

Business Closures and (Re)Openings in Real Time Using Google Places

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Abstract

We present a new method to measure business opening and closure rates using real-time information from Google Places, the dataset behind the Google Maps service. Our Canadian application confirms the importance of temporary closures and reopenings during the COVID-19 pandemic. Over 50% of the temporarily closed food and retail businesses during the April 2021 lockdown reopened by the end of September. Our estimates align well with the timing of COVID-19 restrictions and are validated by a survey of recently opened businesses. Our framework provides policy-makers with a tool for the timely monitoring of business dynamics.

Topics: Firm dynamics; recent economic and financial developments

JEL codes: D22, E32, C55, C81

1 Introduction

Given the speed at which COVID was spreading, lockdowns and restrictions of business activities seemed essential to limit the human cost of the pandemic. Viable businesses would be put under extreme stress, at least in the short run, hence the implementation of large business support measures.¹ However, in the absence of real-time data on business health, it is harder to calibrate such policies, with either the risk of too little too late, or too much too broadly turning non-productive firms into zombies (Gourinchas et al., 2021). To fill part of this gap, we propose a new measure of business openings and closures using non-traditional real-time data.²

In this paper, we use data from Google Places, the database behind Google Maps, to compute reliable rates of business exit, temporary closures, entry, and reopening in a timely manner for customer-facing industries. We apply our method to the retail, food, and accommodation sectors for three major cities in Canada during the reopening phase of the COVID-19 pandemic. We track a sample of 12,976 unique businesses during the reopening phase of the COVID crisis over the months of May to September 2021.

Our main result is that the reopenings of temporarily closed businesses largely contributed to the spikes in business entries as the COVID-19 restrictions were progressively lifted. About half of the businesses recorded as temporarily closed in May 2021 had reopened by the end of September, 40% were still hibernating, and only 10% were closed for good. The fraction of temporarily closed businesses in April 2021, prior to the lifting of COVID restrictions, was 40% for night clubs and bars,³ only 20% for cafe and restaurants thanks to the ability to offer take-out and deliveries, and at most 10% for the retail sector. By the end of the summer, the rate of temporarily closed businesses converged back to a 2% to 10% range, depending on the sector and the city.

Although the quality of the Google Places dataset is beyond our control, we validate our measures of closures and openings in three ways. First, the business dynamics we observe match the timing of the COVID-19 restrictions across jurisdictions and across business types. Second, our real-time estimates correlate with those produced by Statistics Canada using tax records and business registries (which have a time lag). Third, we validated the accuracy

¹Business entry and exit dynamics are indeed key determinants of long-run productivity (Aghion et al., 2019) and employment (Sedláček, 2020).

²There has been a growing prevalence of using data online, such as job vacancy adverts, to help gauge the current state of the labour market (Turrell et al., 2018), mobility data from mobile phones to look at movement patterns during the pandemic (Sheikh et al., 2020), or scraping of online retailers to develop indices of inflation (Cavallo and Rigobon, 2016).

³Note that night clubs and bars were not all temporarily closed, because many of them are also restaurants.

of our estimates by surveying the businesses that (re)opened in Ottawa/Gatineau. We confirmed 71% of the (re)openings in the food sector and 44% in the retail sector. The higher performance in the food sector is in part explained by its customer-facing characteristic, as it was easier to walk into establishments to ask about the date of (re)opening if they did not answer the phone.

Our method has several advantages over the use of the Statistics Canada experimental estimates of business openings and closures ([Statistics Canada, 2020](#)). These data are collected for enterprises with at least one employee from its tax records. As a consequence, the data lags by three months, does not capture businesses with no employees, and does not take into account the possibility that multiple establishments would belong to the same enterprise. Conversely, the data from Google Places is available promptly, covers self-employed proprietors with no employees, and is available at the establishment level. In addition, the Google Places data can better distinguish between temporarily versus permanently closed businesses. Temporary closures in the Statistics Canada data would be defined as a business going from having one or more employees in a month to not having any employees the subsequent month, but the business may or may not be closed, and public subsidies during the COVID crisis helped maintain the work relationship even if the business was not operational.

Our tool fills a practical gap. It can be readily used by policy-makers to monitor, in a timely manner, the dynamics of the labor-intensive small businesses most impacted by COVID. Moving forward this is especially important, as the threat of further COVID waves might imply a non-linear recovery of businesses. Our results suggest that government subsidies that supported closed businesses and helped maintain employer-employee relationships may have been helpful to speed up the economic recovery by making many closures only temporary.

Traditional bankruptcies or business registries data cannot capture COVID features well. For instance, businesses were more likely to voluntarily and temporarily close rather than go bankrupt, which can be seen with bankruptcies reaching record low levels during the COVID crisis. Statistics on entrepreneurship can also be derived from payroll taxes and business registries, like the Business Formation Statistics for the United States, which track new applications for an employer identification number for tax purposes ([Haltiwanger, 2021](#)), or the experimental estimates for business openings and closures for Canada (although this is available only with a lag of three months ([Statistics Canada, 2020](#))). Instead, [Crane et al. \(2020\)](#) provides an overview of some non-traditional datasets that can be used to measure business entry and exit dynamics, such as Google searches, paycheck issuance, and phone-tracking data. They find that at least some of these measures can capture the main trends well.

