How do gender and marital status differ effect of work from home on staff performance?

Introduction

Working from home (WFH; sometimes also known as telecommuting or telework) becomes a famous terminology since the Covid-19 pandemic had started. While the populace is still assessing the impact of WFH on routine office operation, research conducted by Bloom et al. (2015) in a Shanghai call centre of a renowned Chinese travel agency, Ctrip[1], have concluded that WFH personnel have their performance better than those who worked in the office by approximately 13% and it is additionally observed that the WFH practice has no negative impact on the service performance.

There are omnipresent fears that WFH may be a risk to productivity as some members of staff may not working but slacking off due to the absence of supervisors and lack of a decent workplace atmosphere. Job nature, job complexity, staff autonomy during WFH, employee's connection, and how staff handle their non-work life are perceived as part of the driving factors in influencing the result of WFH (Olson, & Primps, 1984).

Bloom et al. (2015) conducted research, in which the data collected is publicly available, to assess the impact on performance by randomly sending volunteered employees in call-centre to WFH for a total of 9 months. During the experiment, office and home employees used the exact same set of equipment, had the same job duties, received identical compensation plan. This made the location of work the only difference between home and office workers. These home workers are not permitted to switch back to work in the office during the experiment. It is reported that those home-based workers received higher job satisfaction, lower attrition, and a surprisingly lower promotion rate. The experiment has proven the success of the WFH practice. Hence, after the 9-month experiment, Ctrip extended the option of WFH, letting employees choose between working from the office or home. Such a selection effect boosted the gain to 22%, reaffirming the benefit of the WFH approach in call-centre jobs.

Olson, & Primps (1984) indicated that individual characteristics could be exceptionally decisive when influencing the effect of WFH. To deepen the understanding of the impact of WFH on the workplace environment and especially how it may diverge among various workers, 2 key characteristics, gender, and marital status will be investigated on their differential effects of WFH on staff performance based on the already available data.

In the following sections, the hypothesis will firstly be illustrated. Subsequently, the exploratory data analysis will be displayed in detail and the paper concludes with a short conclusion.

Research Question

Numbers of scholars advocated that gender and marital status could make a difference when it comes to workplace and organization performance. Morrison (2009) indicating there is the gender difference in terms of tendency to leave the organization, team cohesion, and job satisfaction when it comes to workplace friendship. Fine, Sojo Monzon, & Lawford-Smith (2020) found out that gender diversity could improve firm and team performance due to difference in vocational behaviour. Padmanabhan, & Magesh (2016) concluded that unmarried employees tend to perform better than those who are married in the IT industry on the grounds that married workers requires more family commitment and more stress when balancing family and work life.

[1] In 2019, the company renamed Trip.

The new workplace management approach of WFH eliminated the physical barrier between employees' working part and non-working part of life (mainly family). Potential impact on the working performance can be foreseen as volunteers stayed at home during worktime which the time at home was more than pre-experiment. Performance of WFH labour may be affected by the increased working autonomy and isolation due to the absence of co-workers. The data of research provided basic information on individual staff including marital status, gender, age, whether having children, tenure etc. Adding on that the Bloom et al. (2015) paper focused on the general insight from the experiment that it did not illustrate any differences in the effect of experiment among diverse characteristics. Hence, gender and marital status are selected for further study.

Hypothesis

The analysis of this paper will solely be based on the data published by Bloom et al. (2015). Graphical representations of the data are thus adopted for facilitating hypothesis formation.

