The Effect of Social Distancing Mandates on Small Commercial Electricity Users across Ontario

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Abstract

Social distancing mandates were and are used to slow the diffusion of Covid-19 in Ontario. With the exception of Toronto, these mandates are uniform across the province. Electricity consumption is highly correlated with socioeconomic activity. We used the year over year decline in electricity usage of small businesses as a proxy for voluntary and mandated social distancing. Our identification of voluntary social distancing relies on infrequent changes in province wide government mandates. We use both within and across Public Health Units changes in daily electricity usage in response to same day news about disease diffusion to measure the extent of voluntary social distancing, while holding mandates constant. Our estimates show that residents change how they practice social distancing based on same day reports of new infections in their community. In areas with low infection rates, most of their behavior are determined by the provincial wide mandates. These findings suggests that public health units should also provide accurate and timely public information on the diffusion of the disease because residents adjust quickly to that information. Easing social distancing mandates in locations with few cases would lead to increased economic activity in a safer way than uniformly lifting social distancing practices across the province.

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1 Introduction

The first reported case of Covid-19 infection in Ontario was reported on January 25, 2020 in Toronto. Then the disease spreaded rapidly and unevenly across Ontario. As of April 26, there were 14,413 confirmed cases.[1] There are 49 census divisions in Ontario which are allocated to 34 public health units (PHUs).[2], demonstarted in Figure (1). Figure (2) shows the diffusion of daily confirmed new cases across Ontario in three groups of PHUs. On most days, Toronto has more new cases that the twenty three PHUs with the least total confirmed cases in April. Figure (3) shows the distribution of total confirmed cases per 10,000 individuals by PHUs On May 20, 2020. It shows that the current infection rates differ significantly across PHUs, the highest infected areas have more than ten times the rate of infections compared to the lowest infected ones.

In order to slow the diffusion of the disease, federal and Ontario policy makers successively imposed more and more stringent social distancing mandates.[3] Table (1) shows the dates in which different federal and Ontario social mandates were imposed. Toronto had additional mandates (Table (2)). There are two broad features to these mandates. First, with the exception of Toronto, they are imposed uniformly across Ontario.[4] Second, most of these mandates were imposed within a short time window, between March 13 and 18. For a convenient summary, Figure (4) plots the cumulative sum of the various shutdown mandates for both Ontario and Toronto. On May 8, Statistics Canada released its latest Labour Force Survey which was for the month of April. In February, there were 7.5 million employed workers in Ontario. In March 403,000 Ontario workers lost their jobs and 800,000 workers experienced declines in their hours of work. During April, a further 690,000 workers lost their jobs.

There are over two million elementary and high school students and over half a million university students in Ontario. All their schools were physically closed. Elementary and high school students are at home. On May 8, Statistics Canada released its latest Labour Force Survey which was for the month of April. In February, there were 7.5 million employed workers in Ontario. 403,000 Ontario workers lost their jobs and 800,000 workers experienced declines in their hours of work in March. In April, a further 690,000 workers lost their jobs.

This paper examines real time voluntary social distancing behavior over and above what was imposed by government mandates across the province of Ontario. In general, it is difficult to separately identify voluntary versus mandated social distancing behavior. Social mandates are not exogenous and respond to

[1] Data on infections from Berry I, Soucy J-PR, Tuite A, Fisman D. Open access epidemiologic data and an interactive dashboard to monitor the COVID-19 outbreak in Canada. CMAJ. 2020 Apr 14;192(15):E420. doi: https://doi.org/10.1503/cmaj.75262

[2] Densely populated census divisions have their own PHUs.

[3] The social distancing mandates measures are from Rida Aamer, "COVID-19 Social Distancing Mandates and Shutdowns in Ontario, May 11, 2020", < https: \ \ www.covid.economics.utoronto.ca >

[4] There were minor exceptions in a few other PHUs such as Mississuaga shutting down their playgrounds before Toronto.

the diffusion of the disease. Our identification strategy relies on daily measures of electricity usage in different public health units in Ontario (34 PHUs in all). Except for Toronto, social distancing mandates are uniform across the province and they do not change daily. There are daily reports of new cases of infections by public health units, PHUs, across Ontario. Thus our identification strategy is based on studying the variations in daily electricity usage with same day reports of new cases and current stock of infections within PHUs, and across PHUs with different mandate regimes.

As Ontario begins to consider relaxing social distancing mandates, it is important to estimate the extent of crowd out, i.e. how much voluntary social distancing is displaced by government mandates. Towards that end, we also estimate a social distancing model which includes an interaction effect between news on disease diffusion and government mandates.

Using daily electricity usage as a proxy for social distancing, our empirical results show that most daily social distancing behavior are due to government mandates. Voluntary daily social distancing behavior in a PHU responds to same day reports of new cases and the stock of infection in that community. Finally, we obtained very imprecise estimate of the interaction effect between disease diffusion and mandates on usage. This imprecision is likely to due to the fact that our current sample does not have sufficient variation in the mandate index. In particular, it does not include any data on the relaxation of mandates. At this point, we are unable to provide an estimate of the crowd out effect of social distancing mandates.

Our results provide two normative suggestions. First, public health authorities should provide timely and accurate public information about the local diffusion of the disease. Second, easing social distancing mandates in locations with few cases will lead to increased economic activity in a safer way than uniformly lifting social distancing practices across the province.

2 The Effects of Social Distancing Mandates on Electricity Usage in PHUs

Currently there is no systematic high frequency data at the census division level, daily or weekly, on the socioeconomic effects of adherence to social distancing mandates in Ontario. With non-essential businesses shut down and workers in essential businesses working at home, commercial electricity usage has significantly declined. Analysts have long used high frequency electricity consumption to track economic activity.[5] This provides a source of high frequency data which allows for estimating the impacts of mandates and news about disease diffusion on economic activity.

This paper analyzes daily aggregate electricity usage by small commercial users ($\leq$ 50 kWh) at the PHU level in Ontario from 2018 to April 15, 2020.[6]

[5] Stern (2018) is a survey.

[6] The Independent Electricity System Operator provided aggregate hourly electricity usage

The small commercial class includes customers such as bulk metered multi-residential units of up to 6 apartments or townhouses, most farms that have 3-phase service, and small retail outlets without significant electric equipment load. This may include corner stores depending on the amount of refrigeration and restaurants depending on the fuel for cooking and water heating.[7]

We address the following questions:

1. How does social distancing, both voluntary and mandated, affect daily electricity usage by small commercial users?

2. Is adherence to social distancing uniform across Ontario or do they differ by PHUs?

3. Is there voluntary social distancing over and above what is imposed by government mandates?

4. Is there evidence of crowd out? I.e., is the voluntary social distancing response to news about new cases smaller when mandates are tighter?

Using over a quarter of a century of French data on viral epidemics, Adda (2016) showed that social distancing reduced the spread of the epidemics but was not cost effective. Allcott, et. al. (2020); Cornelson and Miloucheva (2020) showed that political affiliations affected compliance to social distancing mandates and recommendations. Other researchers have also done work on the decline in electricity usage and the Covid-19 pandemic. Chen, et. al. (2020), et. al. explore the relationships between electricity usage with new cases and deaths due to Covid-19, mobility data, unemployment claims, gross measures of social distancing mandates across European countries and US states. Cicala studies the recent decline in electricity usage across European countries. Leach, et. al. studies the decline in electricity usage in February to April across different provinces in Canada. We build on their work. Compared with those studies, we have significantly finer regional variation in the diffusion of disease and electricity use. We also have detailed social distancing mandate indices. The more granular data allows us to differentiate between voluntary and mandated declines in electricity usage, and to investigate crowd out. Also due to our finer grain data, we estimate real time responses of daily usage to same day reports of disease diffusion in the community.