Two analyses are closely related to ours. [Yelp \(2020\)](#) used its platform’s business reviews by customers to compute the relative importance of temporary and permanent closures during the early phase of the COVID-19 crisis. [Kurmann et al. \(2021\)](#) focus on a sample of small US businesses recorded in the Homebase dataset (a software provider for small businesses), which relates employment dynamics to openings and closures as recovered from SafeGraph, Facebook, and Google. They find that small business employment contracted most in the hardest hit service sectors but also rebounded more strongly. They show that, if at first closures accounted for more than half of the initial decline in small business employment, many closed businesses subsequently reopened. Compared to [Kurmann et al. \(2021\)](#), we take a broader view to estimate opening and closure rates in a given area and assess the quality of the estimates.

The paper proceeds as follows. We first outline our novel methodology in Section 2. We then present and discuss the main business opening and closure rates for several Canadian cities in Section 3. Section 4 discusses quality assurance checks, and Section 5 concludes the discussion.

2 A novel method for business opening and closure estimation

2.1 Data

We use Google Places, the dataset behind Google Maps, to identify businesses in a geographic area. Although Google Places is most likely to have comprehensive and timely data, the quality of our estimates depends on the timeliness of the updates to the Google Places data, which are beyond our control. Nonetheless, we find substantial changes in month-to-month data collection.⁴ The information on business listings is compiled by Google from different sources:⁵ business owners who have a business account, customers who provide reviews (about 80% of businesses in our dataset have at least one review), users who report inaccurate listings, or other publicly available information (e.g., an official website).

We focus on the retail, accommodation, and food sectors for the downtown core of cities of Ottawa/Gatineau, Toronto, and Vancouver for several reasons.⁶ First, it is most likely

⁴It can be possible to observe changes on shorter time scales, because the dataset is updated continuously, but for cost considerations we collected data only monthly. During a crisis or if new lockdowns are implemented, it could be valuable to consider weekly estimates.

⁵See [here](#).

⁶Specifically, we focus on the following Forward Sortation Areas (FSA) identified by the first three char-

that sectors with face-to-face consumer interactions would have a better reporting status, because those businesses have the strongest incentive to maintain their online presence on Google Maps. Second, areas with the most foot traffic are also likely to be areas with better data quality due to reviews and reporting by Google users. Third, these sectors were the most affected by the COVID-19 crisis and thus most relevant to track in a timely manner.

We use the functionality of “Nearby Search” in our queries to Google Places API,⁷ which, instead of searching for a specific business, returns all businesses of a given type within a bounding circle, defined by a point (in latitude and longitude) and a radius (in meters). Out of 96 possible business types returned by the query,⁸ we use “store”, “gas_station”, “lodging”, “restaurant”, “bar”, “cafe”, and “night_club”. Those keywords allow us to match the North American Industry Classification System (NAICS) codes 44/45, 721, and 722 for the retail, accommodation, and food sectors, respectively.

2.2 Cross-section of businesses

Each query returns at most 20 places, with a flag indicating whether more than 20 places were available but not returned by the query. We use this flag to design a simple bisection algorithm to find a set of queries such that (1) each query returns no greater than 20 results and (2) a desired area is fully covered.

We begin with a single large square and query the circle that circumscribes it. Whenever the query flags that there are more than 20 results, we sub-divide the square into four smaller squares and re-run the query on each. This terminates when there are no more than 20 results per query. The details are in Algorithm 1 in Appendix A. An example of the geographic units and the query results that our algorithm arrives at is shown in Figure 1: the higher the density of businesses (the dots), the narrower the search grid needs to be (the squares).⁹

2.3 Time series of openings and closures

Since Google Places API returns only the most recent information and not any historical data, we need to repeatedly scrape the same area at a certain interval (e.g., monthly) to

acters of the postal code: K1A, K1N, K1P, K1R, K1S, K2P, J8X for Ottawa/Gatineau; M5A, M5B, M5C, M5E, M5G, M5H, M5J, M5S, M5T, M5V, M4X, M4Y for Toronto; V6B, V6C, V6E, V6Z, V7X, V7Y for Vancouver.

⁷Documentation on Google Places API query options can be found [here](#).

⁸The link [here](#) contains a full list of supported business types that are not mutually exclusive.

⁹In order to query the FSAs of downtown Ottawa/Gatineau, we needed about 3400 queries. About 2000 queries were required for downtown Toronto and about 4400 for downtown Vancouver.

