engagement (treatment)'* was a significant predictor of institutional satisfaction. Therefore, the following interpretation can be made: If a faculty was treated (engaged) and also a female, it will increase the odds of having higher institutional satisfaction levels by a multiplicative factor of 29.684 while the other variables in the model are held constant. In this model, the variable *Tenure track* is also statistically significant; thus, the following interpretations can be made: for a faculty who is on a tenure track, it will decrease the odds of having higher institutional satisfaction by a multiplicative factor of 0.496 while other variables stay constant.

c. Does the effect of treatment on faculty satisfaction vary with tenure track status?

Pre-award (interaction with tenure track status)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Preaward satisfaction - 2018=1]	-.747	.6114	-1.945	.452	1.492	1	.222	.474
	[Preaward satisfaction - 2018=2]	1.119	.6144	-.085	2.323	3.317	1	.069	3.061
Tenure track * Engagement (treatment)		.026	.3963	-.750	.803	.004	1	.947	1.027
[Preaward satisfaction - 2017=1]		.180	.3711	-.547	.908	.236	1	.627	1.198
[Preaward satisfaction - 2017=2]		-.088	.3422	-.758	.583	.066	1	.797	.916
[Preaward satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
Female		.515	.2750	-.024	1.054	3.510	1	.061	1.674
White		.113	.4681	-.804	1.031	.059	1	.809	1.120
Asian		.633	.5834	-.511	1.776	1.177	1	.278	1.883
Years of service		-.014	.0144	-.042	.014	.966	1	.326	.986
Chair		.002	.6001	-1.174	1.178	.000	1	.998	1.002
(Scale)		1[b]							

Dependent Variable: Preaward satisfaction - 2018
Model: (Threshold), Tenure track * Engagement (treatment), Preaward satisfaction - 2017, Female, White, Asian, Years of service, Chair

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 88)

As seen in **(Figure 88)**, *'Parameter Estimates'* are calculated for interaction between *tenure status* and *treatment* (*tenuretrack* dMtg*) to estimate faculties' pre-award satisfaction level. Based on the p-value (p=0.947), *'Female*Engagement (treatment)'* was

NOT a significant predictor of pre-award satisfaction. However, if the p-value had been significant, the following interpretation would have been made: If a faculty were treated (engaged) and also a tenure, it will increase the odds of having higher pre-award satisfaction levels by a multiplicative factor of 1.027 while the other variables in the model are held constant. This makes sense because non-tenure faculties are more likely to exhibit the satisfaction levels across the organization; thus, treatment's interaction with tenuity may not have significant interaction unless the *tenuretrack* variable is transformed to indicate that 1 is non-tenured and 0 is tenured. Though the variable *Female* is not quite significant, it can be still interpreted that for a faculty who is female, it will increase the odds of having higher pre-award satisfaction levels by a multiplicative factor of 1.674.

Post-award (interaction with tenure track status)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Postaward satisfactoin - 2018=1]	-.116	.6423	-1.375	1.143	.032	1	.857	.891
	[Postaward satisfactoin - 2018=2]	1.804	.6567	.517	3.091	7.546	1	.006	6.073
Tenure track * Engagement (treatment)		.333	.3951	-.441	1.107	.711	1	.399	1.395
[Postaward satisfactoin - 2017=1]		.740	.4213	-.086	1.566	3.084	1	.079	2.096
[Postaward satisfactoin - 2017=2]		.175	.4097	-.628	.978	.183	1	.669	1.191
[Postaward satisfactoin - 2017=3]		0[a]	.	.	.	.	.	.	1
Female		.502	.2732	-.034	1.037	3.369	1	.066	1.651
White		-.119	.4722	-1.044	.807	.063	1	.801	.888
Asian		1.104	.5836	-.040	2.248	3.576	1	.059	3.015
Years of service		-.010	.0148	-.039	.019	.466	1	.495	.990
Chair		-.561	.5900	-1.718	.595	.905	1	.341	.570
(Scale)		1[b]							

Dependent Variable: Postaward satisfactoin - 2018
Model: (Threshold), Tenure track * Engagement (treatment), Postaward satisfactoin - 2017, Female, White, Asian, Years of service, Chair

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 89)

As seen in **(Figure 89)**, *'Parameter Estimates'* are calculated for interaction between *tenure status* and *treatment* (*tenuretrack* dMtg*) to estimate faculties' post-award satisfaction level. Based on the p-value (p=0.399), *'Female*Engagement (treatment)'* was NOT a significant predictor of post-award satisfaction. However, if the p-value had been significant, the following interpretation would have been made: If a faculty were treated (engaged) and also a tenure, it will increase the odds of having higher post-award satisfaction levels by a multiplicative factor of 1.395 while the other variables in the model are held constant.

