TITLE*

SUBTITLE

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25 February 2021

Abstract

ABSTRACT

Contents

*Code and data are available at: https://github.com/yangg1224/groupproject-.git

Table 1: First 6 rows Raw data

type	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Control	M5W	Toronto	Family Style	Franchise	11	Yes	No	1-10	20.11	No	No change	No change	44140
Control	L7C	Peel	Fine Dining	No	10	Yes	No	1-10	23.31	No	No change	No change	42217
Control	L7C	Peel	Family Style	No	2	Yes	Yes	1-10	16.74	No	No change	Decrease	37507
Control	L6A	York	Fast Casual	No	2	Yes	Yes	1-10	19.21	No	No change	No change	41194
Control	L6H	Halton	Premium Casual	No	1	Yes	No	1-10	15.22	No	No change	No change	56615
Control	L4Z	Peel	Fast Food	No	3	Yes	No	1-10	15.60	No	No change	No change	51303

1 Introduction

2 Data

2.1 Intervention

2.2 Data Gathering Method

2.3 Descriptive Analysis

After discussing data gathering method, we sampled data in R (R Core Team 2020). We totally have **3274** observations, and 14 of following features according to the questionnaires.

- `type` : Categorical identifier ["Treated" or "Control"] for each observation
- `Q1` : First three digits of the postcode
- `Q2` : Categorical identifier for distinguishing the type of restaurants
- `Q3` : Region name in GTA
- `Q4` : Describe whether the restaurant is a franchise ("Franchise" or "No")
- `Q5` : The length of the operation years for each restaurant
- `Q6` : Describe whether the restaurant offer takeout service ("Yes" or "No")
- `Q7` : Describe whether the restaurant offer delivery service ("Yes" or "No")
- `Q8` : Number of employees in the restaurant (category type)
- `Q9` : Average employee hourly rate (CAD)
- `Q10` : Describe whether the restaurant has been a site of a potential COVID case ("Yes" or "No")
- `Q11` : Describe the restaurant's fixed costs change situation
- `Q12` : Describe the restaurant's flexible costs change situation
- `Q13` : The restaurant's past month revenue (CAD)

The first six rows of raw data is shown in the Table1. (Table 1)

2.3.1 EDA

Taking a deep look at all the features from survey questionnaire, we learned some demographic features about the restaurants in GTA:

- From figure1(Figure 1) and figure2(Figure 2), we noticed that more restaurants are located in Toronto (around 500) and Peel (around 400). The number of restaurants in Hilton is similar to the number in Durham. Meanwhile, Casual dining takes the lead in the restaurant type in GTA, with around 26%. Then it comes to Family style restaurant, accounting for 20%. Fast food restaurant, fine dining restaurant and Premium casual restaurant almost equally make up 10%. There is no big difference between treated group and control group in terms of restaurant number and type distributions.