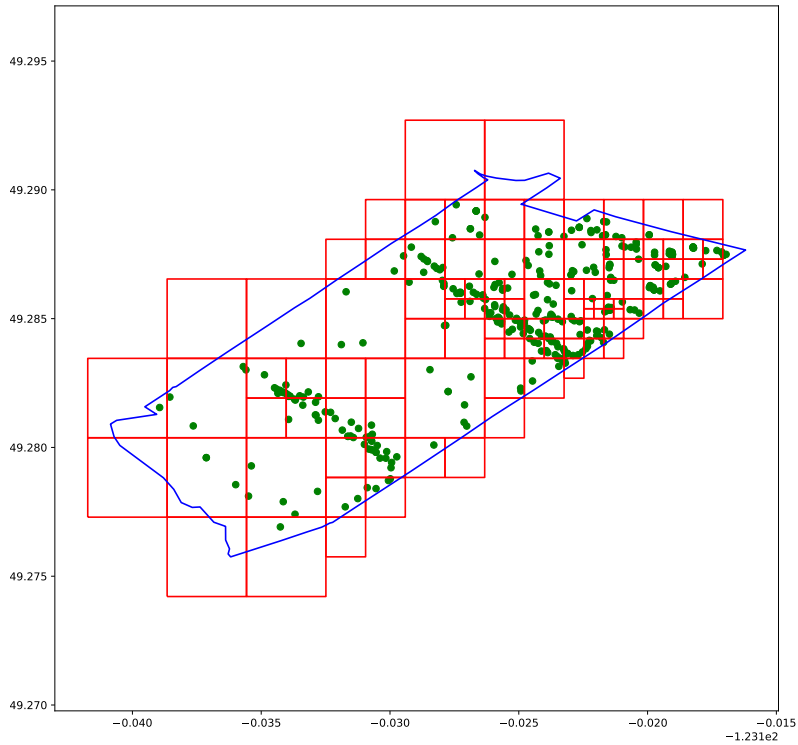


Figure 1: Illustration of Algorithm 1 for keyword "store" in downtown Vancouver

Note: The blue shape is the bounding box of the Forward Sortation Area with postal code V6E. The vertical and horizontal axes represent latitude-longitude coordinates. The red squares are those inscribed in the coverage disks of each query, and the green points indicate the places found. Smaller squares are required where the density of the places is higher. Data as of August 23 of 2021.

build a time series going forward. In order to save time and cost¹⁰ per query, instead of beginning each month’s data collection with an uninformative grid of squares, we initialize Algorithm 1 by using the grid of squares resulting from the previous month’s query.

Table 1 illustrates our definitions. We identify an exit if the business unique identifier `place_id` is removed from the dataset. We further identify temporary closures by using the feature `business_status`, which indicates whether a business is currently operational or temporarily closed. The closure rate is computed as the fraction of exiting or temporarily closing businesses compared to the previous month.¹¹

Likewise, we identify an entry when a new unique identifier appears in the dataset. A reopening corresponds to a business previously temporarily closed that is operational again. The opening rate is computed as the fraction of entrant or reopening businesses compared to the previous month.

	open in t with:		temporarily	non-existent
	≤ 10 reviews	> 10 reviews	closed in t	in t
open in t-1	Continuing		Temporary closure	Exit
temporarily closed in t-1	Reopening			
non-existent in t-1	Entry			

Table 1: Business openings (entry+reopening) and closures (exit+temporary closures)

If a business is not immediately captured by Google Places upon opening, it could enter the dataset at a later stage when reporting is improved. If a business was setup earlier but just entered the dataset, then it is likely to have accumulated customer reviews already. Conversely, if a business is opening in a given month, it is unlikely to have a large number of customer reviews at that time. So we require new openings in a month to have at most 10 reviews. The choice of the 10-review cutoff is informed by a survey we conducted to assess the accuracy of the entry rate in Ottawa (discussed in Section 4).

¹⁰Our use of the Google Places API requires a fixed cost per query.

¹¹We can also find relocations, which have the same unique identifier but a change in address. If the relocation is outside the city for which we downloaded the data, it will be treated as an exit. But in the most likely case where the relocation is in the same city, it is treated as a continued business, unless the business had to temporarily close for a month or more during the move.

3 Business openings and closures when COVID-19 restrictions were progressively lifted in 2021

Table 2 displays a breakdown of businesses by sector for the month of June 2021 for the downtown areas of the Canadian cities we are considering. Within the businesses we cover, about 60% can be classified as belonging to the retail sector, 40% to the food sector, and only 6% to the accommodation sector. Given the smaller representation of the accommodation sector, which is also largely present in the periphery of cities, we display it in Appendix B. The total of the three sectors is larger than 100% because we collect data using keywords that are not mutually exclusive: a store with a cafe or a cafe with a small store section would both have the two tags “store” and “cafe” and, thus, it is classified both in the retail and the food sectors. In our case, about 6% of businesses have multiple tags that assign them to more than one business sector.

We have a total of 62,424 observations with 12,976 unique businesses over the months of May to September 2021. The last two columns of Table 2 provide an approximate comparison of the count of businesses for June 2021 with the number of business postal addresses recorded by Canada Post and with the number of businesses that have at least one employee identified by Statistics Canada from tax records. We note that Google Places data have a very good coverage of businesses, especially given that the count in the two other datasets is most likely an upper bound. Indeed, Canada Post data cover the same geographical area but is not limited to the three sectors we have covered. Conversely, Statistics Canada data cover the same sectors but has a wider geographical area at the level of the Census Metropolitan Area rather than the downtown cores in our case.

Figure 2 shows the monthly opening and closure rates computed for three Canadian cities over the spring and summer of 2021, the time period that corresponds to the progressive lifting of COVID-19 restrictions as the economy reopened in Canada. As expected, business openings were larger than business closures from the end of spring onward, but both balanced out by the end of the summer, possibly because of the uncertainty around a new wave of COVID-19 cases. The spike of business openings in late spring is largely driven by reopenings, rather than entries, once restrictions were lifted. This suggests that government support to businesses that were forced to close temporarily due to COVID-19 restrictions may have helped to prevent further permanent scarring from business exits. Reopening businesses, more than new businesses, drove the reopening of the economy.