Figure 1: Performance Comparison by Marital Status

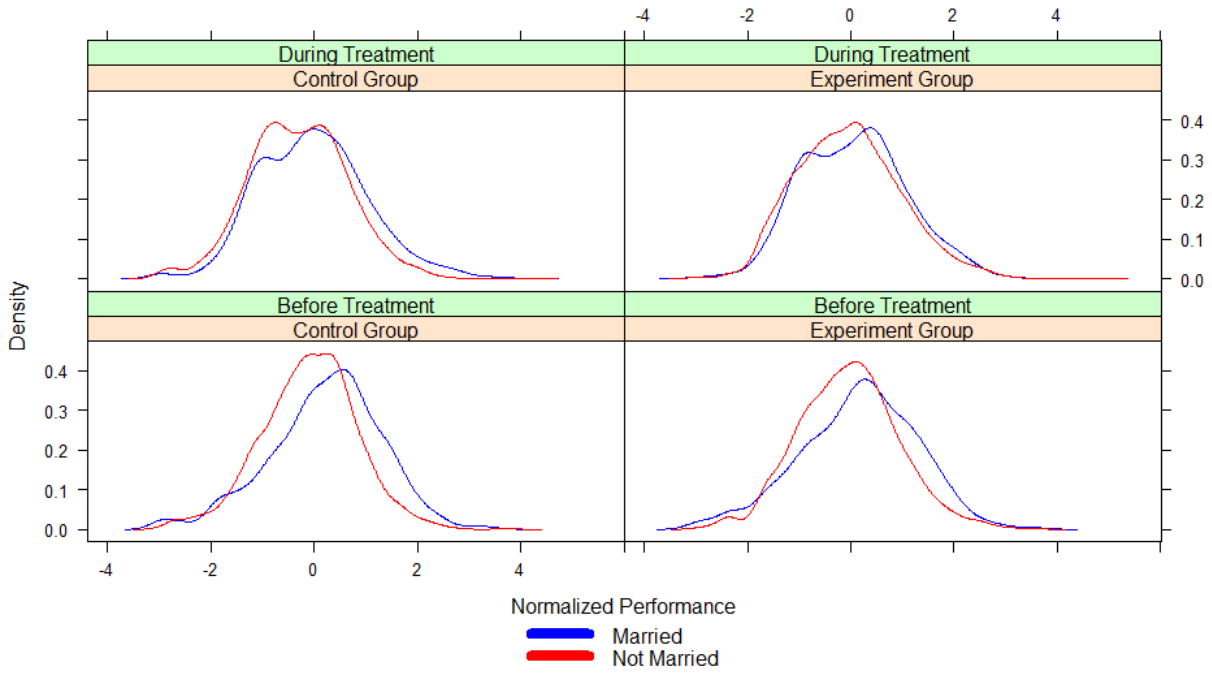

Figure 1 above is a density plot showing the distribution of normalized performance faceting the observation periods and observation groups, comparing the difference between marital status. From the figure, the differences between married and not-married group appear to be considerable. Before the experiment started, married people seem to perform better. With the reason yet to be discovered, this forms our 1st hypothesis: Marriage affects the performance of call-centre staff.