Departmental (interaction with tenure track status)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Departmental satisfaction - 2018=1]	-1.342	.6677	-2.650	-.033	4.037	1	.045	.261
	[Departmental satisfaction - 2018=2]	1.181	.6651	-.122	2.485	3.154	1	.076	3.258
Tenure track * Engagement (treatment)		.423	.4262	-.412	1.258	.986	1	.321	1.527
[Departmental satisfaction - 2017=1]		.368	.4368	-.488	1.224	.711	1	.399	1.445
[Departmental satisfaction - 2017=2]		-.019	.4018	-.807	.768	.002	1	.962	.981
[Departmental satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
Female		.943	.2817	.391	1.495	11.203	1	<.001	2.567
White		-.494	.4774	-1.430	.442	1.071	1	.301	.610
Asian		.394	.5874	-.757	1.545	.450	1	.502	1.483
Years of service		.008	.0151	-.022	.037	.255	1	.613	1.008
Chair		-.275	.6323	-1.514	.964	.189	1	.664	.760
(Scale)		1[b]							

Dependent Variable: Departmental satisfaction - 2018
Model: (Threshold), Tenure track * Engagement (treatment), Departmental satisfaction - 2017, Female, White, Asian, Years of service, Chair

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 90)

As seen in **(Figure 90)**, *'Parameter Estimates'* are calculated for interaction between *tenure status* and *treatment* (*tenuretrack**

dMtg) to estimate faculties' departmental satisfaction level. Based on the p-value (p=0.321), *'Female*Engagement (treatment)'* was NOT a significant predictor of departmental satisfaction. However, if the p-value had been significant, the following interpretation would have been made: If a faculty were treated (engaged) and also a tenure, it will increase the odds of having higher departmental satisfaction levels by a multiplicative factor of 1.527 while the other variables in the model are held constant. In this model, it is also observed that the variable *Female* is statistically significant; thus, the following interpretation can be made: for a faculty who is female, it will increase the odds of having higher departmental satisfaction levels by a multiplicative factor of 2.567 assuming all the other variables stay constant.

Institutional (interaction with tenure track status)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Institutional satisfaction - 2018=1]	-.186	.7661	-1.687	1.316	.059	1	.809	.831
	[Institutional satisfaction - 2018=2]	1.926	.7809	.396	3.457	6.084	1	.014	6.863
Tenure track * Engagement (treatment)		.163	.4165	-.653	.980	.154	1	.695	1.177
[Institutional satisfaction - 2017=1]		.639	.5931	-.524	1.801	1.159	1	.282	1.894
[Institutional satisfaction - 2017=2]		.247	.5920	-.913	1.408	.175	1	.676	1.281
[Institutional satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
Female		.714	.2811	.163	1.264	6.445	1	.011	2.041
White		-.124	.4760	-1.057	.809	.068	1	.795	.884
Asian		.579	.5866	-.571	1.729	.974	1	.324	1.784
Years of service		-.026	.0153	-.056	.004	2.895	1	.089	.974
Chair		-.887	.6228	-2.108	.334	2.029	1	.154	.412
(Scale)		1[b]							

Dependent Variable: Institutional satisfaction - 2018
Model: (Threshold), Tenure track * Engagement (treatment), Institutional satisfaction - 2017, Female, White, Asian, Years of service, Chair

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 91)

As seen in **(Figure 91)**, *'Parameter Estimates'* are calculated for interaction between *tenure status* and *treatment* (*tenuretrack* dMtg*) to estimate faculties' institutional satisfaction level. Based on the p-value (p=0.695), *'Tenure track*Engagement (treatment)'* was NOT a significant predictor of institutional satisfaction. However, if the p-value had been significant, the following interpretation would have been made: If a faculty were treated (engaged) and also a tenure, it will increase the odds of having higher institutional satisfaction levels by a multiplicative factor of 1.177 while the other variables in the model are held constant. Looking at the variable *Female* by itself, we can see that p-value is significant (p=0.011); and thus we can make the following interpretation: For a female faculty, there will be increase in odds of having higher institutional satisfaction by a multiplicative factor of 2.041 while other variables stay constant.

d. Does the effect of treatment on faculty satisfaction vary independently with **gender and tenure track** status?

Pre-award (interaction with gender and with tenure track status)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Preaward satisfaction - 2018=1]	-.929	.6051	-2.115	.257	2.359	1	.125	.395
	[Preaward satisfaction - 2018=2]	1.069	.6062	-.119	2.257	3.111	1	.078	2.913
Tenure track * Engagement (treatment)		-.809	.4566	-1.704	.086	3.139	1	.076	.445
Female * Engagement (treatment)		2.749	.5967	1.579	3.918	21.219	1	<.001	15.623
[Preaward satisfaction - 2017=1]		.068	.3793	-.675	.812	.033	1	.857	1.071
[Preaward satisfaction - 2017=2]		-.198	.3499	-.883	.488	.319	1	.572	.821
[Preaward satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
White		-.021	.4718	-.946	.903	.002	1	.964	.979
Asian		.327	.5996	-.848	1.502	.298	1	.585	1.387
Years of service		-.008	.0147	-.037	.021	.276	1	.599	.992
Chair		.222	.5993	-.952	1.397	.137	1	.711	1.249
(Scale)		1[b]							

Dependent Variable: Preaward satisfaction - 2018
Model: (Threshold), Tenure track * Engagement (treatment), Female * Engagement (treatment), Preaward satisfaction - 2017, White, Asian, Years of service, Chair

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 92)

As seen in **(Figure 92)**, *'Parameter Estimates'* are calculated for two different interactions (*dMtg*female & dMtg*tenuretrack*). Based on the p-value (p<0.001), *'Female*Engagement (treatment)'* was a significant predictor of pre-award satisfaction. However, *'Tenure track*Engagement (treatment)'* was not quite a significant predictor given the p-value (p=0.076). Therefore, the following interpretation can be made: If a faculty was treated (engaged) and was a female, it will increase the odds of having higher pre-award satisfaction levels by a multiplicative factor of 15.623 while the other variables in the model are held constant.