Our data is also suggestive of the existence of business hibernation during the pandemic. Figure 3 tracks the evolution of the status of 1008 businesses recorded as temporarily closed in

		Google Places			Canada Post	Statistics Canada
Coverage		Downtown 3 sectors			Downtown all sectors	Metropolis 3 sectors
	Count	Share			Count	Count
Sector		Retail	Accommodation	Food		
NAICS		44,45	721	722		
Keywords		store, gas_station	lodging	restaurant, bar, cafe, night_club		
Ottawa/Gatineau	2537	56.0%	6.5%	44.6%	4492	NA
Toronto	6479	58.0%	5.8%	42.0%	12213	21991
Vancouver	2998	61.8%	6.8%	37.2%	4228	11192

Table 2: Summary statistics of dataset for a given month, June 2021

Note that for the Google Places data, the percentages by sector do not add up to 100% because Google keywords are not mutually exclusive. A business may have two keywords associated with it, for instance both **store** and **cafe** if there is a cafe in the store. The Canada Post data, similar to our study, is at the level of Forward Sortation Area (FSA) and covers the same 4 FSAs of downtown Vancouver, 12 FSAs of downtown Toronto, and 6 FSAs of downtown Ottawa/Gatineau. But unlike our study, there is no breakdown by business types, and therefore the Canada Post data are not segmented into the retail, food, and accommodation sectors. Finally, in the Statistics Canada data, the business types covered are the retail and food sectors, similar to our study. But a substantial difference is that the geographical granularity is more limited. Data are collected at the Census Metropolitan Area (CMA) level, which contains 98 FSAs in Vancouver and 177 FSAs in Toronto, compared to the 4 FSAs of downtown Vancouver and 12 FSAs of downtown Toronto that we have covered. Given the smaller number of businesses, Statistics Canada data for Ottawa/Gatineau is not available with a similar breakdown.

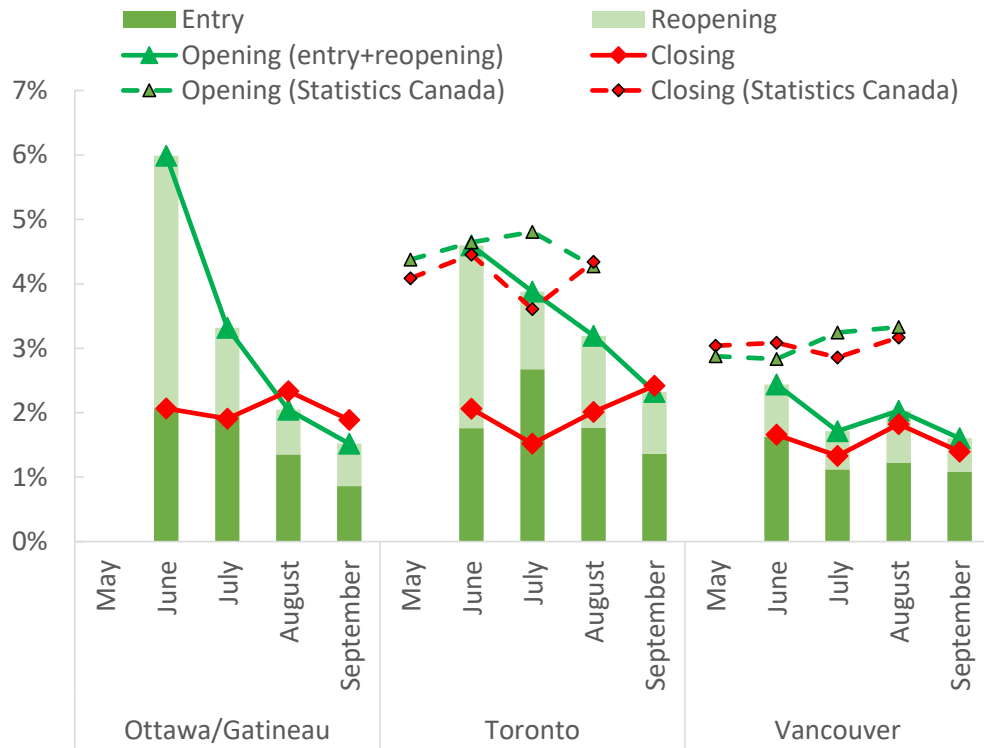


Figure 2: Business opening and closure rates for the retail and food sectors in 2021.

Note: The figure displays the monthly opening and closure rates estimated from Google Places data for the city centers of Ottawa/Gatineau, Toronto, and Vancouver. They are compared to the experimental estimates of opening and closure rates from Statistics Canada (from [Table 33-10-0270-01](#)) for the corresponding metropolitan areas. Rates from Statistics Canada are available only for some sectors and cities because certain breakdowns generate a small number of observations that does not satisfy confidentiality requirements. Data from Statistics Canada, derived from tax records, are not available for recent periods because of a reporting lag. May data were collected only for the food but not the retail sector; see Figure 4.

April or May 2021. By the end of September, 50.5% had reopened, 39.9% were still identified as temporarily closed, and the remaining 9.6% were definitively closed and disappeared from the dataset. The proportion of businesses identifying as temporarily closed for the first time dropped from 0.7% in June to 0.3% in September. Figure 5 shows the evolution of the fraction of businesses identified as temporarily closed for each sector. The fraction of temporarily closed businesses was highest for night clubs and bars in April 2021 prior to the lifting of COVID restrictions, at about 40%, and recovering to reach 5 to 10% by the end of the summer. Note that night clubs were not all temporarily closed, because many of them are also restaurants. Indeed, the possibility of take-out and deliveries meant that restaurants and cafes did not have as many temporary closures in April 2021, at most 20%, converging to the same 5 to 10% by the end of the summer.

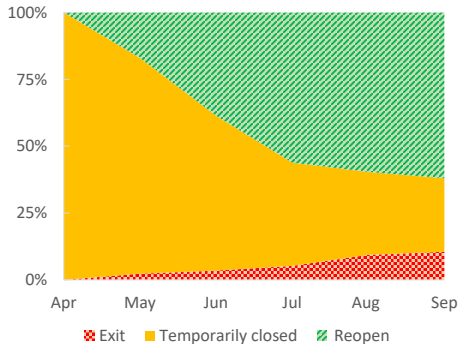
4 External validations

We carry out external validations of the quality of the results in three different ways.