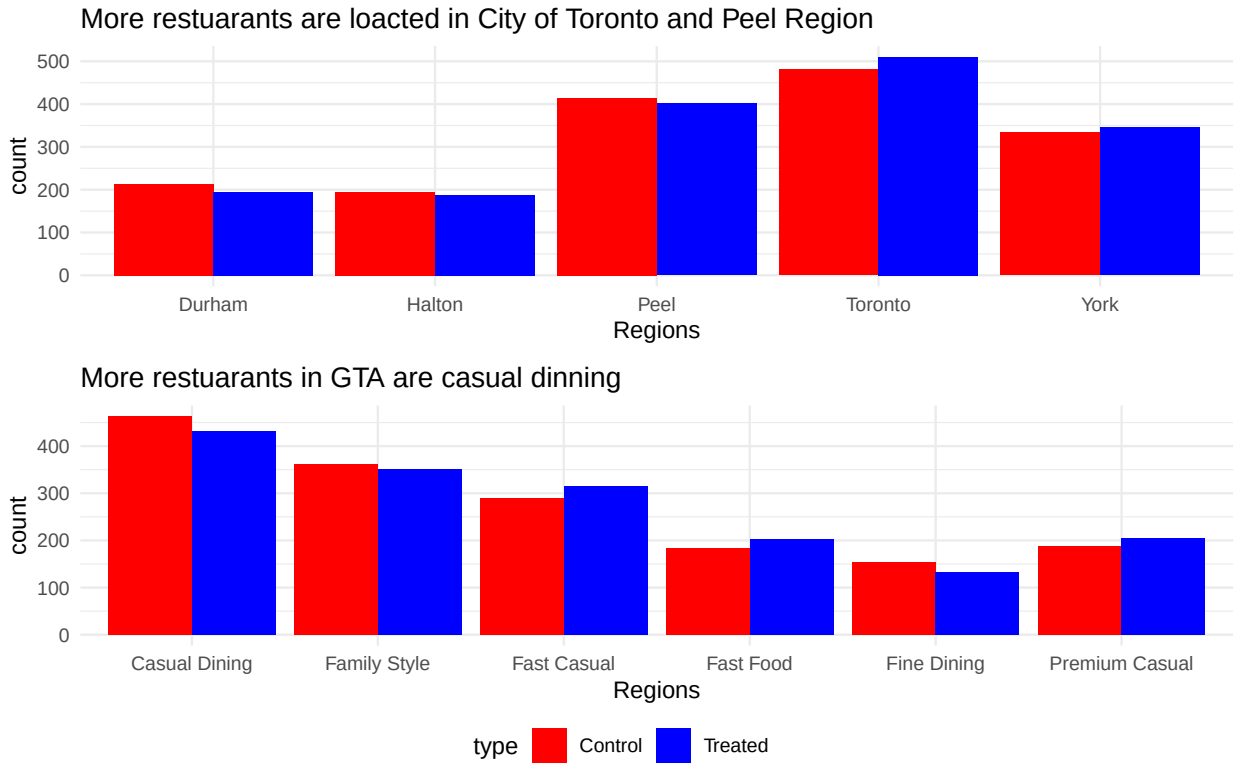


Figure 1: Restaurant numbers and types

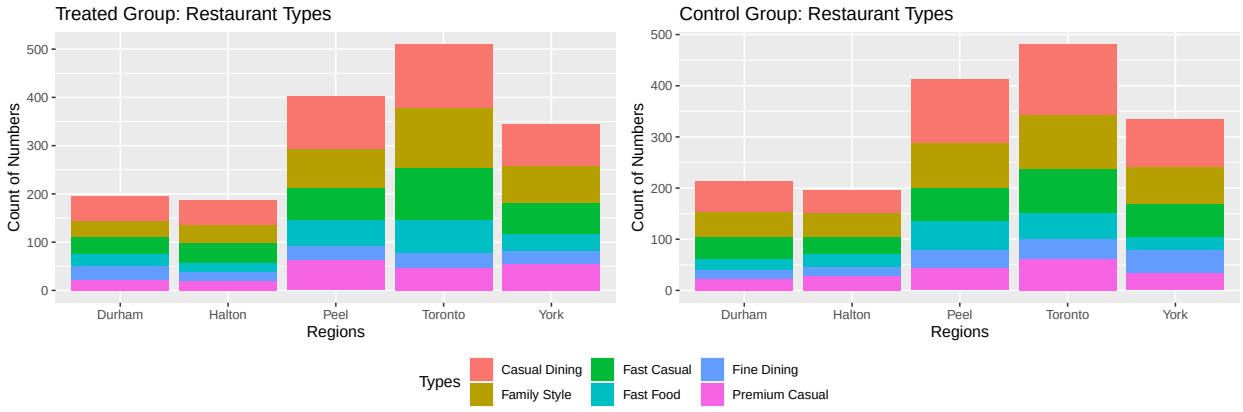


Figure 2: Restaurant types

- In terms of employees salary, the average hourly rate before and after intervention is both around 17 CAD. In contrast with two boxplots, we can see there is a slight increase in the treated group. The reason behind might because the employee take more risks to go for work, accordingly they will receive higher salary. (Figure 3)