Post-award (interaction with gender and with tenure track status)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Postaward satisfactoin - 2018=1]	-.335	.6428	-1.594	.925	.271	1	.603	.716
	[Postaward satisfactoin - 2018=2]	1.791	.6576	.502	3.080	7.416	1	.006	5.994
Tenure track * Engagement (treatment)		-.597	.4575	-1.493	.300	1.700	1	.192	.551
Female * Engagement (treatment)		3.311	.6553	2.026	4.595	25.526	1	<.001	27.400
White		-.335	.4772	-1.270	.601	.492	1	.483	.716
Asian		.806	.6024	-.375	1.987	1.790	1	.181	2.239
Years of service		-.002	.0151	-.032	.028	.015	1	.902	.998
Chair		-.269	.5988	-1.443	.904	.202	1	.653	.764
[Postaward satisfactoin - 2017=1]		.655	.4302	-.189	1.498	2.315	1	.128	1.924
[Postaward satisfactoin - 2017=2]		.039	.4188	-.782	.860	.009	1	.926	1.040
[Postaward satisfactoin - 2017=3]		0[a]	.	.	.	.	.	.	1
(Scale)		1[b]							

Dependent Variable: Postaward satisfactoin - 2018
Model: (Threshold), Tenure track * Engagement (treatment), Female * Engagement (treatment), White, Asian, Years of service, Chair, Postaward satisfactoin - 2017

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 93)

Similarly, in **(Figure 93)**, *'Parameter Estimates'* are calculated for two different interactions (*dMtg*female & dMtg*tenuretrack*). Based on the p-value (p<0.001), only *'Female*Engagement (treatment)'* is a significant predictor of post-award satisfaction. Therefore, the following interpretation can be made: If a faculty was treated (engaged) and was a female, it will increase the odds of

having higher post-award satisfaction levels by a multiplicative factor of 27.400 while the other variables in the model are held constant.

Departmental (interaction with gender and with tenure track status)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Departmental satisfaction - 2018=1]	-1.826	.6683	-3.136	-.516	7.462	1	.006	.161
	[Departmental satisfaction - 2018=2]	.806	.6571	-.482	2.094	1.506	1	.220	2.240
Tenure track * Engagement (treatment)		-.542	.4952	-1.512	.429	1.196	1	.274	.582
Female * Engagement (treatment)		4.292	1.0731	2.189	6.396	15.998	1	<.001	73.135
White		-.748	.4786	-1.686	.190	2.445	1	.118	.473
Asian		-.002	.6074	-1.192	1.188	.000	1	.997	.998
Years of service		.016	.0158	-.015	.047	1.073	1	.300	1.016
Chair		-.107	.6325	-1.347	1.133	.029	1	.866	.899
[Departmental satisfaction - 2017=1]		.129	.4549	-.763	1.020	.080	1	.777	1.137
[Departmental satisfaction - 2017=2]		-.189	.4155	-1.003	.626	.206	1	.650	.828
[Departmental satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
(Scale)		1[b]							

Dependent Variable: Departmental satisfaction - 2018
Model: (Threshold), Tenure track * Engagement (treatment), Female * Engagement (treatment), White, Asian, Years of service, Chair, Departmental satisfaction - 2017

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 94)

Next, in **(Figure 94)**, *'Parameter Estimates'* are calculated for two different interactions (*dMtg*female & dMtg*tenuretrack*). Only *'Female*Engagement (treatment)'* was a significant predictor of departmental satisfaction based on the p-value (p<0.001). Therefore, the following interpretation can be made: If a faculty was treated (engaged) and was a female, it will increase the odds of having higher departmental satisfaction levels by a multiplicative factor of 73.315 while the other variables in the model are held constant.

Institutional (interaction with gender and with tenure track status)

Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval Lower	95% Wald Confidence Interval Upper	Hypothesis Test Wald Chi-Square	Hypothesis Test df	Hypothesis Test Sig.	Exp(B)
Threshold	[Institutional satisfaction - 2018=1]	-.480	.7948	-2.038	1.077	.365	1	.546	.619
	[Institutional satisfaction - 2018=2]	2.001	.8139	.405	3.596	6.042	1	.014	7.394
Tenure track * Engagement (treatment)		-1.089	.5239	-2.115	-.062	4.318	1	.038	.337
Female * Engagement (treatment)		3.886	.6639	2.585	5.188	34.264	1	<.001	48.730
White		-.332	.4863	-1.285	.621	.467	1	.495	.717
Asian		.174	.6154	-1.032	1.380	.080	1	.777	1.190
Years of service		-.017	.0158	-.048	.014	1.190	1	.275	.983
Chair		-.653	.6323	-1.893	.586	1.067	1	.302	.520
[Institutional satisfaction - 2017=1]		.460	.6244	-.764	1.684	.543	1	.461	1.584
[Institutional satisfaction - 2017=2]		.157	.6229	-1.063	1.378	.064	1	.801	1.170
[Institutional satisfaction - 2017=3]		0[a]	.	.	.	.	.	.	1
(Scale)		1[b]							

Dependent Variable: Institutional satisfaction - 2018
Model: (Threshold), Tenure track * Engagement (treatment), Female * Engagement (treatment), White, Asian, Years of service, Chair, Institutional satisfaction - 2017

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

(Figure 95)

Finally, in **(Figure 95)**, *'Parameter Estimates'* are calculated for two different interactions (*dMtg*female* and *dMtg*tenuretrack*). Both *'Female*Engagement (treatment)'* (p<0.001) and *'Tenure Track*Engagement (treatment)'* (p=0.038) were a significant predictor of institutional satisfaction. Therefore, the following interpretation can be made: If a faculty was treated (engaged) and

was a female, it will increase the odds of having higher institutional satisfaction levels by a multiplicative factor of 48.730 while the other variables in the model are held constant. Conversely, if a faculty was treated (engaged) and was a tenure, it will decrease the odds of having higher institutional satisfaction by a multiplicative factor of 0.337 while the other variables in the model are held constant.