Figure 2: Performance Comparison by Gender

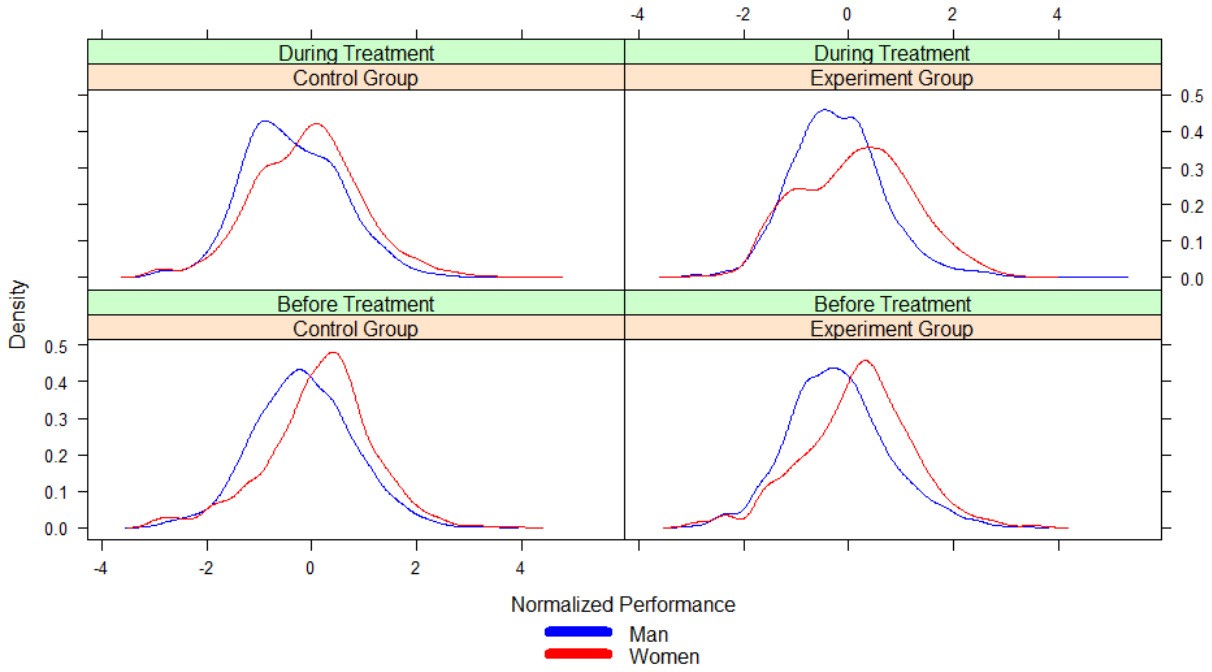

Figure 2 above is another density plot illustrating the distribution of normalized performance faceting the observation periods and observation groups, comparing the difference between gender. From the figure, the differences between men and women appear to be significant. Women appear to perform better than men both during the experiment and before the experiment. Based on this figure, it is believed that there is the difference in performance in between both genders. The 2nd hypothesis is formed: Gender affects the performance of call-centre staff.

Proposed Model

With the purpose of investigating how experiment differs among different group of research participants and with reference to the Bloom et al. paper (2015), the experiment's effect on individual performance with consideration on gender and marital status is estimated via equation (1):

$$Employee\ Performance_{i,t} = \propto Experiment_t + Treatment_i + \beta_t + \gamma_i + \varphi_i + \omega_i + \varphi_i\omega_i + \varepsilon_{i,t} - (1)$$

where variables are defined as follows:

- $Employee\ Performance_{i,t}$ is a z-score measure of workers' weekly performance with a mean = 0, and standard deviation = 1. z-score is adopted for making performance of diverse research participants comparable.
- $\propto$ is the effect of the experiment.
- $Experiment_t$ is a dummy variable which equals to 0 for the control period and equals to 1 for the experimental period.
- $Treatment_i$ is a dummy variable which equals to 0 if the research participant belongs to the control group of the experiment, and equals to 1 if the research participant belongs to the treatment group.
- β_t is a set of weekly time dummy variables.

- γ_i is a set of individual dummy variables, which is staff id of participants in this experiment.
- φ_i is a dummy variable for gender which equals to 0 if the research participant is female, 1 if the research participant is male.
- ω_i is a dummy variable for marital status which equals to 0 if the research participant is not married, 1 if the research participant is married.
- $\varphi_i \omega_i$ is the interaction effect between the two variables.
- $\varepsilon_{i,t}$ is the error term that may appear in the experiment.

To measure how gender and marital status affects performance when it comes to the experiment, several methods will be used, Pooled Ordinary Least Square (POLS), Fixed Effect Model, Random Effect Model, and First Differencing Method. In the findings section, the result from different models will be illustrated.

Exploratory Data Analysis

The data consists of numbers of demographic variables, including age, tenure, gender, marital status etc. Below, the relationship of some of these variables with the normalized performance regardless of the experiment will be investigated.