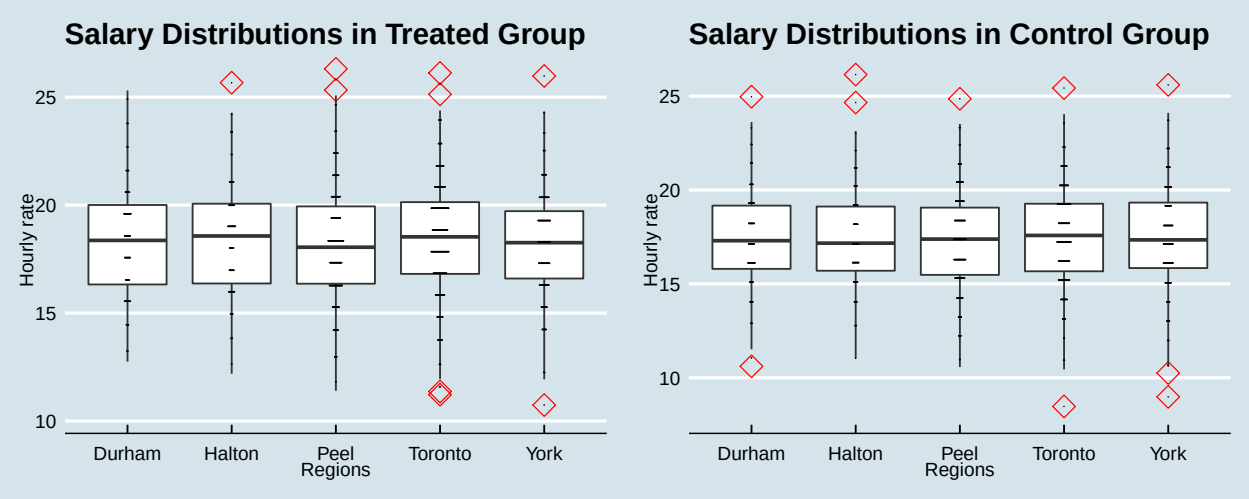
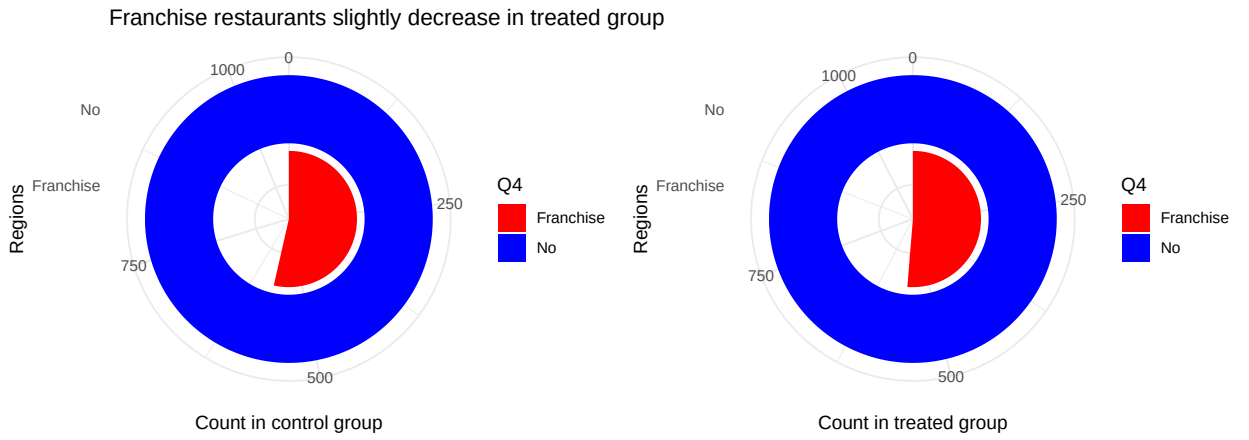


Figure 3: Employee salary distribution

- The attributes of the restaurant determine its management mode, so whether the restaurant is a franchise is quite important factor. From the pie charts (Figure **??**), we found the portion of franchise rate in treated group is slightly lower than control group. We assume in treated group, the branch franchise restaurants should follow the rules by the head office. Considering the potential cost of COVID issues, chain restaurants will face greater risks, which is why they are less likely to be in the treated group.