Q3 (Sean Jung)	Types of Satisfaction →	Pre-award		Post-award		Departmental		Institutional	
Types of Term ↓	Variable ↓	Exp(B)	P-value	Exp(B)	P-value	Exp(B)	P-value	Exp(B)	P-value
Main Effect	Engagement	3.374	<0.001	5.396	<0.001	6.142	<0.001	5.163	<0.001
	Female	1.52	0.134	1.486	0.16	2.394	0.003	1.878	0.028
	Tenure Track	0.806	0.436	0.648	0.128	0.541	0.037	0.548	0.040
Interaction w/ Gender	Engagement * Female	10.826	<0.001	21.104	<0.001	59.425	<0.001	29.684	<0.001
	Tenure Track	0.765	0.331	0.634	0.107	0.496	0.019	0.496	0.017
Interaction w/ Tenure	Engagement * Tenure	1.027	0.947	1.395	0.399	1.527	0.321	1.177	0.695
	Female	1.674	0.061	1.651	0.066	2.567	<0.001	2.041	0.011
Interaction w/ Gender and w/ Tenure	Engagement * Female	15.623	<0.001	27.400	<0.001	73.135	<0.001	48.73	<0.001
	Engagement * Tenure	0.445	0.076	0.551	0.192	0.582	0.274	0.337	0.038

(Figure 96)

Lastly, a comprehensive table that summarized Exp(B) and p-value by types of satisfaction and term is shown **(Figure 96)**. Notice that P-value that is greater than or equal to 0.05 is coded as red text to indicate that there is not enough statistical evidence to interpret that particular coefficient to be significant. Also, the coefficients that have the biggest value across each term is bolded to highlight which satisfaction levels show the outstanding effect by each variable.

4. Estimate the effects of the following variables, *rasunit, female, white, asian, yos, chair, tenuretrack, and doctortype* on the following outcomes **(5 points)**:
   a. Number of proposals

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Number of proposals	217	0	16	2.81	2.828	7.999
Valid N (listwise)	217					

(Figure 97)

Number of proposal is a count variable; thus when determining the effect of variables on the dependent count variable, either Poisson regression or negative binomial regression should be used. Standard deviation is the square root of the variance, meaning variance is calculated by squaring the standard deviation: $2.828^2 = 7.999$. Therefore, mean value is different from the variance value, indicating that negative binomial regression should be used to observe the effects of the variables on the number of proposals.

Comparing the result from different regression techniques in terms of deviance and AIC/BIC measures **(Figure 98, 99, 100, and 101)**, negative binomial regression with custom parameters seems to be the best as it has the deviation value/df closest 1, and lowest AIC/BIC values. Additionally, for the purpose of interpreting the model coefficients at ease, categorical independent variables can be entered as continuous variable except for the variable that has more than two categories. All the independent variables such as *female, white, asian, yos, chair,* and *tenuretrack* are categorical dummy variables with only two levels, and *doctortype* and *rasunit* are the only independent variables that have more than two levels; thus, first six variables can be entered into the model as continuous variable while doctortype and *rasunit* should be entered as a categorical variable as shown in **(Figure 102)**.

'Categorical Variable Information' and *'Continuous Variable Information'* are shown in **(Figure 103)** and **(Figure 104)**, respectively. Additionally, based on the 'Goodness of Fit' output **(Figure 105)** and its deviance value/df of 1.140 indicates the slight overdispersion, but given its proximal value to 1 along with relatively low AIC/BIC score, we can safely proceed with further interpretation.

Dependent Variable → Independent Variables ↓	Number of Proposals (negative binomial)		
[Type of doctoral degree = No Doctoral Degree]	-0.841	0.431	0.027
[Type of doctoral degree = Ph.D]	-0.242	0.785	0.335
[Type of doctoral degree = M.D.]	-0.647	0.524	0.013
[Type of doctoral degree = M.D., Ph.D]	0	1.000	n/a
Chair	-0.257	0.773	0.324
[RAS Unit = ABOSS]	-0.707	0.493	0.035
[RAS Unit = Basic Science]	-0.426	0.653	0.213
[RAS Unit = CAPS]	-0.927	0.396	0.012
[RAS Unit = Cancer and Imaging]	-0.527	0.590	0.106
[RAS Unit = Dept of Medicine]	0.081	1.084	0.808
[RAS Unit = Hospital & Speciality]	-0.296	0.744	0.414
[RAS Unit = Pediatrics]	-0.119	0.888	0.736
[RAS Unit = Public Health & Nursing]	-0.379	0.685	0.265
[RAS Unit = Yerkes]	0	n/a	n/a
Female	-0.147	0.863	0.281
White	-0.448	0.639	0.034
Asian	-0.225	0.799	0.369
Years of Service	-0.003	0.997	0.700
Tenure Track	0.48	1.616	<0.001
	B	Exp(B)	p-value

(Figure 106B)

Parameter Estimates for Poisson Regression with *'Number of proposals'* as the dependent variable are shown in **(Figure 106A)**, and we can make inferences about each coefficient, especially for the variables with statistically significant p-values ($p<0.05$) as summarized in **(Figure 106B)** with blue borders enclosed around the variables with statistically significant p-values. For the faculty with no doctoral degree (type of doctoral degree = 0), the logs of expected number of proposals would be expected to go down by 0.841 unit while holding the other variables in the model constant. For example, if we consider two faculties of same gender and tenure status, we would expect the faculty with the no doctoral degree to have lesser number of proposals than the other faculties with doctoral degree(s).