Figure (5) show aggregate daily electricity usage by small commercial users (hereafter users) for three different groups of PHUs in 2020. Although the PHUs are different in terms of socioeconomic characteristics, the users in the sample are similar because the data consists of only small commercial users. Toronto and the next ten largest PHUs in terms of total confirmed infections have more electricity usage than all the other 23 PHUs. There were declines in commercial

data for small commercial users by census division in Ontario. No individual level data was provided.

[7] https://www.oeb.ca/sites/default/files/OEB-Staff-Report-Rate-Design-20190221.pdf, p. 11.

electricity usage for all groups. There were also strong day of week and other calender effects. In order to control for these calender effects, Figure (6) shows the difference in log aggregate daily electricity usage by users in 2020 relative to the average of daily log usage in 2018 and 2019 for the three different groups of PHUs.[8] The first observation is that daily log changes in electricity usage were the same for all three different groups of PHUs. Users in all three groups used on average the same amount of electricity in January and February 2020 as compared with the previous two years. Average usage fell in March and to roughly 20% lower than the previous two years by April 15, 2020. Independent of their exposure to Covid-19, most PHUs experienced at least a daily 16% fall in electricity usage in March and the first weeks of April. This decline in electricity usage is significantly larger than what would have been predicted by the percentage changes in the labour market for the month of March.

Figure (7) shows the average of the daily log changes in usage in 2020 compared with the daily average in 2018 and 2019 by PHUs. The plots are arranged by PHUs with decreasing total currently infected per 10,000 population from April 07-15. This figure shows that most PHUs experienced a significant decline in electricity usage in March and April. Moreover, the declines were increasing in the infection rates. However since most PHUs have seen an increase in infections over time, it is not surprising to see social distancing increasing with time. To see whether PHUs with higher infection rates have larger declines in electricity use, the top half of Figure (8) shows that the distribution of the average current infection rates from April 7-15, 2020 per 10,000 individuals by PHUs. The bottom half of the figure shows the average of the log declines in daily electricity usage relative to previous years by the corresponding PHUs from March 15-April 15. There is, at best, a weak negative correlation between infection rates and decline in usage across PHUs.

3 Voluntary Versus Mandatory Social Distancing by PHUs

Individuals responded to social distance voluntarily when they received news and public information about the spread of the diseaese in the community. They also responded to social distancing mandates. In some regions, the social distancing mandates may have been binding which means that the voluntary responses would not have been active.

We examine the relative importance of these two causes of social distancing using regression analysis. We study how the log change in daily electricity usage at the PHU level changed with two groups of factors: (1) Changes in daily reports of the course of the disease measured by changes in a three day moving average of reported daily new cases and number of total currently infected per 10,000 population in the PHU, (2) changes in social distancing mandates issued by the government as measured by social distancing mandates indices and

[8] Exact definition in equation 1 below.

these indices interacted with the log of population density of the PHU, and (3) interaction effects between the disease and mandates.[9] We average new cases over three days because the daily new cases data is noisy with non-systematic reporting lags across and within PHUs.

Table (3) show the characteristics of the 34 PHUs. The mean population per PHU is a little under four hundred thousand. There is significant variation in populations across PHUs. The variation in population densities across PHUs is also large. Other than Southern Ontario where Toronto is, population is sparce in the rest of Ontario. In the week starting on April 7, the average number of daily new cases per 10,000 people was 0.246. The coefficient of variation, standard deviation divided by the mean, was 0.874. The average of the average number of daily total infected per 10,000 for that week was 4.02. The coefficient of variation was 0.679 1. Both the rate of new cases and total infected across PHUs have long right tails. The mean of the mean change in log daily electricity usage in the week starting April 7 between 2020 and the average of 2019 and 2018 across PHUs was -0.171. The coefficient of variation was 0.655. To a first order, the distribution of mean declines in daily usage across PHUs is a symmetric distribution.

Although all PHUs reduced their usage in April relative to the two years before, there was already a secular decline in daily usage in January and February between the two years. Thus we control for this secular decline in electricity demand to estimate the effect of the pandemic on the decline in electricity use. Let c_{it}^{y} be the daily aggregate electricity usage by small commercial users in PHU i on calendar day t in year y. Our dependent variable in all regressions are

$$y_{it} = \ln c_{it}^{2020} - 0.5 * (\ln c_{it}^{2019} + \ln c_{it}^{2018}) \tag{1}$$

We also match days of the week to the year 2020. The sample starts on January 2, 2020 and ends on April 15, 2020. There are 34 PHUs. Since few individuals expected the disease to spread to Ontario, there was no response by the public or policy makers to the transmission of the disease in January or February 2020. Other than verbal screening at a few airports, travel to and from Ontario was unrestricted in January and February. As can be seen in Figure (7), there was no systematic decline in electricity usage in any PHU in January and February. In all our regressions, we included PHUs fixed effects. We also included a March/April dummy variable to allow for a decline in usage in March and April which was not captured by our disease and mandates covariates.

Model 1, reported in column 1 of Table (4) , we included two disease variables, first, a three day moving average of $t-2$, $t-1$ and t of new cases per 10,000 individuals for t. The moving average window was chosen to maximize R^2 and to account for the noise of daily new cases- substantial unsystematic reporting lags. So averaging the new cases reduces the noise. The second disease variable is the total currently infected per 10,000 at day t which is a sum of new

[9]The mandates were (1) shutdown of public schools, (2) shutdown of private schools, (3) shutdown of non-essential services, (4) expansion of list of non-essential services to be shutdown.

cases from $t-17$ to t.

For both January and February, the values of the disease variables were zero for most PHUs. For the SD mandates, we use the Ontario and Toronto cumulative shutdown mandate indices illustrated in Figure (4), and also the interaction of the Ontario shutdown mandate index with the log of population density of the PHU. As the figure shows there were rapid increases in the values of the indices between March 14 and 18.

The point estimate of the March/April intercept is -5.38 with a standard error of 0.496. Hence, we cannot reject the hypothesis that there would have been an enormous large quantitative decline in daily usage after March 1st if the disease had not occured. Such a large predicted decline makes no sense and points to model mispecification. The point estimates of both disease variables, rate of new cases and current infection rate are both negative and statististicallly different from zero. Although of the right signs, we dispense with further discussion of this specification due to the large negative estimated March/April effect.

Model 2, reported in column 2 of the table added an Ontario and a Toronto shutdown mandates indices, and an Ontario index interacted with log population density. The estimated coefficients for the Ontario mandate and its interaction with density are both negative and statistically different from zero at the 1% significance level. This means that an increase in the mandate index reduced electricity usage. Moreover, the decline in usage is larger if the PHU is more dense which means compliance with the mandate increased with population density. The estimated effect of the Toronto mandate index is positive but not statistically different from zero. Since the density in Toronto is the highest among the PHUs, the Ontario mandate effect for Toronto is quantitatively large. A positive point estimate for the Toronto mandate index is not unreasonable.