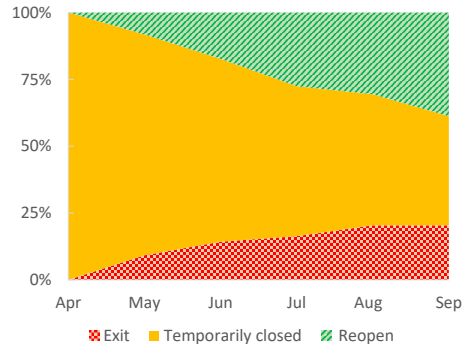
4.1 Business opening and closure rates align with COVID-19 restrictions

Given that major restrictions in British Columbia (containing Vancouver) were lifted in May (for restaurants) and July (for night clubs), we would expect a higher (re)opening rate during those months in Vancouver. Likewise, the major restrictions in Ontario (with both Toronto and Ottawa) were lifted in June (for retail and restaurants) and July (for restaurants and night clubs), which should be reflected in entry rates in Ottawa and Toronto.¹² This is exactly what we observe in Figure 4, which computes rates split by business types. Note that for the food sector (Figure 4b), we have one extra month of data for Ottawa and Vancouver, from May onward. As expected, the entry rate peaks earlier in May for Vancouver, versus in June for Ottawa, given that the reopening started earlier in British Columbia compared to Ontario.

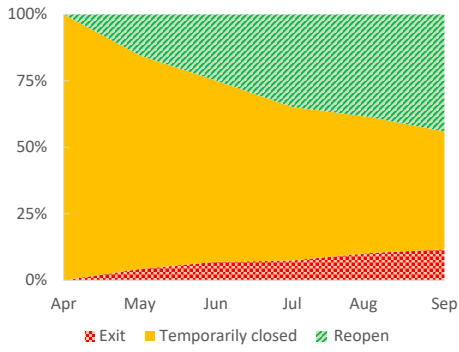
¹²Table 3 in Appendix C provides a timeline of the change in regulation that affected the retail and food sectors in the provinces of British Columbia and Ontario.



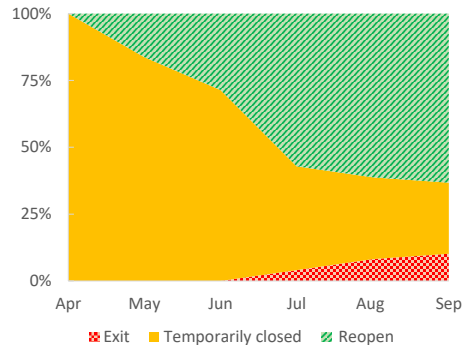
(a) Bar



(b) Cafe



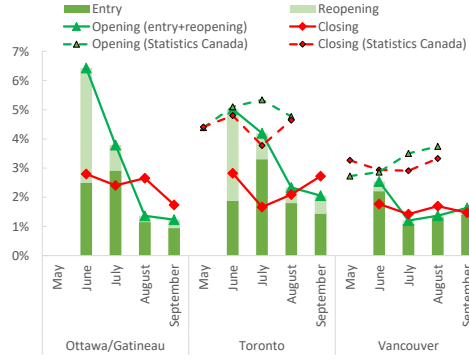
(c) Restaurant



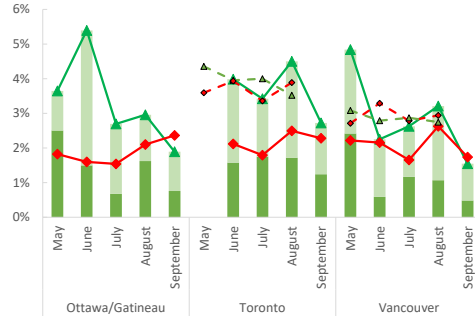
(d) Night club

Figure 3: Evolution of the status of businesses identified as temporarily closed in April 2021

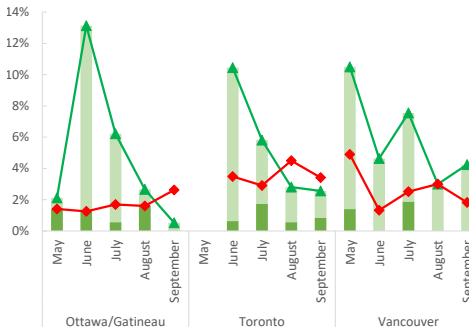
Note: The figure displays the evolution of the status of businesses identified as temporarily closed in Google Places at the beginning of our data collection period in April 2021. Businesses temporarily closed in April 2021 can either remain temporarily closed, reopen, or exit in the subsequent months.