Similarly, for the faculty with medical doctor (type of doctoral degree = 2) degree, the logs of expected number of proposals would be expected to go down by 0.647 unit while holding the other variables in the model constant. When looking at the variable *RAS Unit*, it is observed that there are two departments with which we can further interpret the coefficients based on the significant p-values as follows: for the faculty who belong in ABOSS, the logs of expected number of proposals would be expected to go down by 0.707 unit while holding other variables in the model constant. Similarly, for faculties in CAPS, the logs of expected number of proposals would be expected to go down by 0.927. Next, the variable *White* is also significant: for a white faculty, the logs of expected number of proposals would be expected to go down by 0.448 unit while holding other variables in the model constant. Lastly, for a variable *Tenure track*, we can interpret as follows: for a tenured faculty, the logs of expected number of proposals would be expected to go up by 0.480 unit while holding other variables constant.

b. Number of awards received

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Number of awards	217	0	31	2.76	3.510	12.320
Valid N (listwise)	217					

(Figure 107)

Similar to the dependent variable in the part a, *'Number of awards received'* is also a count variable; thus when determining the effect of variables on the dependent count variable, either Poisson regression or negative binomial regression should be used. Given the standard deviation value of 3.510, the variance is $3.510^2 = 12.320$. Therefore, mean value is also different from the variance value, indicating that negative binomial regression should be used to observe the effects of the variables on the number of awards received. Variables and type of models are specified exactly the same way as the previous one with the only difference being the dependent variable.

'Categorical Variable Information' and *'Continuous Variable Information'* for *'Number of awards'* as the dependent variables are shown in **(Figure 108)** and **(Figure 109)**, respectively. Additionally, based on the 'Goodness of Fit' output **(Figure 110)** and its deviance value/df of 1.105 indicates the slight overdispersion, but given its proximal value to 1 along with relatively low AIC/BIC score, we can safely proceed with further interpretation.

Dependent Variable → Independent Variables ↓	Number of Awards Received (negative binomial)		
[Type of doctoral degree = No Doctoral Degree]	**-1.130**	0.323	**0.014**
[Type of doctoral degree = Ph.D]	-0.366	0.694	0.217
[Type of doctoral degree = M.D.]	0.106	1.112	0.722
[Type of doctoral degree = M.D., Ph.D]	0	1.000	n/a
Chair	-0.112	0.894	0.685
[RAS Unit = ABOSS]	-0.733	0.480	0.057
[RAS Unit = Basic Science]	-0.098	0.907	0.802
[RAS Unit = CAPS]	-0.744	0.475	0.080
[RAS Unit = Cancer and Imaging]	-0.325	0.723	0.379
[RAS Unit = Dept of Medicine]	0.300	1.350	0.427
[RAS Unit = Hospital & Speciality]	-0.32	0.726	0.438
[RAS Unit = Pediatrics]	-0.621	0.537	0.130
[RAS Unit = Public Health & Nursing]	-0.359	0.698	0.362
[RAS Unit = Yerkes]	0	1.000	n/a
Female	-0.156	0.856	0.291
White	-0.423	0.655	0.062
Asian	-0.416	0.660	0.131
Years of Service	0.012	1.012	0.147
Tenure Track	0.159	1.172	0.320
	B	Exp(B)	p-value

(Figure 111B)

Parameter Estimates for Poisson Regression with *'Number of awards'* as the dependent variable are shown in **(Figure 111A)**. We can make inferences about each coefficient, especially for the variables with statistically significant p-values ($p<0.05$) as summarized in **(Figure 111B)** with a variable that is bolded when it has a statistically significant p-values. For the faculty with no doctoral degree (type of doctoral degree = 0), the logs of expected number of awards would be expected to go down by 1.130 unit while holding the other variables in the model constant. For example, if we consider two faculties of same gender and tenure status, we would expect the faculty with the no doctoral degree to have lesser number of awards than the other faculties with doctoral degree(s).

c. Total proposals submitted in $

The variable *'Total proposals submitted in $'* is continuous variable. Given different variables are used to predict continuous dependent variable, OLS regression is used.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.357[a]	.128	.094	1.48731

a. Predictors: (Constant), Type of doctoral degree, RAS Unit, Chair, Years of service, Asian, Female, Tenure track, White

(Figure 112)

First, R^2 value is computed to observe how much of the total variation in the dependent variable, *'Total proposals submitted in $'*, can be explained by the eight independent variables as indicated in **(Figure 112)**. In this case, 35.7% variance can be explained.