The estimated coefficient on the rate of new cases is -4.24 with a standard error of 1.69. The estimated coefficient on the total infections rate is -0.087 with a standard error of 0.137. The F-test that both coefficients are different from zero has a p-value of 0.05. The mean of total infection rates in the week of April 7 is 16 times larger than the mean new case rate. However, a report of an additional new case induced a much larger immediate decline in usage than an addition to the reported current stock. The current stock is a weighted average of past new cases. The quantitative comparison of the two estimated effects says that new information about the disease is much more salient for social distancing than dated information. And because the news on new cases and usage data occured on the same day, we cannot reject the hypothesis that daily information about the spread of the disease in the PHU have immediate effects on electricity usage. Since we have controlled for mandates, the disease effects represent voluntary social distancing over and above mandated social distancing. Finally, the point estimate of the March/April is -0.378 with a standard error of 0.412. Compared with the point estimate in model 1, the point estimate in model 2 is quantitatively much closer to zero. Also, the standard error in model 2 imples that we cannot reject the hypothesis that if the disease did not occur in Ontario, electricity usage would not have fallen from March on. As a whole,

the results in column 2 are strongly consistent with the hypothesis that small commercial users reduced their electricity consumption as the disease spread and the mandate index increased.

Column 3 repeats the covariates in column 2, leaving out the March/April dummy variable. The estimated coefficients and standard errors on all covariates are essentially the same as that in column 2. In other words, our disease and mandate model is sufficient to explain the mean decline in electricity usage in March and April 2020. Figure (10) show the daily actual and predicted usage, decomposed into mandates and disease effects, by PHUs. We also include confidence intervals for the daily predicted usage. For all PHUs, the predicted decline in electricity usage in March and April were significant. The two standard deviations confidence intervals excluded a zero decline. Also for most PHUs, the predicted decline in usage was primarily due to the shutdown mandate by the government. For many PHUs, there were significant voluntary social distancing effects. There was also a significant minority of PHUs in which predicted voluntary social distancing were minimal.

To summarize the results from Figure (10), we use the point estimates in column 3 to computed the predicted average daily decline in log usage from March 15 to April 15 for each PHU. Then we decompose this total predicted decline into the share predicted by the spread of the disease and the share explained by changes in mandates in each PHU. These decompositions are in Figure (**??**). The PHUs are arranged in declining total infections between April 7-15. The figure shows that total usage fell as the infection rate increased. The shares captured by the mandates were roughly independent of the total infection rate of the PHUs. As the mandates were uniform across Ontario, the variation in shares due to mandates across PHUs were due to density differences across PHUs. The shares captured by voluntary social distancing fell with the reported infection rates. In all PHUs, the predicted decline in usage was disproportionately explained by mandates rather than voluntary social distancing. The decline in electricity use in PHUs with low reported infection rates were primarily caused by the provincial wide mandates.

In addition to main effects, there may also be interaction effects between disease diffusion and mandates in affecting electricity usage. The public policy interest in study these interaction effects is to investigate whether there is any crowd out of voluntary social distancing when government mandates are imposed. Using consumer spending data from Sweden and Denmark, Anderson, et. al. (2020) showed that there was significant crowd out when Denmark imposed mandates and Sweden did not.

Model 4, reported in column 4 dropped the March/April dummy which were not statistically significant in previous specifications. Instead, it added two disease and mandate interactions: (1) reported new cases rate and the Ontario shutdown mandate index, and (2) total current infection rate and the ON shutdown mandate index. We did not interact the disease variables with the mandates interacted with log population density because we have population in the denominator from the disease variables and population in the numerator due to log density, creating collinearity with the first set of interactions. The p-values

of the F tests show that the main disease effects, main mandate effects, and the interaction effects between disease and mandates are 0.012 or lower. That said, the estimated individual coefficients in model 4 are difficult to interpret. The signs of the main effects are opposite that in the interactions. The standard errors may be small in the main effect and large in the interaction and vice versa. Also, there was no increase in the goodness of fit, R^2, when we included the interaction effect. Part of the imprecision is likely due to the lack of variation in the mandate index in our short sample. We will be able to rectify this short sample problem when we update the sample. Thus for this draft, we will not discuss the interaction model further.

4 Conclusion

Social distancing mandates were and are used to slow the diffusion of Covid-19 in Ontario. We used the year over year decline in electricity usage of small businesses as a proxy for voluntary and mandated social distancing. Our estimates show that residents change how they practice social distancing based on same day reports of new infections in their community. In areas with low infection rates, most of their behavior are determined by the provincial wide mandates. These findings suggests that public health units should also provide accurate and timely public information on the diffusion of the disease because residents adjust quickly to that information. Easing social distancing mandates in locations with few cases would lead to increased economic activity in a safer way than uniformly lifting social distancing practices across the province.

Due to our short sample, we were unable to provide an estimate of the extent of crowd out, the substitution of voluntary social distancing by government mandates.

5 References

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6 Tables of social mandates

Table 1: Timeline of Social Distancing Mandates: Ontario

Date	**Mandate**	**Notes**
Friday, March 13	Government of Ontario recommends the immediate suspension of all gatherings over 250 people.	
Saturday, March 14	Government of Ontario mandates the closure of all publicly funded schools	Note: March 16 was the first day of March Break. Ontario Schools were initially closed for two weeks following the Break.
Sunday, March 15	Ontario Parks cancels all planned events until further notice and closes all Ontario Parks buildings.	Outdoor parks still remain operational.
Sunday, March 15	Ontario Ministry of Health recommends all hospitals ramp down elective surgeries and other non-emergent activities.	
Monday, March 16	Ontario Ministry of Health recommends the immediate suspension of all gatherings over 50 people.	
Monday, March 16	Ontario Ministry of Health recommends closure of recreational programs, libraries, private schools, day cares, churches and other faith settings, bars and restaurants.	Restaurants that can shift to takeout/delivery only are permitted to remain open.
Monday, March 16	Ontario Ministry of Health releases first written statement recommending social distancing, self-monitoring for symptoms, and self-isolation for elderly and immunocompromised individuals.	
Tuesday, March 17	Government of Ontario enacts Declaration of Emergency - mandates closure of certain establishments and prohibits gatherings of over 50 people.	Mandates closure of all facilities providing indoor recreational programs, libraries, private schools, licensed child care centers, bars and restaurants (except for takeout/delivery), theatres, cinemas, and concert venues.
Wednesday, March 18	Government of Ontario closes all provincial parks	Including car camping, backcountry camping, roofed accommodations, day use operations and public buildings.

[9]Huron is part of Huron Perth PHU,which contains Perth too. Oxford is part of Southwestern PHU, which contatins St.Elgin as well

Date	**Mandate**	**Notes**
Tuesday, March 24	Government of Ontario provides immediate electricity rate relief for families, small businesses, and farms paying time-of-use rates.	Electricity prices are held to the off-peak rate for 24 hours everyday.
Wednesday, March 25	Ontario mandates the closure of all non-essential workplaces	Initially in effect for 14 days but was later extended. Businesses that can operate remotely can continue to operate.
Saturday, March 28	Government of Ontario mandates suspension of gatherings of more than 5 people.	Does not apply to child care centres supporting frontline health care workers and first responders. Funerals can proceed with up to 10 people at a time.
Monday, March 30	Government of Ontario extends Declaration of Emergency - extends mandatory closure of non-essential businesses, closure of public spaces and establishments, and restrictions on social gatherings.	
Monday, March 30	Government of Ontario mandates closure of all outdoor recreational amenities, including playgrounds and sports fields.	All communal or shared, public or private, outdoor recreational amenities everywhere in Ontario.
Tuesday, March 31	Government of Ontario extends closure of public schools.	Private school closures can only be extended for one 14-day period at a time under a Declaration of Emergency.
Friday, April 3	Government of Ontario reduces the list of businesses classified as essential	Residential construction ends and cannabis stores no longer considered essential, among others.
Saturday, April 11	Government of Ontario extends emergency orders under the *Emergency Management and Civil Protection Act.*	Extends closure of outdoor amenities in parks and recreational areas, non-essential businesses, public places and bars and restaurants, along with restrictions on social gatherings.
Tuesday, April 14	Government of Ontario extends Declaration of Emergency	Allows government to continue to enforce current emergency orders such as closure of non-essential businesses, outdoor amenities, public places and bars and restaurants, and restrictions on gatherings of more than 5 people.

