Data for the Ontario Restaurant Closures Experiment*

Simulation Methods and Parameterization Research

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Abstract

This document explains how data for the Ontario restaurant closures experiment was simulated, including the research that was used for parameterization and the methods used to randomize data.

Contents

*Code and data are available at: github.com/amycfarrow/ontariorestaurantclosuresexperiment.

1 Introduction

Analysis for this project uses the R statistical programming language (R Core Team 2020), and more specifically, the `tidyverse` package for data manipulation (Wickham et al. 2019). Because the data is managed using R Projects, `here` is used to reference file locations (Müller 2020). `kableExtra` formats tables (Zhu 2020). `bookdown` is used to format the report (Xie 2020).

First, we read in the skeleton for the survey data in Table 1. This is what we would hypothetically know about a restaurant before they took the survey. We keep only the ID numbers, the group, and the last 3 characters of the postal code, which the survey-taker will have to enter to verify identity. All other variables, like name and full address, are only kept in the only frame for surveying, which contains no private information.

Table 1: Frame for surveys

ID	group	verify
101	control	7C5
102	control	2M7
103	control	4V3
104	control	1B1
105	treatment	0X2
106	treatment	0Y4
107	treatment	2A9
108	control	3L2
109	control	1H3
110	control	2A7

From there, data was simulated for all questions asked on the survey.

2 Type of service provided

2.1 Research

First, we used Yelp restaurant data to see how many Ontario restaurants offered different types of service in Table 2 and Table 3 ("Download Yelp Dataset" 2019).

Table 2: Yelp Ontario take-out data

RestaurantsTakeOut	count	percentage
FALSE	276	0.0627843
TRUE	4120	0.9372157

We used these percentages to estimate proportions of restaurants with take-out and dine-in service, in Table 4.

According to Ontario restaurant data from Yelp ("Download Yelp Dataset" 2019), approximately 6% of restaurants offer dine in service, 32.5% offer takeout, and 61.5% offer both.

Table 3: Yelp Ontario table service data

RestaurantsTableService	count	percentage
FALSE	1448	0.3293904
TRUE	2948	0.6706096

Table 4: Estimated service type proportions

service	percentage	digits
takeout	0.33	7
dinein	0.06	7
both	0.62	7

2.2 Survey 1 and 2

We randomly sampled to assign each restaurant to be "dinein", "both", or "takeout", with probabilities of 0.06, 0.615, and 0.325, in Table 5 and Table 6.

3 Demographic traits of owners: disability

3.1 Research

0.5% of small to medium enterprises in Canada are owned by persons with disabilities ("SME Profile: Ownership Demographics Statistics" 2020).

3.2 Survey 1 and 2

We randomly sampled to assign each restaurant to either "yes", "no", or "nonanswer", with probabilities of 0.005, 0.985, and 0.01, in Table 7 and Table 8.

4 Demographic traits of owners: racial and ethnic minorities and gender

Table 5: Adding service type to Survey 1 data

ID	group	verify	service_type
101	control	7C5	dinein
102	control	2M7	both
103	control	4V3	both
104	control	1B1	takeout
105	treatment	0X2	both
106	treatment	0Y4	takeout
107	treatment	2A9	both
108	control	3L2	both
109	control	1H3	dinein
110	control	2A7	dinein

Table 6: Adding service type to Survey 2 data

ID	group	verify	service_type
101	control	7C5	dinein
102	control	2M7	both
103	control	4V3	both
104	control	1B1	takeout
105	treatment	0X2	both
106	treatment	0Y4	takeout
107	treatment	2A9	both
108	control	3L2	both
109	control	1H3	dinein
110	control	2A7	dinein

Table 7: Adding owner disability status to Survey 1 data

ID	group	verify	service_type	disability
101	control	7C5	dinein	no
102	control	2M7	both	no
103	control	4V3	both	no
104	control	1B1	takeout	no
105	treatment	0X2	both	no
106	treatment	0Y4	takeout	no
107	treatment	2A9	both	no
108	control	3L2	both	no
109	control	1H3	dinein	no
110	control	2A7	dinein	no