Dependent Variable → Independent Variables ↓	Total proposals submitted in $ (OLS)	
[Type of doctoral degree = No Doctoral Degree]	-1.53	0.005
[Type of doctoral degree = Ph.D]	-1.277	0.002
[Type of doctoral degree = M.D.]	-1.789	<0.001
[Type of doctoral degree = M.D., Ph.D]	0	n/a
Chair	0.827	0.03
[RAS Unit = ABOSS]	-3.455	<0.001
[RAS Unit = Basic Science]	-2.992	<0.001
[RAS Unit = CAPS]	-3.862	<0.001
[RAS Unit = Cancer and Imaging]	-3.593	<0.001
[RAS Unit = Dept of Medicine]	-2.416	<0.001
[RAS Unit = Hospital & Speciality]	-2.937	<0.001
[RAS Unit = Pediatrics]	-3.074	<0.001
[RAS Unit = Public Health & Nursing]	-3.504	<0.001
[RAS Unit = Yerkes]	0	n/a
Female	-0.289	0.152
White	0.004	0.991
Asian	0.279	0.470
Years of Service	0.005	0.649
Tenure Track	0.612	0.003
	B	p-value

(Figure 113B)

Parameter Estimates for Linear Regression with *'Total Proposal in $'* as the dependent variable are shown in **(Figure 113A)**, and we can make inferences about each coefficient, especially for the variables with statistically significant p-values ($p<0.05$) as summarized in **(Figure 113B)** with blue borders around when it has a statistically significant p-values. For the faculty with no doctoral degree (type of doctoral degree = 0), there will be 1.53 unit decrease in *'Total Proposal in $'*.

Similarly, for the faculty with Ph.D or M.D., there will be -1.277 and -1.789 unit decrease in *'Total Proposal in $',* respectively. Next, for a faculty who is also a chair of department, there will be 0.827 unit increase in *'Total Proposal in $'*. RAS Unit is an interesting variable as all levels in this variable indicate statistical significance based on p-value. It is also observed that their coefficients range anywhere between around -2.9 to -3.9. Thus, the following interpretation can be made: for the faculties across different RAS unit, there will be anywhere from 2.9 to 3.9 unit decrease in *'Total Proposal in $'*. Note that *CAPS* is the department with most notable unit decrease in dependent variable; while, *Dept of Medicine* is the department with least notable unit decrease in dependent variable. Lastly, for a faculty who holds tenure status, there will be 0.612 unit increase in *'Total Proposal in $'*.

d. Total awards received in $

The variable *'Total awards received in $'* is also considered continuous variable. Given different variables are used to predict continuous dependent variable, OLS regression should be used in here as well.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.247[a]	.061	.025	1.10621

a. Predictors: (Constant), Type of doctoral degree, RAS Unit, Chair, Years of service, Asian, Female, Tenure track, White

(Figure 114)

Similar to previous part, R^2 value is computed to observe how much of the total variation in the dependent variable, *'Total awards received in $'*, can be explained by the eight independent variables as indicated in **(Figure 114)**. In this case, 24.7% variance can be explained.

Dependent Variable → Independent Variables ↓	Total awards received in $ (OLS)	
[Type of doctoral degree = No Doctoral Degree]	-0.36	0.405
[Type of doctoral degree = Ph.D]	-0.034	0.918
[Type of doctoral degree = M.D.]	-0.309	0.348
[Type of doctoral degree = M.D., Ph.D]	0	n/a
Chair	0.156	0.611
[RAS Unit = ABOSS]	-2.045	<0.001
[RAS Unit = Basic Science]	-1.399	0.002
[RAS Unit = CAPS]	-2.252	<0.001
[RAS Unit = Cancer and Imaging]	-1.949	<0.001
[RAS Unit = Dept of Medicine]	-1.377	0.002
[RAS Unit = Hospital & Speciality]	-1.872	<0.001
[RAS Unit = Pediatrics]	-1.818	<0.001
[RAS Unit = Public Health & Nursing]	-1.666	<0.001
[RAS Unit = Yerkes]	0	n/a
Female	-0.249	0.124
White	0.013	0.960
Asian	0.035	0.911
Years of Service	0.000	0.959
Tenure Track	0.221	0.177
	B	p-value

(Figure 115B)

Parameter Estimates for Linear Regression with *'Total awards received in $'* as the dependent variable are shown in **(Figure 115A)**, and we can make inferences about each coefficient, especially for the variables with statistically significant p-values ($p<0.05$) as summarized in **(Figure 115B)** with blue borders around to indicate when it has a statistically significant p-values. It is observed that only variables that belong to *'RAS unit'* are statistically significant with its coefficients ranging anywhere from -1.377 to -2.252. The most notable decrease in *'Total awards received in $'* happens in the CAPS department while the least amount of decrease occurs in the department of medicine. For example, for a faculty in CAPS department, there is 2.252 unit decrease in *'Total awards received in $'*. For a faculty in department of medicine, there is only 1.377 unit decrease.