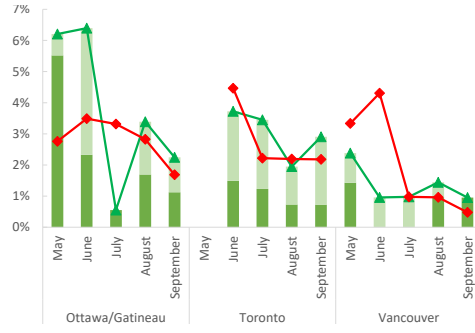
(a) Retail sector, NAICS 44-45



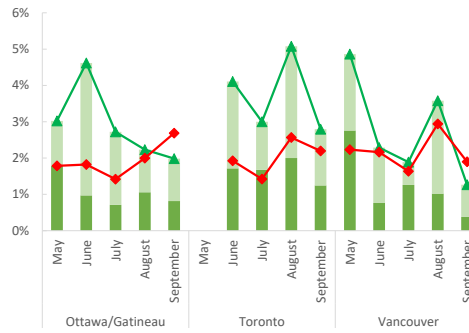
(b) Food sector, NAICS 722



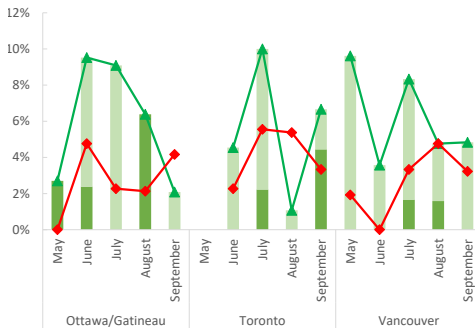
(c) Bar



(d) Cafe



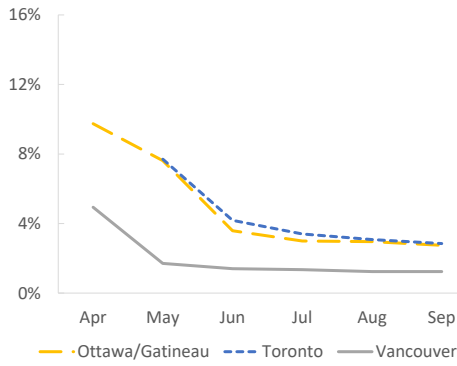
(e) Restaurant



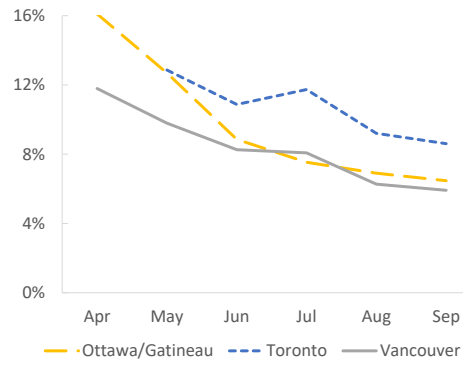
(f) Night club

Figure 4: Business opening and closure rates computed by sector and keyword in 2021

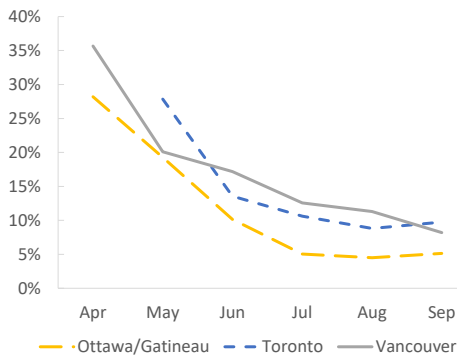
Note: The figure displays the monthly opening and closure rates for each city derived from Google Places data, split by sectors and keywords. The food sector is the aggregation of the results by the keywords `bar`, `cafe`, `restaurant`, and `night_club`. Data for the retail and food sectors are compared to the experimental estimates of opening and closure rates from Statistics Canada (from [Table 33-10-0270-01](#)) for the corresponding metropolitan areas. Data from Statistics Canada are available only for some sectors and cities because certain breakdowns generate a small number of observations that does not satisfy confidentiality requirements. Data from Statistics Canada cover the entire Census Metropolitan Area (CMA), while we collect Google Places data for downtown areas only. Data from Statistics Canada, derived from tax records, are not available for recent periods because of a three-month reporting lag. In April, we did not collect data for the retail sector across cities nor for the food sector for Toronto, so the opening and closure rates are not computed for May.



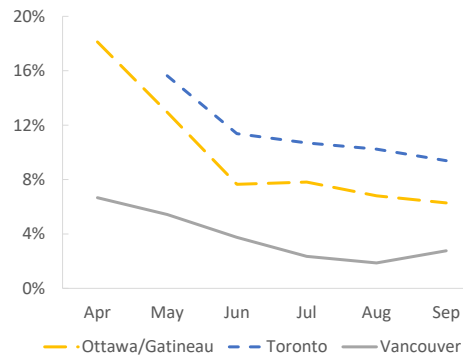
(a) Retail sector, NAICS 44-45



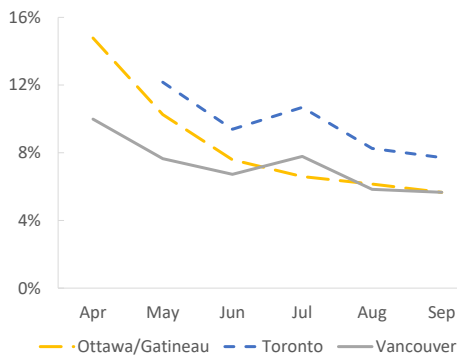
(b) Food sector, NAICS 722



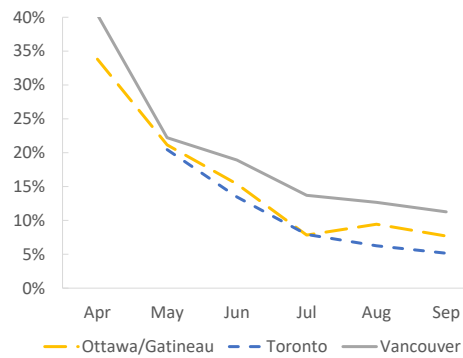
(c) Bar



(d) Cafe



(e) Restaurant



(f) Night club

Figure 5: Evolution of the rate of businesses temporarily closed by sector

Note: The figure displays the monthly rate of temporarily closed businesses derived from Google Places. The food sector is the aggregation of the results by the keywords `bar`, `cafe`, `restaurant`, and `night_club`. In April, we did not collect data for any of the food sub-sectors for Toronto. The month of April for the retail sector is only an estimate based on a smaller sample.