Table 8: Adding owner disability status to Survey 2 data

ID	group	verify	service_type	disability
101	control	7C5	dinein	no
102	control	2M7	both	no
103	control	4V3	both	no
104	control	1B1	takeout	no
105	treatment	0X2	both	no
106	treatment	0Y4	takeout	no
107	treatment	2A9	both	no
108	control	3L2	both	no
109	control	1H3	dinein	no
110	control	2A7	dinein	no

Table 9: Populations in Ontario local health authorities

Info	haliburton	algoma	hamilton	windsor	simcoe	timiskaming	brant	sudbury	northwestern	waterloo	durham	southwestern
Total Population	179083	113084	536917	398953	540249	33049	134943	196448	76455	535154	645862	2e+05
Indigenous	4795	15365	12135	9870	24110	2760	7025	24045	28060	8980	12540	4e+03
Visible Minority	4655	2580	100055	70725	35055	500	10245	6345	1275	100025	173330	6e+03
Women	90755	57815	274390	202695	274225	16680	69160	99860	38260	270890	331190	1e+05

Table 10: Populations in treatment and control groups

Info	Ontario	Treatment	Control
Total_Population	13448494	1801335	1788702
Indigenous_Population_25%_sample	374395	69035	84675
Visible_Minority_25%_sample	3885585	213570	297250
Total_Population_Women	6889105	916560	910715

4.1 Research

We researched racial and ethnic minorities and women using census data broken down by local health authorities (Statistics Canada 2017), shown in Table 9, Table 10, and Table 11.

We established expected percentages for the treatment and control regions based on census data (Statistics Canada 2017).

15.6% of business owners are women in Canada ("SME Profile: Ownership Demographics Statistics" 2020).

Visible minorities are 25% of the population ("Number and Proportion of Visible Minority Population in Canada, 1981 to 2036" 2017).

12.2% of business owners are visible minorities ("SME Profile: Ownership Demographics Statistics" 2020).

Therefore, visible minorities are 0.49 as likely to own a business. Therefore, we can estimate that 0.058 of restaurant owners are a visible minority in the treatment group, and 0.081 in the control group.

Indigenous people have 3.7% service business ownership as opposed to 15.3% in the reference population ("Table a-1 Counts of Businesses Per 1,000 Residents by Province/Territory and Industry" 2019). They are 0.24 times as likely to own a service business in Ontario. Therefore, we can estimate that 0.009 of business owners in the treatment group are Indigenous, and 0.011 in the control group.

4.2 Survey 1 and 2

We randomly sampled to assign each restaurant to either "yes", "no", or "nonanswer", for the owner being Indigenous, a visible minority, or a woman, using the proportions above (with 0.01 set aside for "nonresponse"), in Table 12 and Table 13.

Table 11: Proportions in treatment and control groups

Info	Ontario	Treatment	Control
Total_Population	1	1	1
Indigenous_Population_25%_sample	0.028	0.038	0.047
Visible_Minority_25%_sample	0.289	0.119	0.166
Total_Population_Women	0.512	0.509	0.509

Table 12: Adding owner minority status and gender to Survey 1 data

ID	group	verify	service_type	disability	woman	indigenous	visible
101	control	7C5	dinein	no	no	no	no
102	control	2M7	both	no	no	no	no
103	control	4V3	both	no	no	no	no
104	control	1B1	takeout	no	no	no	no
105	treatment	0X2	both	no	yes	no	no
106	treatment	0Y4	takeout	no	no	no	no
107	treatment	2A9	both	no	yes	no	no
108	control	3L2	both	no	no	no	no
109	control	1H3	dinein	no	no	no	no
110	control	2A7	dinein	no	no	no	no

Table 13: Adding owner minority status and gender to Survey 2 data

ID	group	verify	service_type	disability	woman	indigenous	visible
101	control	7C5	dinein	no	no	no	no
102	control	2M7	both	no	no	no	no
103	control	4V3	both	no	no	no	no
104	control	1B1	takeout	no	no	no	no
105	treatment	0X2	both	no	yes	no	no
106	treatment	0Y4	takeout	no	no	no	no
107	treatment	2A9	both	no	yes	no	no
108	control	3L2	both	no	no	no	no
109	control	1H3	dinein	no	no	no	no
110	control	2A7	dinein	no	no	no	no