* The polar chart illustrates the employee numbers distribution, as can be seen in figure 5. (Figure 4) Because of COVID rule, no restaurant is allowed to open for large group dine in. So in the control group, there is 0 restaurant which has more than 30 employees. Most of restaurant has 10 to 20 employees.

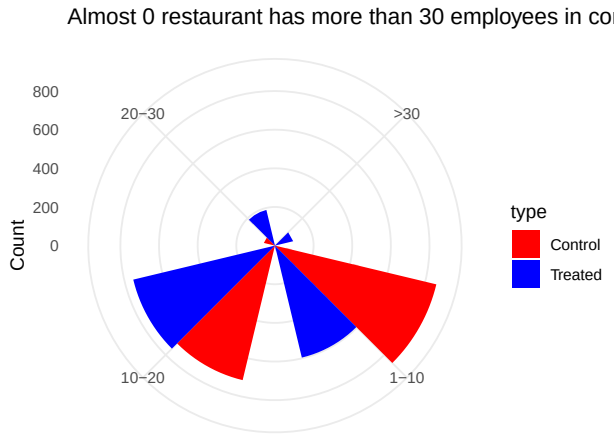


Figure 4: Empoyee numbers distribution

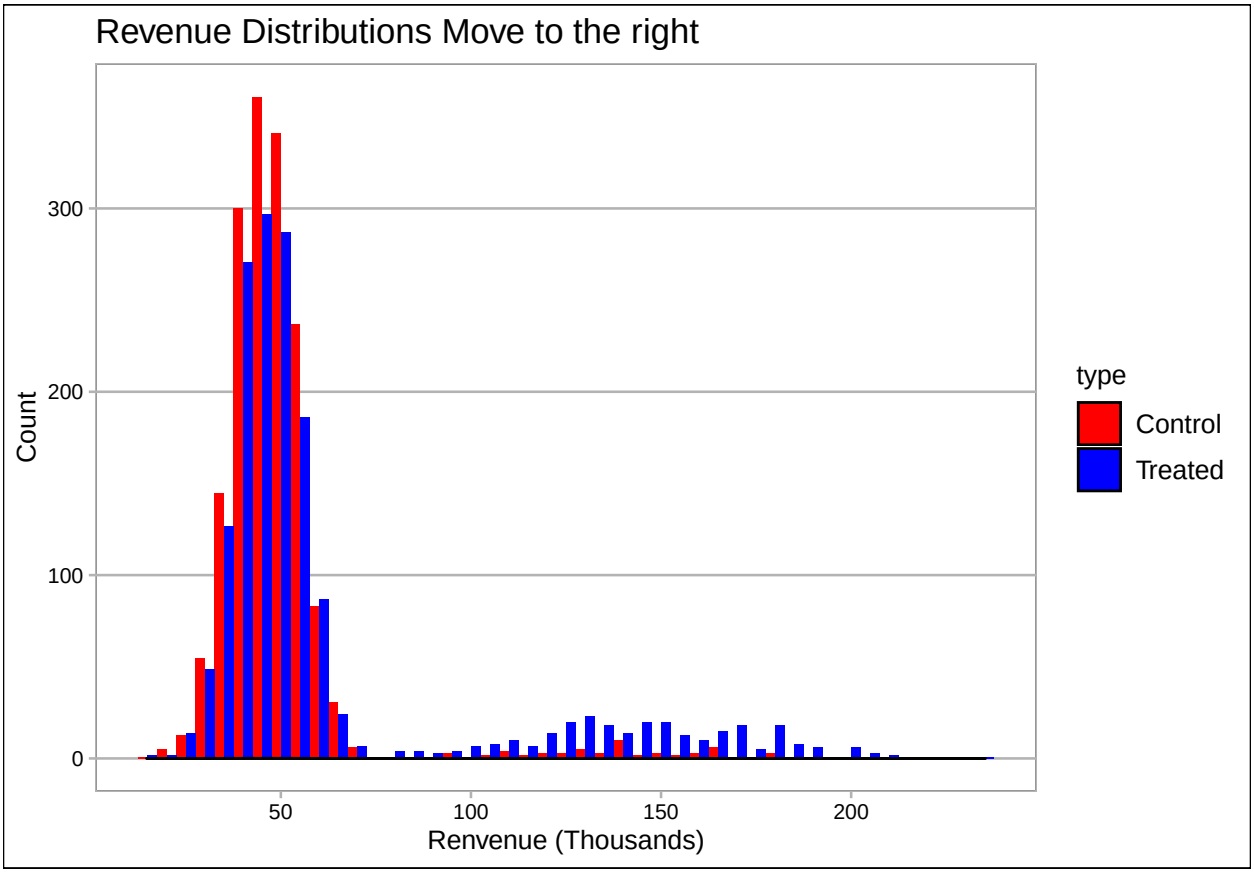
Table 2: T Test on the Restaurant's revenue