Table 2: Timeline of Social Distancing Mandates: Toronto

Date	**Mandate**	**Notes**
Friday, March 13	City of Toronto cancels programs and closes facilities.	Including March Break camps, licensed childcare centres, community and recreation centres, greenhouses, arenas, pools, libraries, museums, galleries.
Monday, March 16	City of Toronto recommends closure of all bars, dine-in restaurants, nightclubs, and theatres close.	
Saturday, March 21	City of Toronto recommends all March Break travellers should self-isolate for 14 days.	
Monday, March 23	City of Toronto declares a State of Emergency.	
Wednesday, March 25	City of Toronto mandates closure of all playgrounds and other park amenities.	
Tuesday, March 31	City of Toronto cancels all City-led major mass participation events, festivals, conferences and cultural programs, as well as all City permits for externally organized events.	
Thursday, April 2	City of Toronto mandates physical distancing in parks and public squares.	Any two people not from the same household who fail to physically distance themselves in a public space can face prosecution and fines up to $5000.

Table 3: Summary Statistics, April 7-15, 2020

Variable	Obs	Mean	Std. Dev.	Min	Max
Population per 10,000(2016)	34	39.554	51.724	3.305	273.157
Population per sq km	34	275.294	756.39	.3	4334.4
Daily new cases per 10,000	34	.246	.215	.011	1.049
Daily total current infected per 10,000	34	4.024	2.728	.686	11.833
ON shutdown mandates index (Mar 15-Apr 15)	34	18.625	7.885	3	25
Jan-Feb 2018 daily usage (100,000KWh)	34	7.367	5.585	.776	23.861
Jan-Feb 2019 daily usage (100,000KWh)	34	7.043	5.536	.714	24.407
Jan-Feb 2020 daily usage (100,000KWh)	34	5.949	4.312	.631	19.073
Mar 15-April 15 y_{it}	34	-17.061	11.198	-32.173	35.222

Table 4: Regression Results

VARIABLES	(1) %Change	(2) %Change	(3) %Change	(4) %Change
New Cases per 10,000	-13.18***	-4.235**	-4.231**	34.45
	(3.030)	(1.689)	(1.691)	(22.82)
Current Infections per 10,000	-1.683***	-0.0867	-0.0706	-14.10***
	(0.353)	(0.137)	(0.130)	(4.671)
Ontario Soc.Distancing Mandates		-0.422***	-0.437***	-0.423***
		(0.0508)	(0.0452)	(0.0450)
Toronto Soc.Distancing Mandates		0.0721	0.0719	0.0794
		(0.0517)	(0.0516)	(0.0518)
Ontario Social Mandates*ln(density)		-0.0565***	-0.0567***	-0.0541***
		(0.0118)	(0.0119)	(0.0120)
New Cases per 10,000*Ontario Soc.Mandates				-1.501
				(0.926)
Current Infections per 10,000*Ontario Soc.Mandates				0.555***
				(0.184)
Post-1Mar2020	-5.379***	-0.378		
	(0.496)	(0.412)		
Observations	3,465	3,465	3,465	3,465
R-squared	0.495	0.603	0.603	0.604
PHU FE	YES	YES	YES	YES
P-value(Mandates variables Joint Sig.)	-	0.00000	0.00000	0.00000
P-value(Disease variables Joint Sig.)	0.00002	0.05322	0.05101	0.00947
P-value(Interaction variables Joint Sig.)	-	-	-	0.01149

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 1: PHU Map [9]