Table 14: Adding closures to Survey 2 data

ID	group	verify	service_type	disability	woman	indigenous	visible	shutdown
101	control	7C5	dinein	no	no	no	no	none
102	control	2M7	both	no	no	no	no	none
103	control	4V3	both	no	no	no	no	none
104	control	1B1	takeout	no	no	no	no	none
105	treatment	0X2	both	no	yes	no	no	temporary
106	treatment	0Y4	takeout	no	no	no	no	none
107	treatment	2A9	both	no	yes	no	no	temporary
108	control	3L2	both	no	no	no	no	none
109	control	1H3	dinein	no	no	no	no	none
110	control	2A7	dinein	no	no	no	no	none

5 Shutdowns

5.1 Research

43.2% of restaurants shut down temporarily due to the pandemic ("Impact of Covid-19 on Business or Organization Status, by Business Characteristics" 2021).

3% closed of restaurants in the US closed permanently between March and June (Sparks 2020). This period was about six times as long as our two week closure.

6 Survey 2

We randomly sampled to assign each restaurant to either "none", "temporary", or "permanent" for shutdowns, with probabilities of 0.558, 0.432, and 0.01, in Table 14.

7 Revenue

7.1 Research into restaurant revenue

In 2019, there were 25,836 restaurants and eating-places that were employers ("Canadian Business Counts, with Employees, December 2019" 2021) and 6,968 restaurants that were not employers ("Canadian Business Counts, Without Employees, December 2019" 2021) in Canada, for a total of 32,804 restaurants.

In the same year, full-service restaurants had $13,456,600,000 in revenue, and limited-service eating places had $14,082,700,000 in revenue ("Food Services and Drinking Places, Summary Statistics" 2021).

From this, we can calculate an estimated $69,959 average revenue per month.

From an analysis of Kaggle restaurant data ("Kaggle Restaurant Revenue Prediction" 2019), we can see that restaurant revenue looks like an F-distribution. The distribution rf(n, df1, df2, ncp) = rf(num_rest, 20, 20) gives an approximately correct shape. Using the F-distribution formula, we know the distribution has a mean of 10/9, so we would multiply by 62,963 to get the mean to 69,959.

7.2 Survey 1

We randomly sampled from the above F-distribution to generate revenues for the restaurants, in Table 15.

Table 15: Adding revenue to Survey 1 data

ID	group	verify	service_type	disability	woman	indigenous	visible	revenue
101	control	7C5	dinein	no	no	no	no	39438
102	control	2M7	both	no	no	no	no	54313
103	control	4V3	both	no	no	no	no	78926
104	control	1B1	takeout	no	no	no	no	56312
105	treatment	0X2	both	no	yes	no	no	90603
106	treatment	0Y4	takeout	no	no	no	no	32325
107	treatment	2A9	both	no	yes	no	no	38142
108	control	3L2	both	no	no	no	no	33071
109	control	1H3	dinein	no	no	no	no	75825
110	control	2A7	dinein	no	no	no	no	41174

7.3 Research into changes in revenue due to closures

First, the revenues from the first survey will have a randomized factor (normal distribution with a mean of 1 and a standard distribution of 0.1) to add some random variance between months.

Second, places that are closed permanently will be assumed to experience -75% average revenue, and temporary shutdowns will be assumed to experience -50% revenue.

Revenues went to -35% during the first lockdown wave in March (Dixon 2020). We will assume that these numbers are accurate for a dine-in/takeout restaurant that is experiencing a takeout-only closure. They are closed 14 out of 31 days, so we will assume average losses of -17%.

We will assume that takeout-only restaurants will not have losses on average, and dine-in only places will have -100% revenue on average for the days they are closed. With closures 14 out of 31 days in the month, dine-in only will have average losses of -45%.