mean_of_Treated	mean_of_Control	p.value	conf.low	conf.high	method	alternative
63143.44	49358.97	0	11638.18	15930.76	Welch Two Sample t-test	two.sided

2.3.2 T-Test

The T Test is used to compare the sample mean of our Treated group and Control group. The goal is to determine whether the intervention has an effective effect on the treated group. Our hypothesis is the intervention will have positive impact towards the restaurant's revenue. (Kim 2015) The T test results is represented in the Table2(Table 2). The package **Broom**(Robinson, Hayes, and Couch 2021) is used to clean the t test results and convert it into the dataframe. The p value we get is $<$ 2.2e-16, as the p value would indicate a significant result, meaning that the actual p value is even smaller than 2.2e-16 (a typical threshold is 0.05, anything smaller counts as statistically significant).(Kim 2015) So we can interpret hypothesis not rejected which means the intervention has a significant effect on treated group.

2.3.3 Invention effect on Revenue distributions



Two merged histograms charts were used to illustrate the restaurant's revenue distribution. (Figure @ref(fig:revenue_distribution))

2.3.4 Invention effect on Flex and fiexed cost

2.3.5 Correlation matrix

3 Discussion

3.1 Overview

3.2 Findings

3.2.1 Finding ONE

3.2.2 Finding TWO

3.2.3 Finding THREE

3.3 Limitation

3.4 Future Directions

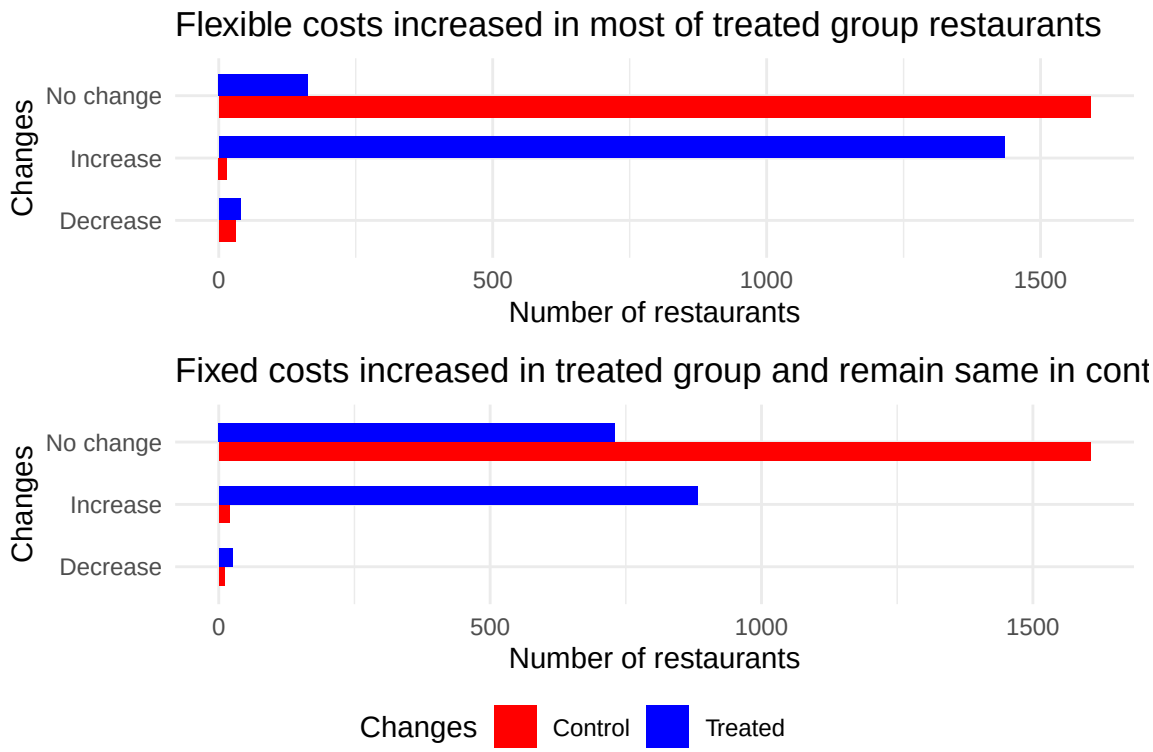


Figure 5: (#fig:felx_fix)Invention effect on Flex and fiexed cost

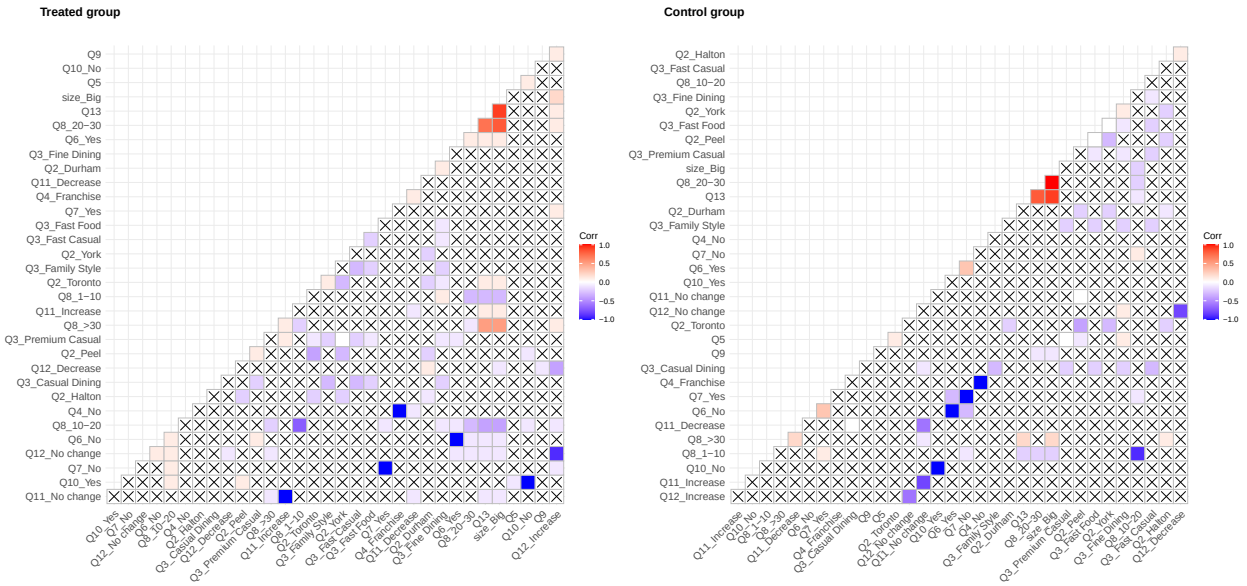


Figure 6: Correlation matrix

Table 3: Detailed information for stratification

Region	Number of Restuarants	Proportion(%)	Sample Selected
Toronto	7500	29.58	48430
Durham	3260	12.86	21051
York	5553	21.90	35858
Peel	6235	24.59	40262
Halton	2803	11.06	18100
Total	25351	100.00	1637

Table 4: Estimated Cost

Components	Cost per unit	Total cost for each component
Printing Cost	0.05	738.95
Envelope Cost	0.15	4433.70
Stamp Cost	0.55	16256.90

4 Appendix

4.1 Appendix A

4.2 Appendix B

References

Kim, Tae Kyun. 2015. "T Test as a Parametric Statistic." *Korean Journal of Anesthesiology* 68 (6): 540.

R Core Team. 2020. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

Robinson, David, Alex Hayes, and Simon Couch. 2021. *Broom: Convert Statistical Objects into Tidy Tibbles*. https://CRAN.R-project.org/package=broom.