4.2 Comparison with Statistics Canada data

We compare our opening and closure rates with the monthly estimates of openings and closures from Statistics Canada. Statistics Canada’s experimental estimates of business openings and closures rely on tax data, namely, tax forms for wages. Therefore, these data are collected only for enterprises with at least one employee. Moreover, Statistics Canada data have a three-month publication lag¹³ and does not capture businesses with no employees or multiple establishments that belong to the same enterprise. Conversely, the Google Places data are available in real time at the level of establishment (one enterprise can have multiple establishments) and includes self-employed proprietors with no employees.

A key strength of the Google Places data is that it can better distinguish between temporarily versus permanently closed businesses. In the Statistics Canada dataset, a temporary closure may be a shift from one or more employees to no employees, and then back to one or more employees. However, not having employees temporarily may not mean that the business is closed if, for example, the owner runs the business. In addition, during the pandemic, government subsidies allowed many workers to remain employed even if their enterprises had to temporarily close their operations: a closed enterprise that kept its employees on payroll would not be counted as a temporary closure in the data from Statistics Canada.

Broadly, the opening and closure rates inferred from Google Places data are in a range similar to those from Statistics Canada, despite the differences in definitions and geographical coverage (Figure 2). Data from Statistics Canada suggests a higher opening than closure rate for most of June and July, and this is indeed what we obtain from Google Places. The sign of the changes in the closure rates from Google Places perfectly correlates with those from the Statistics Canada estimates, for both the retail (Figure 4a) and food sectors (Figure 4b). The sign of the change in the opening rates also mostly coincides across the two datasets, but one has to keep in mind that the coverage is not identical in both datasets. Thus, we now turn to a survey of business (re)openings to further assess the quality of the data.

4.3 Business opening rates confirmed by a survey

We carried out a survey of 196 business openings in Ottawa/Gatineau from May to September. We either called or physically checked when we did not get a response and confirmed 71% of the new entries in the food sector. If we consider the businesses that appear in the dataset with more than 10 customer reviews to be entries, in a broader definition, then the ratio of confirmed openings would be reduced to 62%. This then confirms our hypothesis

¹³As of the writing of this paper, Statistics Canada official statistics are only available up until July 2021.

that true business entries are associated with fewer reviews upon entry. In our survey, we also confirmed 44% of the new entries in the retail sector.

The percentages reported here should be understood as a lower bound for several reasons. First, if the full address or the phone number was not available, we were unable to perform validation. Second, some businesses may operate from an office building that is not physically accessible given COVID-19 restrictions. Finally, a few businesses appear to be located in more residential areas—which is partly related to online businesses that are operated from the owner’s residence, or businesses where the listed address is that of the owner. Anecdotally, well-known chains that opened or closed locations during our study were systematically correctly reported in our sample. We also noticed that the accuracy rate is higher in the busier streets of the city center than outside the main commercial areas. Our survey confirms that the data quality is superior for the food sector, especially in busy downtown areas, likely because of active reviews by customers and incentives to maintain an online presence (e.g., for take-out).

5 Discussion and conclusion

We introduce a new method to track business dynamics in a timely manner using Google Places, the data behind the Google Maps service. Our estimates for business opening and closure rates move as expected with the timing of the lifting of COVID-19 restrictions across jurisdictions and sectors in the summer of 2021. In particular, the re-entry of temporarily closed businesses largely contributed to the business entry rate at the beginning of the summer of 2021. This suggests that government financial support to maintain workers’ relationships with their employers during the COVID-19 lockdowns might have helped speed up the reopening.

For a crisis propagating as fast as the COVID-19 pandemic, monitoring the evolution of businesses in a timely manner is critically important for policy-makers. Our method can complement existing business registries and records from income taxes by providing a timely assessment of changes in the landscape of businesses and by covering self-employed businesses that are often harder to account for. Our method could be used as early warning systems for future crises, or also used to calibrate micro-simulations of agent-based models of business dynamics. In addition, our method could be used by local business communities to track the health of businesses and suggest measures to support local economic activity.

It is important to highlight several limitations of our work. First, as data collection can only be performed in real time with no historical data available, we cannot observe the onset of the

pandemic. The absence of long-term data also prevents us from benchmarking our opening and closure rates with normal times. Some of those issues can be progressively addressed as we continue to collect data moving forward. Second, the quality of our estimates is inherently based on the quality of the Google Places data itself. In particular, business closures are harder to assess because the business no longer exists for us to confirm the timing of its shutdown. For instance, a closed business not reported as such by the owner or customers may remain in the dataset until a new business opens at the same location. In the future, Google itself might want to report business opening and closure rates since it is best placed to assess the quality of its data.

Our methodology can be used for further research in several areas. Following [Kurmman et al. \(2021\)](#), one could look at the intersection of local business health and labor market dynamics in labor-intensive service sectors. For example, the business and labor dynamics may be different in core versus suburban areas, changes to the labor market may be heterogeneous when certain sectors are more affected by a shock, or small businesses may be more impacted when large retailers open a new location or when online retailers or "Instagram sellers" gain a larger market share. One could also study how changes in economic policies affect business dynamics. Namely, one could investigate the change in business closure rates after an increase to minimum wages in a region. Furthermore, changes of public infrastructure and government regimes may have observable effects on business dynamics and the choice of location.