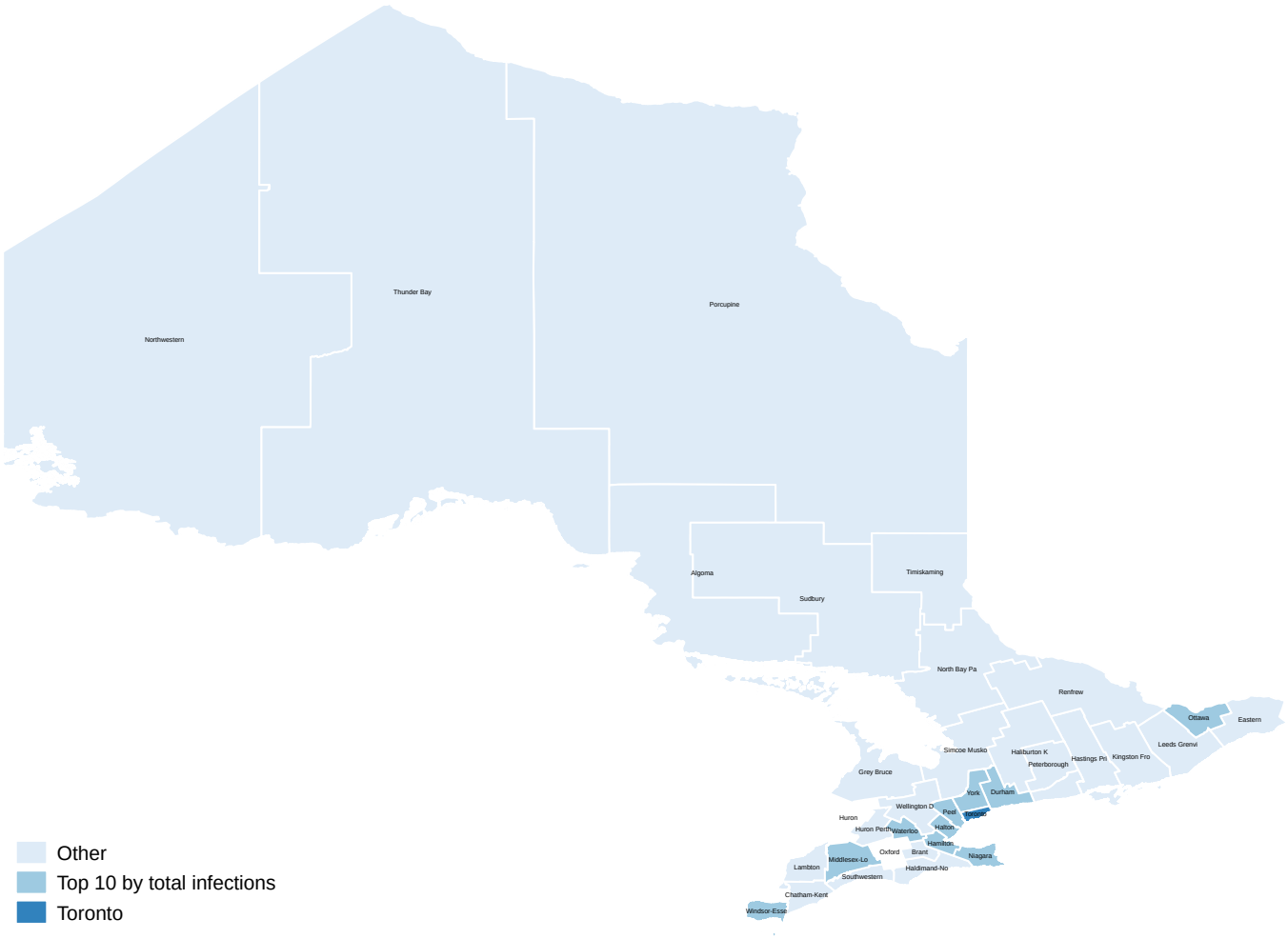


Figure 2: New Cases Per Day In Three Ontario Regions

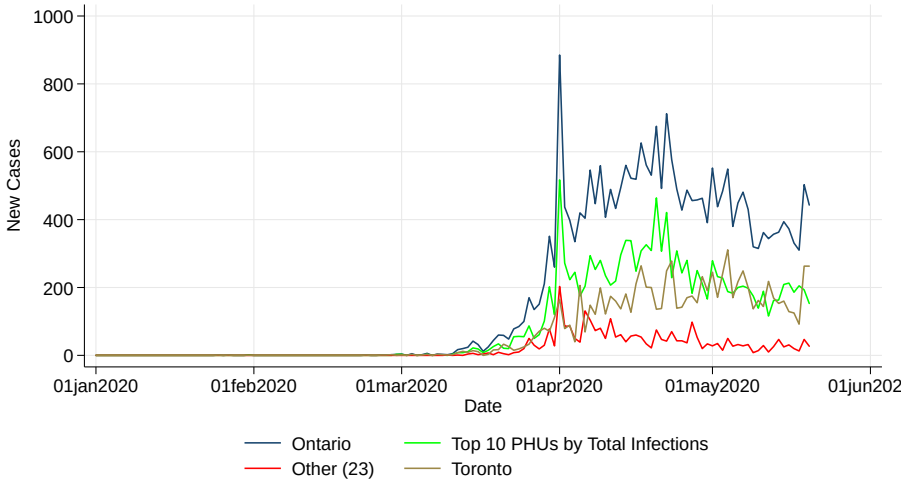


Figure 3: Total Cases Per 10,000 as of 20May2020

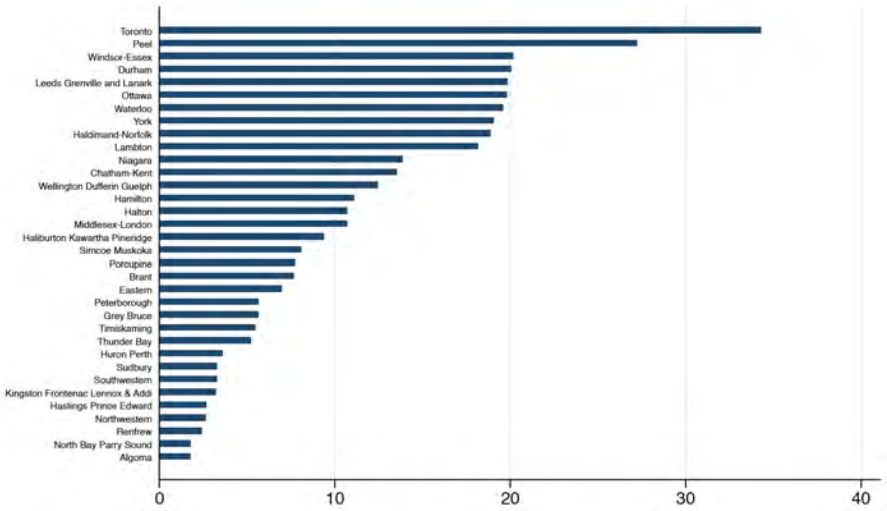


Figure 4: Cumulative Index of Social Distancing Recommendations and Mandates in Ontario