All businesses had a median decrease of -15%, but visible minority-owned businesses had a median decrease of -25% ("Business or Organization Revenue from August 2020 Compared with August 2019, by Business Characteristics" 2021). Therefore, an additional -12% will be applied to visible minority-owned restaurants.

There seems to be no significant difference in business losses for disabled owners or female business owners ("Business or Organization Revenue from August 2020 Compared with August 2019, by Business Characteristics" 2021).

7.4 Survey 2

We started by randomly sampling from the same F-distribution multiplied by 62963, but also multiplied by random sampling from normal distribution centred at 1, with a standard deviation of 0.1, to add some variation from the previous data. For the treatment group data, we then applied a factor that reduced revenue based on level of shutdown (0.5 for temporary and 0.25 for permanent), another factor that reduced revenue based on service type (0.55 for dine-in and 0.83 for both), and another factor that reduced revenue based on minority status (0.88 for minority business owners). This can be seen in Table 16.

8 Number of employees

8.1 Research

Restaurants averaged $82,000 in yearly sales (gross revenue) per full-time equivalent employee ("2019 Restaurant Industry Factbook" 2019). Therefore, we can estimate 6,833 monthly revenue per full-time equivalent employee.

Table 16: Adding revenue to Survey 2 data

ID	group	verify	service_type	disability	woman	indigenous	visible	shutdown	revenue
101	control	7C5	dinein	no	no	no	no	none	81215
102	control	2M7	both	no	no	no	no	none	61801
103	control	4V3	both	no	no	no	no	none	34067
104	control	1B1	takeout	no	no	no	no	none	53220
105	treatment	0X2	both	no	yes	no	no	temporary	13975
106	treatment	0Y4	takeout	no	no	no	no	none	59474
107	treatment	2A9	both	no	yes	no	no	temporary	27349
108	control	3L2	both	no	no	no	no	none	52842
109	control	1H3	dinein	no	no	no	no	none	81735
110	control	2A7	dinein	no	no	no	no	none	58263

Table 17: Adding employment numbers to Survey 1 data

ID	group	verify	service_type	disability	woman	indigenous	visible	revenue	ft	pt
101	control	7C5	dinein	no	no	no	no	39438	5	2
102	control	2M7	both	no	no	no	no	54313	6	3
103	control	4V3	both	no	no	no	no	78926	9	5
104	control	1B1	takeout	no	no	no	no	56312	7	3
105	treatment	0X2	both	no	yes	no	no	90603	10	6
106	treatment	0Y4	takeout	no	no	no	no	32325	4	2
107	treatment	2A9	both	no	yes	no	no	38142	4	2
108	control	3L2	both	no	no	no	no	33071	4	2
109	control	1H3	dinein	no	no	no	no	75825	9	5
110	control	2A7	dinein	no	no	no	no	41174	5	3

In January 2021, there were 2187300 full time sales and service employees in Canada and 1164000 part time sales and service employees ("Average Usual Hours and Wages by Selected Characteristics, Monthly, Unadjusted for Seasonality (X 1,000)" 2021). Therefore, there are 1.9 full time employees per part time employee. Part time employees in service and sales averaged 16.6 hours per week ("Average Usual Hours and Wages by Selected Characteristics, Monthly, Unadjusted for Seasonality (X 1,000)" 2021). We will assume that 2 PTE = 1 FTE, or 1 PTE = 0.5 FTE. Therefore, for every 1.9 + 1 employees, there are 1.9 + 1*0.5 FTE. For every 2.9 employees, there are 2.4 FTE.

$1.9/(1.9 + 0.5) = 1.9/2.4 = 0.79$

$1/(1.9 + 0.5) = 1/2.4 = 0.42$

8.2 Survey 1

We divided revenue by 6833, multiplied by 0.79 and rounded to find the number of full time employees, and multiplied by 0.42 and rounded to find the number of part time employees, in Table 17.

8.3 Survey 2

For the second survey, we will assume that treatment restaurants shifted towards part time random amounts– that is, the number of full time employees per part time employee dropped from 1.9, a small drop that varied per restaurant.