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A Scraping Algorithm

Algorithm 1 Algorithm to collect data from Google Places

Precondition: A is a two-dimensional polygon in latitude-longitude coordinates. df is globally initialized to be a (initially empty) DataFrame of query results.

```
1: function SCRAPE( $A$ )
2:   Compute  $B((x, y), r)$  to be the smallest circle containing area  $A$  centered over the
   coordinates  $(x, y)$  with a radius  $r$ 
3:    $results, flag \leftarrow \text{QUERY}(B((x, y), r))$ 
4:   if  $flag$  then
5:     Compute  $A_1, \dots, A_4 = B((x \pm \frac{r}{2}, y \pm \frac{r}{2}), \frac{r}{2})$ 
6:     for  $i = 1, \dots, 4$  do
7:       Add SCRAPE( $A_i$ ) to  $df$ 
8:     end for
9:   else
10:    Add  $results$  to  $df$ 
11:  end if
12:  return  $df$ 
13: end function
```

B Graphical Appendix

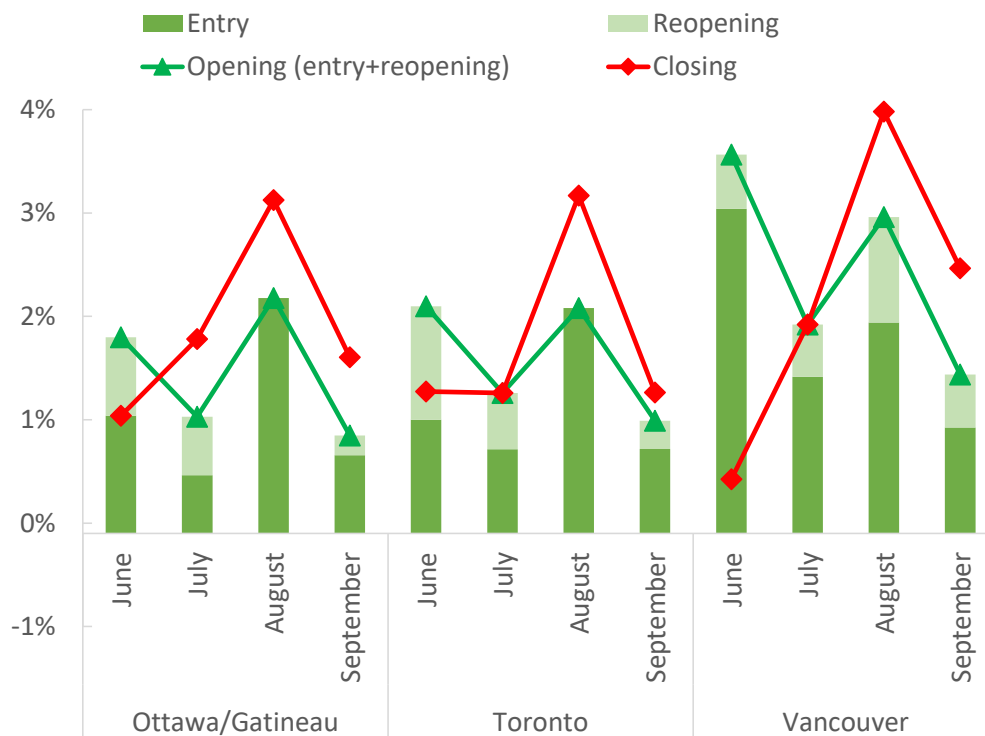


Figure 6: Business openings and closures for the accommodation sector, NAICS 721

Note: The figure displays the monthly opening and closure rates derived from Google Places data split by city, sectors, and keywords. Measures from Statistics Canada are not available over comparable geographical areas because the smaller number of observations does not satisfy confidentiality requirements.

C Timeline of changes in COVID-19 restrictions

Month	British Columbia	Ontario
April		3-Apr. Four-week lockdown for the entire province 8-Apr. Stay-at-home order for the entire province
May	25-May. Phase 1 reopening: indoor and outdoor dining with capacity limits	
June	15-Jun. Phase 2 reopening: maximum of 50 people for outdoor social gatherings and 50 people for seated indoor organized gatherings	2-Jun. Ontario's stay-at-home order expired 11-Jun. Step 1 of reopening: outdoor dining with up to four people per table, non-essential retail at 15% capacity, essential retail at 25% capacity; retail stores in malls remain closed unless they have a street-facing entrance 30-Jun. Step 2 of reopening: outdoor dining with up to six people per table, non-essential retail at 25% capacity, essential retail at 50% capacity
July	1-Jul. Phase 3 reopening; night clubs reopen with capacity limits; return to normal hours for liquor service at restaurants and bars	16-Jul. Step 3 of reopening: indoor dining with no limits per table, essential and non-essential retail with capacity limited to the number of people that can maintain physical distancing, night clubs at up to 25% capacity or up to 250 people
August		
September		24-Sep. Capacity limits eased for settings where proof of vaccination is required

Table 3: Phased reopening across provinces for retail and food sectors in 2021

Note: The city of Gatineau that faces Ottawa on the other side of the river is in the province of Quebec with its own set of restrictions. However, Gatineau accounts for fewer observations of the Ottawa/Gatineau area for which we downloaded data. The area around Gatineau followed a similar timing to Ontario, with a lockdown in April and the start of the reopening from May 31 onward and then throughout June.