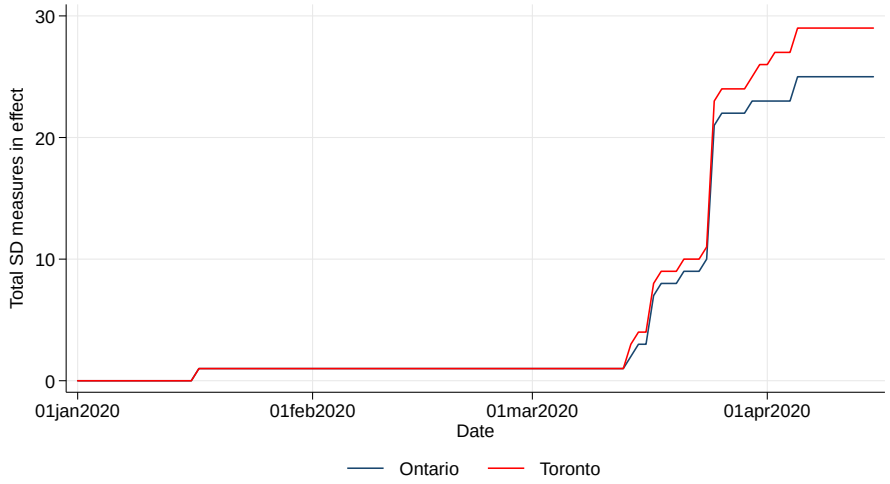


Figure 5: Electricity Consumption by Commercial Users

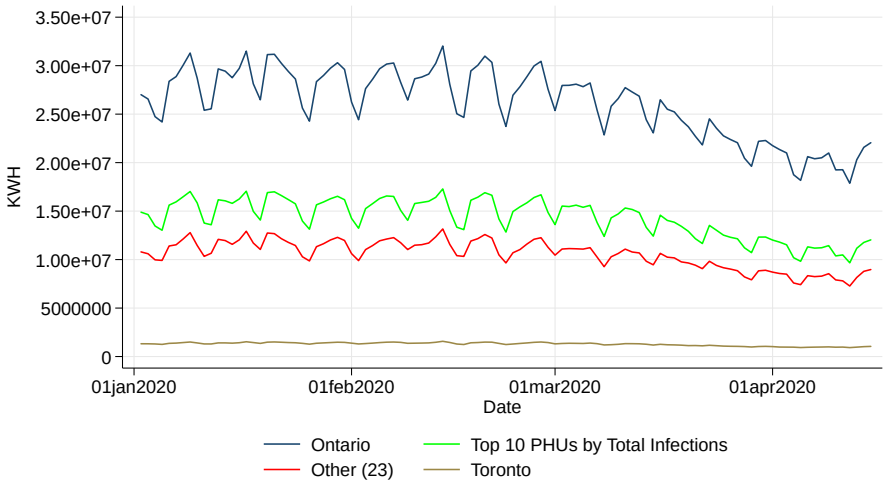


Figure 6: Log differences in Electricity Consumption by three User Groups

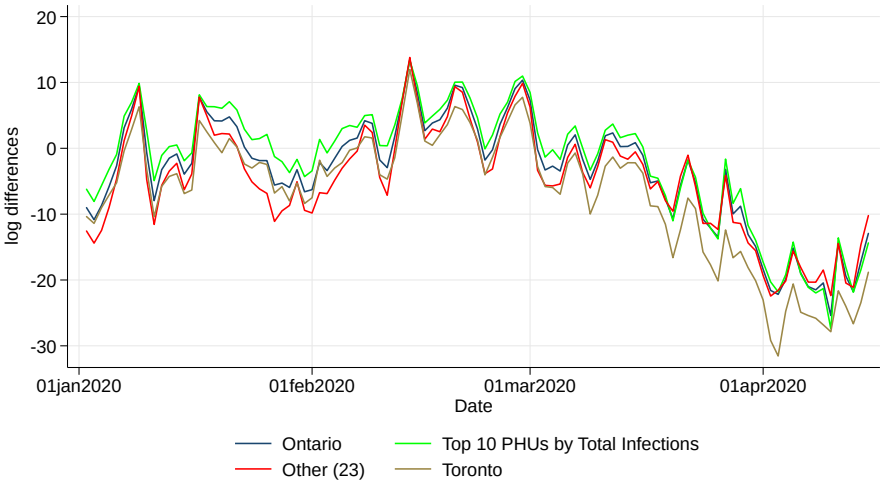


Figure 7: Log Differences in Electricity Consumption by PHUs

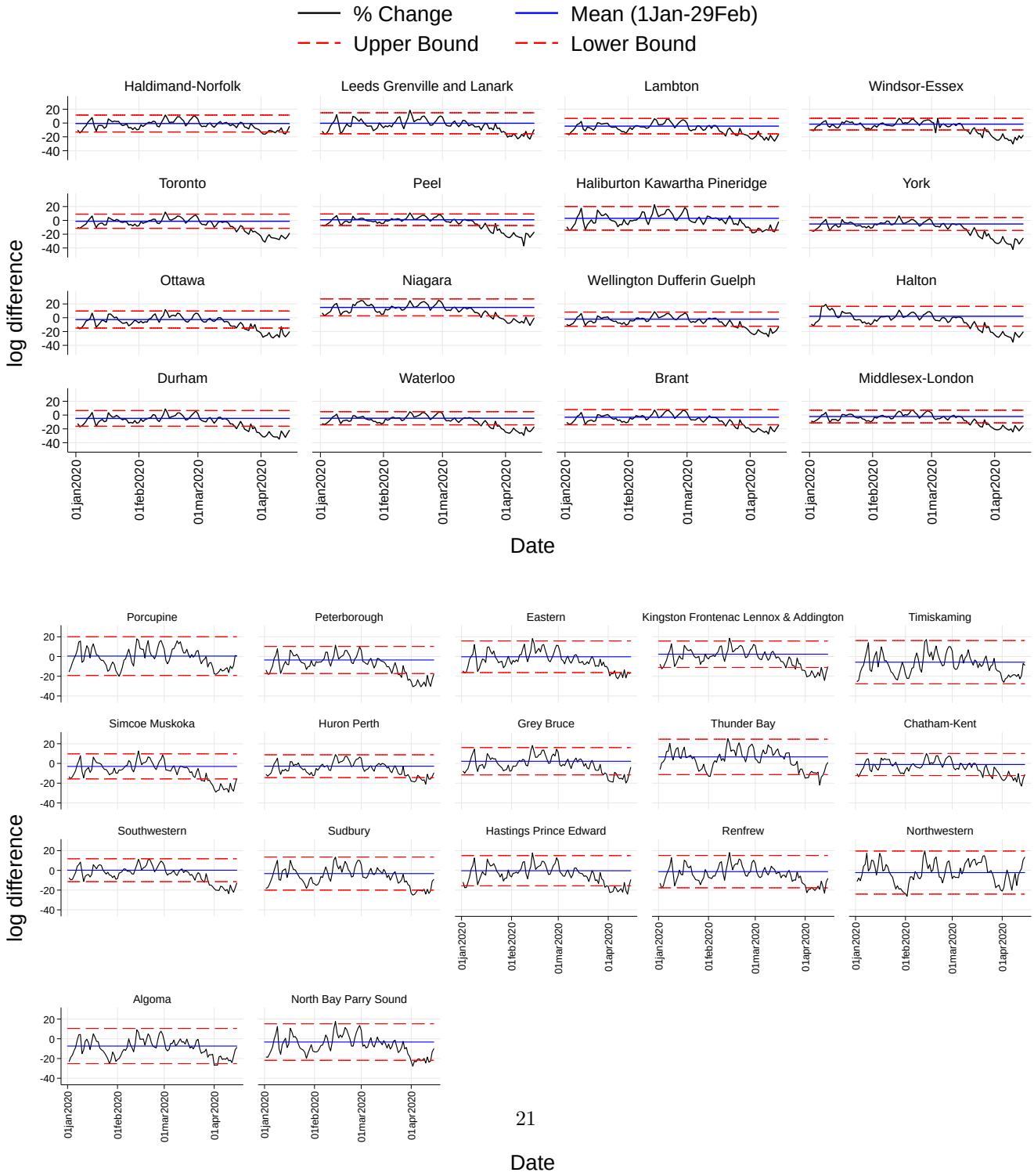


Figure 8: Average of Currently Infected Per 10,000 Population, April 07-15. Average Change in Electricity Consumption, Mar 15 - April 15