We divided revenue by 6833. We used the absolute value of random sample of a normal distribution centred

Table 18: Adding employment numbers to Survey 2 data

ID	group	verify	service_type	disability	woman	indigenous	visible	shutdown	revenue	ft	pt
101	control	7C5	dinein	no	no	no	no	none	81215	9	5
102	control	2M7	both	no	no	no	no	none	61801	7	4
103	control	4V3	both	no	no	no	no	none	34067	4	2
104	control	1B1	takeout	no	no	no	no	none	53220	6	3
105	treatment	0X2	both	no	yes	no	no	temporary	13975	2	1
106	treatment	0Y4	takeout	no	no	no	no	none	59474	7	4
107	treatment	2A9	both	no	yes	no	no	temporary	27349	3	2
108	control	3L2	both	no	no	no	no	none	52842	6	4
109	control	1H3	dinein	no	no	no	no	none	81735	9	6
110	control	2A7	dinein	no	no	no	no	none	58263	7	4

Table 19: Adding nonresponse to Survey 1 data

ID	group	verify	service_type	disability	woman	indigenous	visible	revenue	ft	pt
252	control	0A1	takeout	no	no	no	no	127665	15	8
255	treatment	4L2	takeout	no	no	no	no	47973	6	3
257	control	4L9	both	no	yes	nonanswer	no	54359	6	3
262	control	6X2	takeout	no	no	no	no	70719	8	4
271	treatment	1G3	takeout	no	yes	no	no	61141	7	4
272	treatment	2B8	both	no	no	no	no	208977	24	13
277	treatment	3R3	takeout	no	no	no	no	12557	1	1
279	treatment	ON	takeout	no	no	yes	no	43158	5	3
284	control	1A3	takeout	no	no	no	yes	53052	6	3
287	treatment	3K9	takeout	no	no	no	nonanswer	56577	7	3

at zero, with a standard deviation of 0.1, as a factor to decrease the part-time ratio of 1.9. We then used the new ratio to calculate the number of full-time and part-time employees. This can be seen in Table 18.

9 Non-response

9.1 Research

A professional mail survey with follow up found a non-response rate of 61% (Suominen et al. 2012). We will also assume that some people will mail in answers and fill in the form incompletely.

9.2 Survey 1 and 2

We randomly sampled to assign each row as "yes", "partial", or "no", with probabilities 0.6, 0.01, and 0.39, for nonresponse. We then discarded all the "no" rows. For the partial rows, we randomly selected a column to delete the data for. This can be seen in Table 19 and Table 20.

10 Budget

We Calculated our budget based on Canada Post's business costs ("Get Business Letter Discounts," n.d.), Ontario's minimum wage ("Minimum Wage" 2020), and pricing for data management systems for surveys ("Individuals and Small Teams," n.d.). The budget can be seen in Table 21.

Table 20: Adding nonresponse to Survey 2 data

ID	group	verify	service_type	disability	woman	indigenous	visible	shutdown	revenue	ft	pt
239	control	7T2	both	no	no	no	no	none	56283	6	4
243	control	5L4	both	no	no	no	no	none	88978	10	6
244	treatment	4Y8	dinein	no	no	no	no	none	57120	7	4
247	control	2L1	both	no	no	no	no	none	43296	5	3
248	control	3A4	takeout	no	no	no	yes	none	37485	4	2
253	treatment	1L0	takeout	no	no	no	no	temporary	46044	5	4
257	control	4L9	both	no	yes	nonanswer	no	none	51500	6	3
258	treatment	7N1	both	no	no	no	no	temporary	13398	2	1
259	control	3G1	both	no	no	no	no	permanent	14935	2	1
263	treatment	2V4	both	no	no	no	no	none	41888	5	3

Table 21: Total survey budget

Item	Cost	Description
Data Management	1300	Online survey management account fees
Phone Interviewer Wages	2001	1,203 calls (7 minutes on average) at $14.25/hr
Postage	3410	4,012 mailers at $0.85/ea
TOTAL	6711	

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