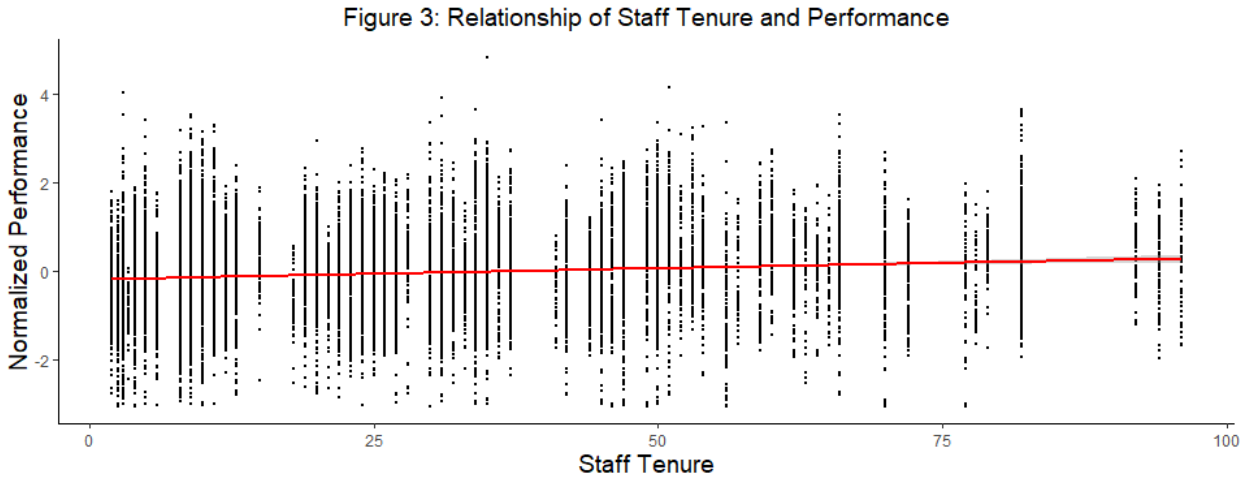

Figure 3 illustrated the relationship between staff tenure and their respective performance. Despite a trend that can still be observed in which the performance z-score increases with the tenure, the residual error appears to be graphically large. Besides, the correlation coefficient of these 2 variables is only 0.11. Hence, staff tenure may not be related to performance.