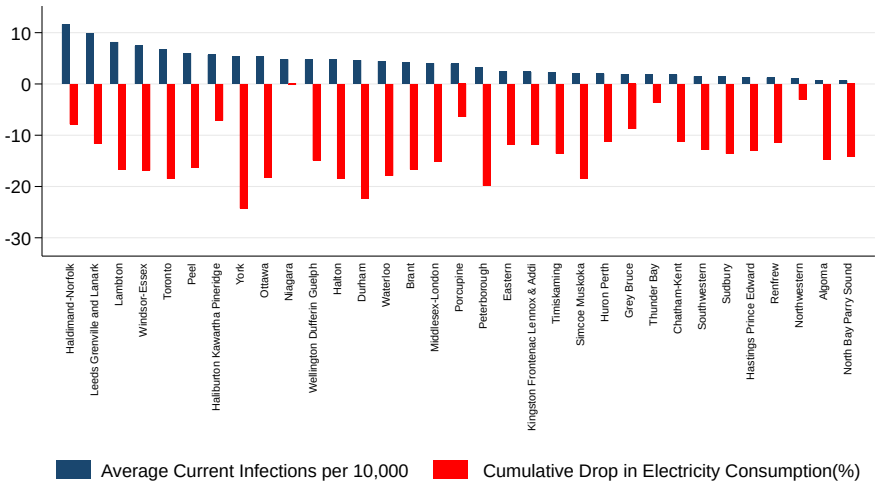
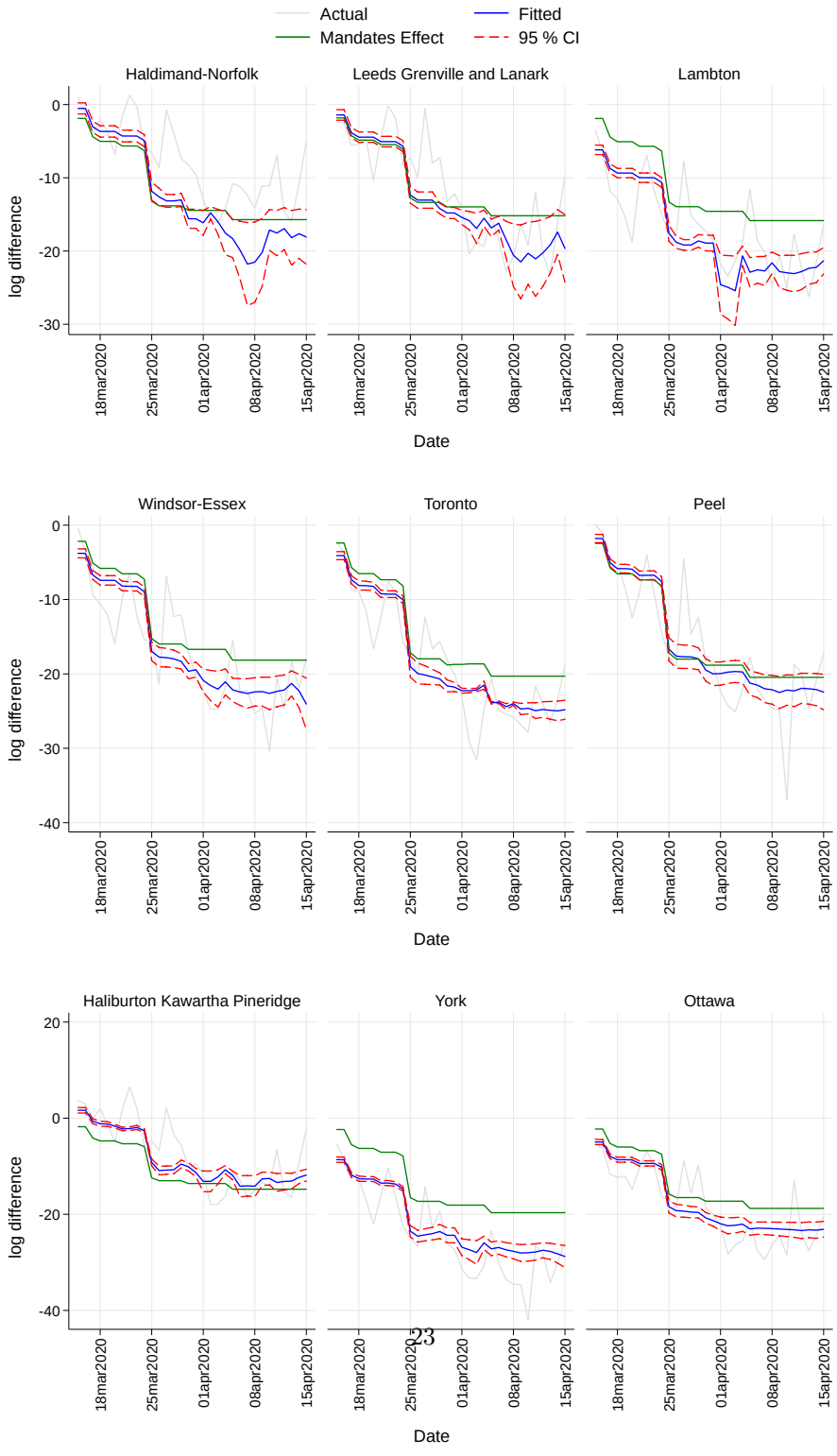
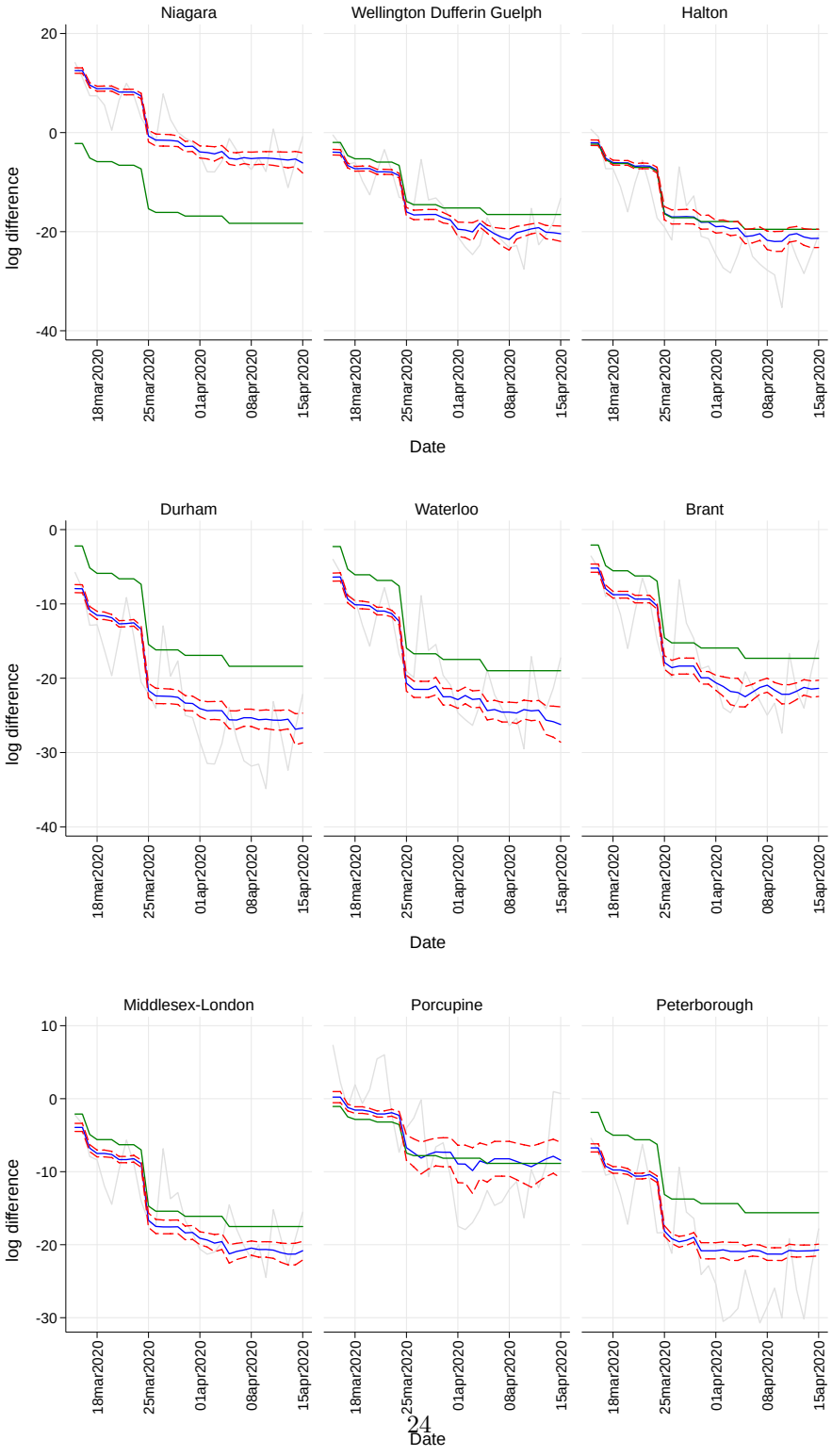
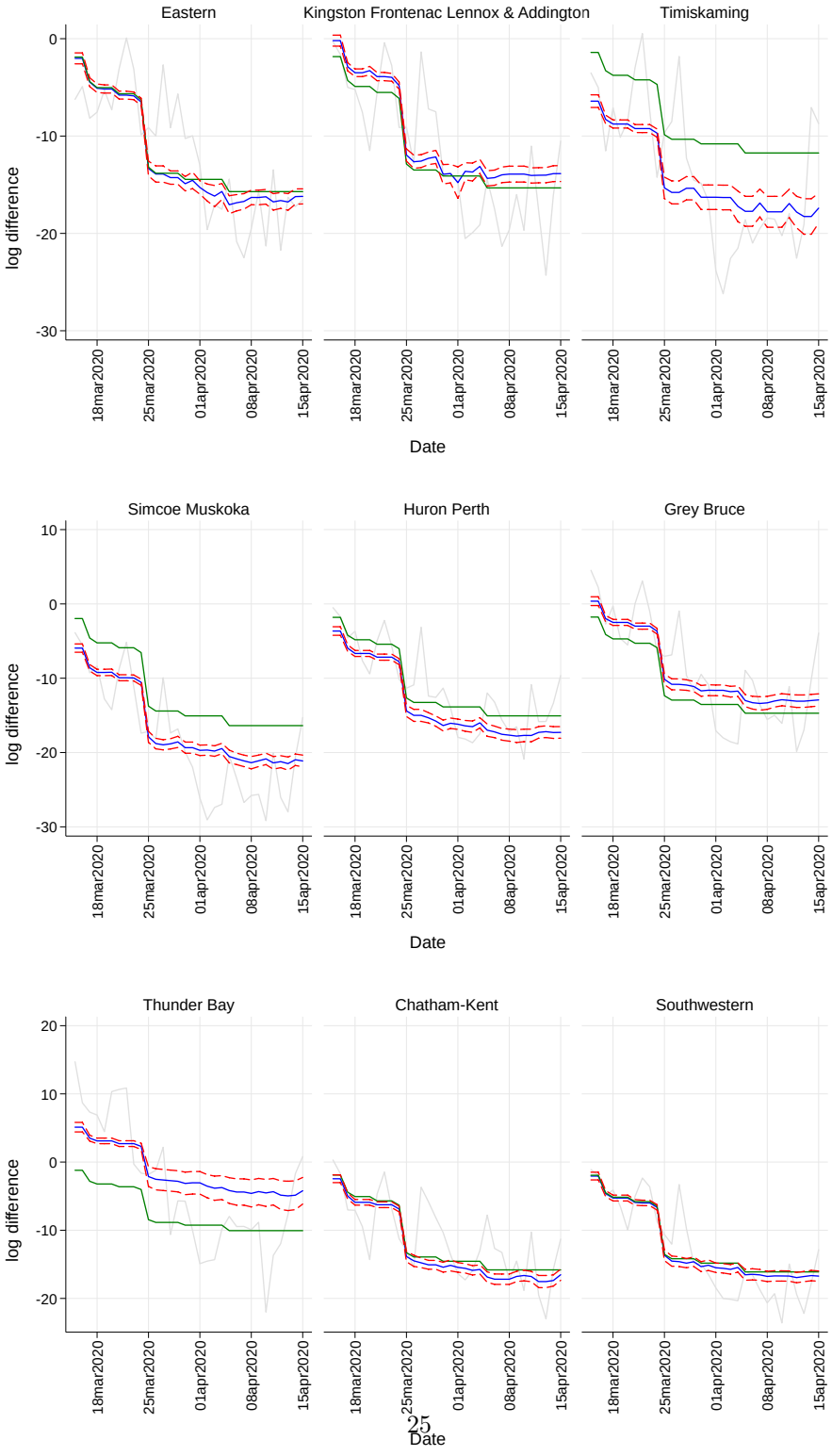