Dependent Variable → Independent Variables ↓	Number of Proposals (negative binomial)			Number of Awards Received (negative binomial)			Total proposals submitted in $ (OLS)		Total awards received in $ (OLS)	
[Type of doctoral degree = No Doctoral Degree]	-0.841	0.431	0.027	-1.130	0.323	0.014	-1.53	0.005	-0.36	0.405
[Type of doctoral degree = Ph.D]	-0.242	0.785	0.335	-0.366	0.694	0.217	-1.277	0.002	-0.034	0.918
[Type of doctoral degree = M.D.]	-0.647	0.524	0.013	0.106	1.112	0.722	-1.789	<0.001	-0.309	0.348
[Type of doctoral degree = M.D., Ph.D]	0	1.000	n/a	0	1.000	n/a	0	n/a	0	n/a
Chair	-0.257	0.773	0.324	-0.112	0.894	0.685	0.827	0.03	0.156	0.611
[RAS Unit = ABOSS]	-0.707	0.493	0.035	-0.733	0.480	0.057	-3.455	<0.001	-2.045	<0.001
[RAS Unit = Basic Science]	-0.426	0.653	0.213	-0.098	0.907	0.802	-2.992	<0.001	-1.399	0.002
[RAS Unit = CAPS]	-0.927	0.396	0.012	-0.744	0.475	0.080	-3.862	<0.001	-2.252	<0.001
[RAS Unit = Cancer and Imaging]	-0.527	0.590	0.106	-0.325	0.723	0.379	-3.593	<0.001	-1.949	<0.001
[RAS Unit = Dept of Medicine]	0.081	1.084	0.808	0.300	1.350	0.427	-2.416	<0.001	-1.377	0.002
[RAS Unit = Hospital & Speciality]	-0.296	0.744	0.414	-0.32	0.726	0.438	-2.937	<0.001	-1.872	<0.001
[RAS Unit = Pediatrics]	-0.119	0.888	0.736	-0.621	0.537	0.130	-3.074	<0.001	-1.818	<0.001
[RAS Unit = Public Health & Nursing]	-0.379	0.685	0.265	-0.359	0.698	0.362	-3.504	<0.001	-1.666	<0.001
[RAS Unit = Yerkes]	0	n/a	n/a	0	1.000	n/a	0	n/a	0	n/a
Female	-0.147	0.863	0.281	-0.156	0.856	0.291	-0.289	0.152	-0.249	0.124
White	-0.448	0.639	0.034	-0.423	0.655	0.062	0.004	0.991	0.013	0.960
Asian	-0.225	0.799	0.369	-0.416	0.660	0.131	0.279	0.470	0.035	0.911
Years of Service	-0.003	0.997	0.700	0.012	1.012	0.147	0.005	0.649	0.000	0.959
Tenure Track	0.48	1.616	<0.001	0.159	1.172	0.320	0.612	0.003	0.221	0.177
	B	Exp(B)	p-value	B	Exp(B)	p-value	B	p-value	B	p-value

(Figure 116)

Summary of the regression output is shown in **(Figure 116)**.

5. Provide a summary and an overall assessment of the intervention based on your answers to questions 1 through 4. **(5 points).**

In question 1 and 2, I observed whether the average levels of faculty satisfaction with four dimension of research support (pre-award, post-award, departmental, and institutional satisfaction) increase significantly from 2017 to 2018 and whether it significantly differs by different groups (Female vs. Male and Tenure vs. Non-tenure). From the analysis, I found that there is not enough statistical evidence to believe that treatment had increased pre-award satisfaction level **(Figure 4)**, post-award satisfaction level **(Figure 7)**, departmental satisfaction level **(Figure 10)**, or institutional satisfaction level **(Figure 13)** from 2017 to 2018.

When attempting to observe the change in different types of satisfaction levels between different groups, I made the following observations with regard to gender difference: Even though descriptive statistics initially indicates that female faculties show a significant increase in pre-award satisfaction level than male faculties at a significantly greater level of change than the increase in satisfaction levels that male faculties showed between 2017 and 2018, there is no reason to believe that there was significant interaction between gender and change in pre-award satisfaction levels. However, female faculties report significantly more pre-award satisfaction levels than male faculties when combining year 2017 and 2018 results **(Figure 18 and 20)**.

I found that female faculties show a significant increase in post-award satisfaction level than male faculties at a significantly greater level of change and that there is significant interaction between gender and change in post-award satisfaction levels between 2017 and 2018 **(Figure 24 and 25)**. I found that female faculties show a significant increase in departmental **(Figure 33**) and institutional **(Figure 40)** satisfaction level than male faculties at a significantly greater level of change between 2017 and 2018 and that female faculties report significantly more post-award satisfaction levels than male faculties. I also found that there is significant interaction between gender and change in departmental **(Figure 35)** and institutional **(Figure 42)** satisfaction levels across 2017 and 2018.

In terms of tenurity, I found that non-tenure faculties show a significant increase in pre-award **(Figure 47)**, post- award **(Figure 54)**, departmental **(Figure 61)**, and institutional **(Figure 68)** satisfaction level than tenure faculties between 2017 and 2018 at a significantly greater level of change and that there is significant interaction between tenure status and change in pre-award **(Figure 48)**, post-award **(Figure 56)**, departmental **(Figure 63)**, and institutional **(Figure 70)** satisfaction levels across 2017 and 2018.

In question 3, I used a regression model to evaluate whether the treatment led to an increase in faculty satisfaction in four dimensions of research support from 2017 to 2018 with different approaches (main effect of treatment, interaction with gender, interaction with tenure, and interaction with gender and with tenure). There are a total of 16 regression models, and here are some of the findings of each model with their respective coefficients that are statistically significant:

Main Effect → Engagement (treatment) were a significant predictors ($p<0.001$) of pre-award satisfaction **(Figure 74)**, post-award satisfaction **(Figure 77)**, departmental satisfaction **(Figure 80)**, and institutional satisfaction **(Figure 83)** as main effect. If a faculty was treated (engaged), it will increase the odds of having higher pre-award satisfaction levels by a multiplicative factor of 3.374, post-award satisfaction by a multiplicative factor of 5.396, departmental satisfaction by a multiplicative factor of 6.142, and institutional satisfaction by a multiplicative factor of 5.163.

Interaction with Gender → *'Female*Engagement (treatment)'* was a significant predictor of pre-award **(Figure 84)**, post-award **(Figure 85)**, departmental **(Figure 86)**, and institutional **(Figure 87)** satisfaction. Therefore, the following interpretation can be made: If a faculty was treated (engaged) and also a female, it will increase the odds of having higher pre-award satisfaction levels by a multiplicative factor of 10.826, post-award satisfaction levels by a multiplicative factor of 21.104, departmental satisfaction levels by a multiplicative factor of 59.425, and institutional satisfaction levels by a multiplicative factor of 29.684. Also, the variable Tenure track is significant variable in both departmental and institutional satisfaction model. It is observed that for a faculty who is on a tenure track, it decreases the odds of having higher departmental and institutional satisfaction levels by a multiplicative factor of 0.496.