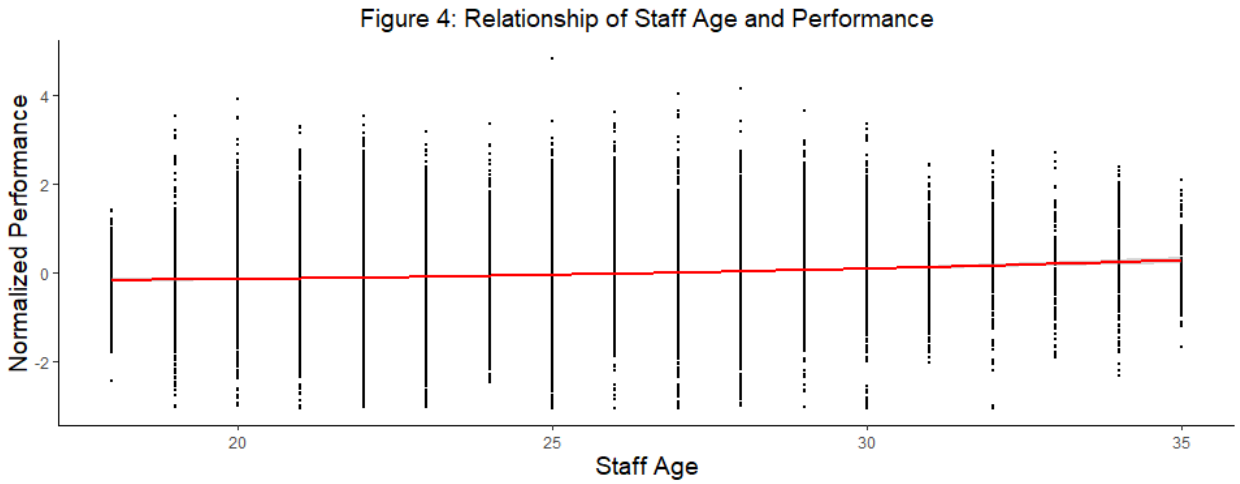

Figure 4 illustrated the relationship between staff age and their respective performance. There seems to be no relationship between these 2 variables. This means that age does not necessarily relate to one's performance as a call-centre staff. The correlation coefficient of 0.09 supports this belief.

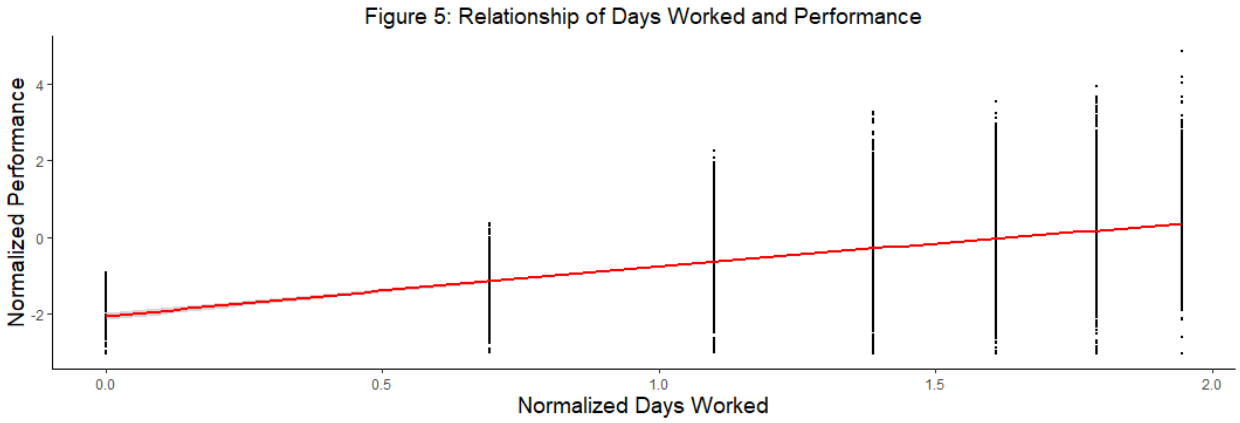

Figure 5 depicted the relationship between normalized days worked of the staff and their performance. There was a considerable increment in performance with the number of days worked during the experiment period. Normalized Days Worked is a normalized number of days the research participants attended to work. The number of days worked could varies among staff due to day leaves taken - sick leaves or other leaves. From the Figure 5, it was clearly visible that the more days staff attended to work, the higher their performance z-score. Such a relationship was then supported by the correlation coefficient of 0.39.