Figure 9: Predicted Log Change in Daily Electricity Consumption, Mar 15 - Apr 15




Niagara
Wellington Dufferin Guelph
Halton
Durham
Waterloo
Brant
Middlesex-London
Porcupine
Peterborough
log difference
Date
18mar2020
25mar2020
01apr2020
08apr2020
15apr2020


Eastern
Kingston Frontenac Lennox & Addington
Timiskaming
Simcoe Muskoka
Huron Perth
Grey Bruce
Thunder Bay
Chatham-Kent
Southwestern
log difference
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-10
-20
-30
10
20
18mar2020
25mar2020
01apr2020
08apr2020
15apr2020
Date

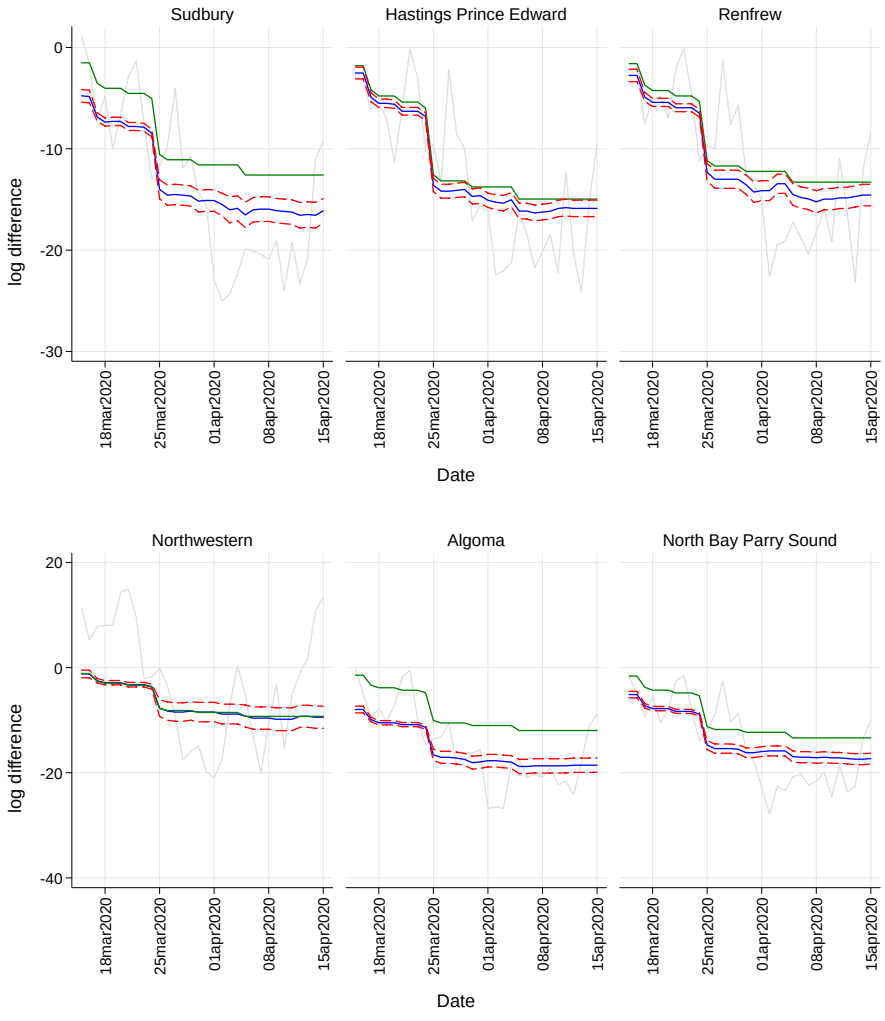
Sudbury
Hastings Prince Edward
Renfrew
Northwestern
Algoma
North Bay Parry Sound
log difference
0
-10
-20
-30
20
-40
18mar2020
25mar2020
01apr2020
08apr2020
15apr2020
Date

Figure 10: Decomposed Average Log Change in Daily Electricity Consumption, Mar 15 - Apr 15