Interaction with Tenure Track → *'Female*Engagement (treatment)'* was NOT a significant predictor of of pre-award **(Figure 88)**, post-award **(Figure 89)**, departmental **(Figure 90)**, and institutional **(Figure 91)** satisfaction based on all the p-values ($p>0.005$) in these models. This makes sense because it is the non-tenure faculties who are more likely to exhibit the satisfaction levels across the organization; thus, treatment's interaction with tenurity does not have significant interaction unless the *tenuretrack* variable is transformed to indicate that 1 is non-tenured and 0 is tenured. Thus, applying reverse logic, it can be inferred that there may be interaction between treatment and non-tenurity. However, the variable *Female* is important variable in Departmental and Institutional satisfaction model. For a faculty who is female, it increase the odds of having higher departmental satisfaction levels by a multiplicative factor of 2.567 and institutional satisfaction levels by a multiplicative factor of 2.041.

Interaction with Gender and with Tenure Track → I found that *'Female*Engagement (treatment)'* was a significant predictor of all four different types of satisfaction while *'Tenure track*Engagement (treatment)'* was a significant predictor only for institutional satisfaction (p=0.038). Therefore, I made the following interpretation (assuming other variables stay constant): For a faculty who was treated (engaged) and a female, it will increase the odds of having higher pre-award satisfaction levels by a multiplicative factor of 15.623 **(Figure 92)**, post-award satisfaction by a multiplicative factor of 27.400 **(Figure 93)**, institutional satisfaction by a multiplicative factor of 73.135 **(Figure 94)**, and institutional satisfaction by a multiplicative factor of 48.730 **(Figure 95)**. Notice that interaction of engagement and female has the most prominent effect on satisfaction rate. Similarly, for a faculty who was treated and was on a tenure track, it decreases the odds of having higher institutional satisfaction levels by a multiplicative factor of 0.337.

In question 4, I estimated the effects of the following variables *rasunit*, *female*, *white*, *asian*, *yos*, *chair*, *tenuretrack*, and *doctortype* on each of the following dependent variables: *number of proposals*, *number of awards received*, *total proposals submitted in $*, and *total awards received in $*.

Number of Proposal → Based on **(Figure 106A)** and **(106B)**, I found that (assuming other variables in the model constant) for the faculty with no doctoral degree (type of doctoral degree = 0), the logs of expected number of proposals would be expected to go down by 0.841 unit. For example, if we consider two faculties of same gender and tenure status, we would expect the faculty with the no doctoral degree to have lesser number of proposals than the other faculties with doctoral degree(s). Similarly, for the faculty with medical doctor (type of doctoral degree = 2) degree, the logs of expected number of proposals would be expected to go down by 0.647 unit. When looking at the variable *RAS Unit*, it is observed that for the faculty who belong in ABOSS, the logs of expected number of proposals would be expected to go down by 0.707 unit. Similarly, for faculties in CAPS, the logs of expected number of proposals would be expected to go down by 0.927. Next, the variable *White* is also significant: for a white faculty, the logs of expected number of proposals would be expected to go down by 0.448 unit while holding other variables in the model constant. Lastly, for a variable *Tenure track*, we can interpret as follows: for a tenured faculty, the logs of expected number of proposals would be expected to go up by 0.480 unit while holding other variables constant.

Number of Awards → From **(Figure 111A)** and **(Figure 111B)**, I found that for the faculty with no doctoral degree (*type of doctoral degree = 0*), the logs of expected number of awards would be expected to go down by 1.130 unit while holding the other variables in the model constant. Notice how this variable is similarly interpreted in the previous model (Number of Proposal). For example, if we consider two faculties of same gender and tenure status, we would expect the faculty with the no doctoral degree to have lesser number of awards than the other faculties with doctoral degree(s).

Total Proposal Submitted in Dollar → From **(Figure 113A)** and **(113B)**, I found that for the faculty with no doctoral degree (type of doctoral degree = 0), there will be 1.53 unit decrease in *'Total Proposal in $'*. Similarly, for the faculty with Ph.D or M.D., there will be -1.277 and -1.789 unit decrease in *'Total Proposal in $',* respectively. Next, for a faculty who is also a chair of department, there will be 0.827 unit increase in *'Total Proposal in $'*. RAS Unit is an interesting variable as all levels in this variable indicate statistical significance based on p-value. It is also observed that their coefficients range anywhere between around -2.9 to -3.9. Thus, the following interpretation can be made: for the faculties across different RAS unit, there will be anywhere from 2.9 to 3.9 unit decrease in *'Total Proposal in $'*. Note that *CAPS* is the department with most notable (2.252) unit decrease in dependent variable; while, *Dept of Medicine* is the department with least notable (1.377) unit decrease in dependent variable. Lastly, for a faculty who holds tenure status, there will be 0.612 unit increase in *'Total Proposal in $'*.

Total Awards received in Dollar → From **(Figure 115A)** and **(Figure 115B)**, I found that only variables that belong to *'RAS unit'* are statistically significant with its coefficients ranging anywhere from -1.377 to -2.252. The most notable decrease (2.252 unit decrease) in *'Total awards received in $'* happens in the CAPS department while the least amount of decrease (1.377 unit) occurs in the department of medicine.