Figure 6: Relationship of Gross Wages and Performance

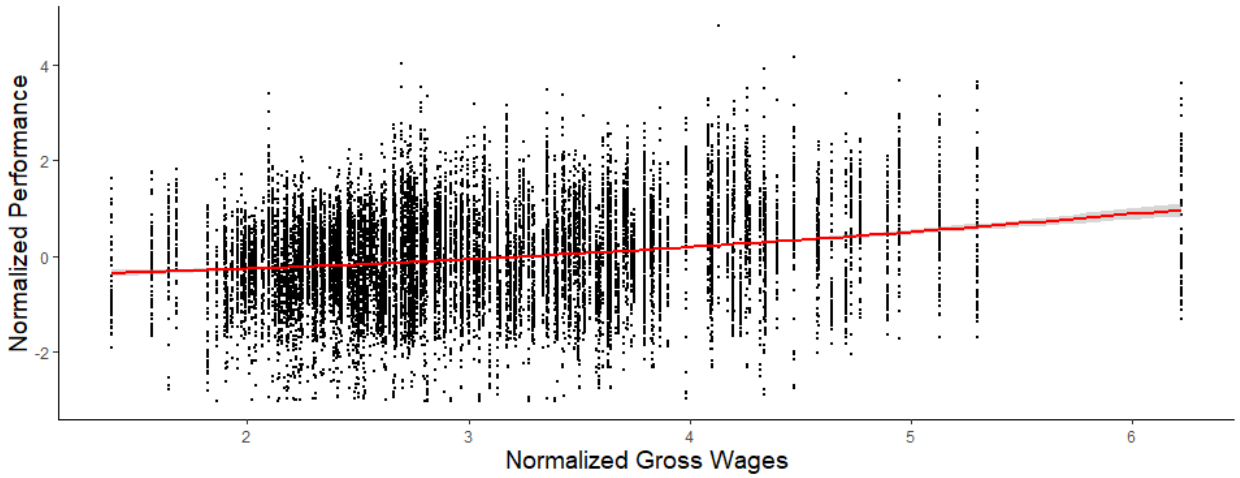

Figure 6 showed the relationship between the gross wages and the performance z-score of each staff. The gross wage comprises the basic salary rate and bonuses, as well as other supplementary payments for instance housing or travel subsidies. As shown in Figure 6, the Normalized Gross Wages is positively correlated to the performance z-score, which the correlation coefficient of these 2 variables is approximately 0.20.

The function of glht from the multcomp package is adopted in R for analysing the differences among means among different groups.

Table 1: Difference in performance between marital status in Hypothesis 1

Contrast Group	Estimate	Standard Error	T statistic	Adjusted P value
BCN - BCM	-0.323833	0.030026	-10.785156	0.00E+00
BEN - BEM	-0.205256	0.032747	-6.267907	5.08E-09
BEN - BCM	-0.277238	0.029004	-9.55847	0.00E+00
BCN - BEM	-0.251851	0.033655	-7.483283	4.83E-13
DCN - DCM	-0.282527	0.037467	-7.540641	3.29E-13
DEN - DEM	-0.109487	0.037347	-2.931645	6.24E-02

Data is separated into 2^3 = 8 groups for analysis in Table 1[2]. The data is splitted according to the value in $Treatment_i$, $Experiment_t$, and $Marital\ Status$. The group naming rules are as follows:

- B = Before (treatment = 0)
- D = During Treatment (treatment = 1)
- E = Experiment Group (expgroup = 1)
- C= Control Group (expgroup = 0)
- M = Married (married = 1)
- N = Not married (married = 0)

This means, in Table 1, DEM equals to During experiment, Experiment group and Married or BCN equals to Before experiment, Control group, and Not-married.

From table 1, it is clearly noted that the normalized value of performance among married staff are better than that of non-married with an absolute value of T-statistics more than 6 except for the comparing group of experiment group during the experiment (DEN and DEM), which is having

[2] Table 1 is a short-listed table. For the full table, please refer to Table A1 in the appendices.

the absolute value for t-statistics less than 3. These drew a conclusion that married staff is working generally better than non-married staff, despite the WFH treatment reduce the difference in the level of performance.

Table 2: Difference in performance between gender in Hypothesis 2				
Contrast Group	Estimate	Standard Error	T statistic	Adjusted P-value
BCM - BCF	-0.317235	0.027769	-11.424267	0.00E+00
BEM - BCF	-0.362511	0.027035	-13.409079	0.00E+00
BCM - BEF	-0.335819	0.027256	-12.320953	0.00E+00
BEM - BEF	-0.381095	0.026508	-14.376626	0.00E+00
DCM - DCF	-0.289316	0.034646	-8.350588	2.00E-15
DEM - DEF	-0.368495	0.030379	-12.130037	0.00E+00

The Table 2[3] is approximately the same except it compares Gender rather than Marital status. The grouping name of M means Male and F means Female. In Table 2, it could be realised that the normalized value of performance among female staff is better than that of Male with an absolute value of T-statistics more than 8. These drew a conclusion that female staff having better performance generally than male staff. These 2 tables indicated that both hypothesis - Gender and Marital affect the performance of call centre staff cannot be rejected.

Findings

Table 3: Regression Table of all 4 models				
	Dependent variable*:* Normalized Performance			
Independent Variables:	POLS	FD	FE	RANDOM
experiment_treatment	0.047***	0.195**	0.237***	0.022
	(0.017)	(0.079)	(0.024)	(0.017)
men	-0.392***			-0.387***
	(0.017)			(0.079)
married	0.085***			0.095
	(0.022)			(0.100)
men:married	0.264***			0.301*
	(0.034)			(0.157)
Constant	0.082***	0.015**		0.036
	(0.013)	(0.007)		(0.056)
Observations	18,044	17,795	18,044	18,044
R^2	0.040	0.0003	0.005	0.002
Adjusted R^2	0.039	0.0003	-0.014	0.002
F Statistic	185.607***	6.073**	93.406***	37.006***
	(df = 4; 18039)	(df = 1; 17793)	(df = 1; 17709)	
Note:				*p<0.1; **p<0.05; ***p<0.01

The above Table 3 listed the result of all 4 models attempted, where POLS = Pooled Ordinary Least Square Method, FD = First Differencing Method, FE = Fixed Effects Model, RANDOM = Random Effect Model.

Several tests were performed that the Random Effect Model stood out among all 4 models. A Lagrange Multiplier Test was conducted and indicated Random Effect was a legit model to be

[3] Table 2 is a short-listed table. For the full table, please refer to Table A2 in the appendices.

adopted (p-value < $2.2e^{-16}$). An F-test for two ways effect was also completed (p-value < $2.2e^{-16}$), implying Fixed Effect Model had a significant effect in predicting the performance than the Pooled OLS. The Hausman test done, indicated Random Effect was a more appropriate model when compared to Fixed Effect Model (p-value < $2.2e^{-16}$). As for First Differencing Model, the R-Squared and F-Statistics were much lower than other methods. Despite the test for serial correlation indicated that there was a serial correlation in the data (p-value < $2.2e^{-16}$), the reduction in sample size due to differencing and slight higher p-value of the F-statistics indicated that First Differencing was the sub-optimal model for estimation.

Surprisingly, the effect of WFH was not significant, the significant level was set at 0.05, as predicted in the Random effect model. It appears that the effect of gender, which female tended to perform better, was so great that other variables were not considered as significant when it came to assessing the effect of WFH treatment on one's performance as a call-centre staff.

Conclusion

The result of female tended to perform better implied that the gender itself became a significant indicator for estimating the staff's performance. While the WFH treatment could have a different effect on other individuals with other characteristics such as level of education and whether they have children at home. To better access other factors in affecting the WFH treatment, more analysis could be performed with these yet-to-analyse variables.

Reference

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Appendix

Table A1: Detailed difference among groups in Hypothesis 1				
Contrast	Estimate	Standard Error	T statistic	Adjusted P value
BCN - BCM	-0.323833	0.030026	-10.785156	0.00E+00
BEM - BCM	-0.071982	0.038241	-1.882333	5.47E-01
BEN - BCM	-0.277238	0.029004	-9.558470	0.00E+00
DCM - BCM	-0.248229	0.039702	-6.252309	2.87E-09
DCN - BCM	-0.530756	0.032539	-16.311392	0.00E+00
DEM - BCM	-0.160258	0.041390	-3.871869	2.54E-03
DEN - BCM	-0.269746	0.030213	-8.928050	0.00E+00
BEM - BCN	0.251851	0.033655	7.483283	4.83E-13
BEN - BCN	0.046594	0.022618	2.060066	4.25E-01
DCM - BCN	0.075604	0.035307	2.141355	3.73E-01
DCN - BCN	-0.206923	0.027002	-7.663301	1.23E-13
DEM - BCN	0.163574	0.037195	4.397725	2.39E-04
DEN - BCN	0.054087	0.024149	2.239749	3.13E-01
BEN - BEM	-0.205256	0.032747	-6.267907	5.08E-09
DCM - BEM	-0.176247	0.042513	-4.145708	7.30E-04
DCN - BEM	-0.458774	0.035915	-12.773793	0.00E+00
DEM - BEM	-0.088277	0.044094	-2.002005	4.64E-01
DEN - BEM	-0.197764	0.033823	-5.847108	6.12E-08
DCM - BEN	0.029009	0.034442	0.842265	9.90E-01
DCN - BEN	-0.253517	0.025861	-9.802954	0.00E+00
DEM - BEN	0.116980	0.036376	3.215874	2.68E-02
DEN - BEN	0.007492	0.022866	0.327661	1.00E+00
DCN - DCM	-0.282527	0.037467	-7.540641	3.29E-13
DEM - DCM	0.087970	0.045367	1.939075	5.07E-01
DEN - DCM	-0.021517	0.035466	-0.606692	9.99E-01
DEM - DCN	0.370497	0.039252	9.438938	0.00E+00
DEN - DCN	0.261010	0.027210	9.592365	0.00E+00
DEN - DEM	-0.109487	0.037347	-2.931645	6.24E-02

Table A2: Detailed difference among groups in Hypothesis 2				
Contrast	Estimate	Standard Error	T statistic	Adjusted P value
BCM - BCF	-0.317235	0.027769	-11.424267	0.00E+00
BEF - BCF	0.018584	0.026204	0.709185	9.97E-01
BEM - BCF	-0.362511	0.027035	-13.409079	0.00E+00
DCF - BCF	-0.235385	0.030092	-7.822121	1.43E-12
DCM - BCF	-0.524701	0.031776	-16.512642	0.00E+00
DEF - BCF	-0.000336	0.028075	-0.011968	1.00E+00
DEM - BCF	-0.368831	0.029147	-12.654273	0.00E+00
BEF - BCM	0.335819	0.027256	12.320953	0.00E+00
BEM - BCM	-0.045275	0.028055	-1.613801	7.40E-01
DCF - BCM	0.081850	0.031012	2.639301	1.40E-01
DCM - BCM	-0.207466	0.032648	-6.354567	4.00E-09
DEF - BCM	0.316899	0.029059	10.905375	0.00E+00
DEM - BCM	-0.051596	0.030096	-1.714388	6.76E-01
BEM - BEF	-0.381095	0.026508	-14.376626	0.00E+00
DCF - BEF	-0.253969	0.029620	-8.574277	1.89E-15
DCM - BEF	-0.543285	0.031329	-17.341420	0.00E+00
DEF - BEF	-0.018920	0.027568	-0.686291	9.97E-01
DEM - BEF	-0.387415	0.028659	-13.518177	0.00E+00
DCF - BEM	0.127126	0.030357	4.187714	7.16E-04
DCM - BEM	-0.162190	0.032026	-5.064259	1.69E-05
DEF - BEM	0.362175	0.028359	12.771253	0.00E+00
DEM - BEM	-0.006320	0.029420	-0.214828	1.00E+00
DCM - DCF	-0.289316	0.034646	-8.350588	2.00E-15
DEF - DCF	0.235049	0.031287	7.512678	3.98E-13
DEM - DCF	-0.133446	0.032252	-4.137597	9.18E-04
DEF - DCM	0.524365	0.032909	15.933588	0.00E+00
DEM - DCM	0.155870	0.033828	4.607688	1.00E-04
DEM - DEF	-0.368495	0.030379	-12.130037	0.00E+00