

The effect of COVID-19 on customer traffic: A case study of Food and Beverage stores in Erie County, New York

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Abstract

The declaration of the COVID-19 pandemic and the resulting lockdowns brought focus on the importance of the retail sector for community well-being. The restrictive government policies that were put into place to curb the spread of COVID-19 virus added pressure on retailers to adapt to the subsequent changes in consumption. This research, using a case study of Erie County in the State of New York (NY), investigates these changes in visitation patterns for a commercial service sector that was deemed 'essential' - food and beverage. This study uses mobile location data to identify variations in shopping patterns for independent and chain stores. The study finds that by comparing the pre-pandemic to pandemic, there were changes to visitation patterns over time and between retail types. While the study highlights the potential to use mobile data to study shifts in consumption behaviours, the paper also reveals several challenges in using such data.

1. Introduction

On March 11, 2020, the World Health Organization declared COVID-19 a pandemic, setting in process global economic, social and political uncertainty [1]. During the pandemic, the retail industry has come to the forefront of public attention [2]. The public's perceptions around the retail industry have largely transformed from profit focused to now being characterized as essential to community well-being [3, 4, 5]. This new perspective has gained significant research interest, with special attention

given to both the necessity and complexities around access to and availability of goods and services [6, 7].

Changes in demand, product hoarding, route suspensions, reductions to shipping capacity, and price gouging have grown to be significant nodes of dialogue and often points of contention [2]. This has created added pressures on retailers attempting to find ways to survive during this unprecedented situation [8].

Finding ways to maintain societal and economic relevance while navigating government interventions (e.g., partial or complete lockdowns restricting movement, social distancing protocols, and curfews) has been a priority for many retailers. While many of these restrictive policies have created severe challenges for the retail industry, some retail sectors have been disproportionately affected. It has been widely documented that non-essential retailers and small businesses have experienced some of the greatest challenges [9, 10]. Changes to purchasing habits, increased vacancy rates, and unemployment rates will continue to present current and future disruptions to the retail industry [11].

To examine these changes in consumer behaviour, this study utilizes mobile location data for Erie County, NY to investigate the changes in shopping behaviours during the pandemic. This research has two objectives: (i) To identify the changes in consumer behaviours (visitor counts and dwell times) pre and during the pandemic; and (ii) to examine the different experiences in consumer shopping between independent and chain retailers.

The paper is divided into four sections, as follows: (i) the research context is provided, highlighting the public policy response to COVID-19 and the effect of such government intervention on consumer behaviour; (ii) the methodology is outlined; (iii) the research findings are presented and discussed; and, (iv) conclusions are drawn and limitations are identified.

2. Research Context

2.1. COVID-19 Timeline in Erie County

Accumulated evidence has shown a clear relationship between government policies and the number of COVID-19 cases and fatalities [12]. From March 2020 to April 2021, Erie County went through five phases of government enforced restrictions and re-openings (Figure 1). On March 22, 2020, New York State implemented a 'PAUSE Executive Order' due to the significant rise of COVID-19 cases in the State. This executive order was a 10-point policy designed to ensure public safety [13]. As it pertains to retail, this policy outlined closures of all non-essential businesses and ordered all non-essential gatherings of individuals to be postponed or cancelled. On May 5th, 2020, New York State released regional guidelines for re-opening known as the NY Forward Plan, outlining four phases for reopening the state. By June 1st, retail businesses in New York State were eligible to reopen at reduced capacity (50%), excluding malls which eventually were able to re-open on September 9th [13]. On October 4th, amidst another surge in COVID-19 cases, non-essential businesses were once again forced to close in areas deemed to be hotspots for infection. In November, curfews for specific business services were put into effect restricting hours of operation, specifically restaurants and gyms [13]. January through to April, 2021 was largely defined by vaccination rollout and the gradual reopening of the economy.

2.2. Mobile location data

The advancements in spatial big data and associated analytics have allowed for more granular level consumer behaviour data to be collected and analyzed. The retail, tourism, management, and health care industries have started to experience significant changes in their informatics and decision-making as a result of this data evolution [14, 15, 16, 17, 18, 19, 20, 21, 22, 23]. Spatial big data are becoming a more prominent research area [24, 25, 26, 27]. Specifically, the adoption of Geographic Positioning System (GPS) technology within mobile devices (i.e., smartphones) has resulted in significant growth in the collection and analysis of spatial-temporal data. With GPS devices becoming cheaper and more portable, it is becoming easier to track individual travel patterns. With personal mobility being important in retail analytics, GPS data has led to the increased sophistication and quality of individual mobility data and as a result has experienced growth in its usage in understanding the successes and failures of retail locations [28, 29]. Traditionally, consumer retail metrics (e.g., conversion rate, customer retention, customer satisfaction, and store media value) were evaluated via qualitative surveys, often lacking the capability of capturing the nuances in consumer buying behaviour [30, 31, 32, 33]. The use of

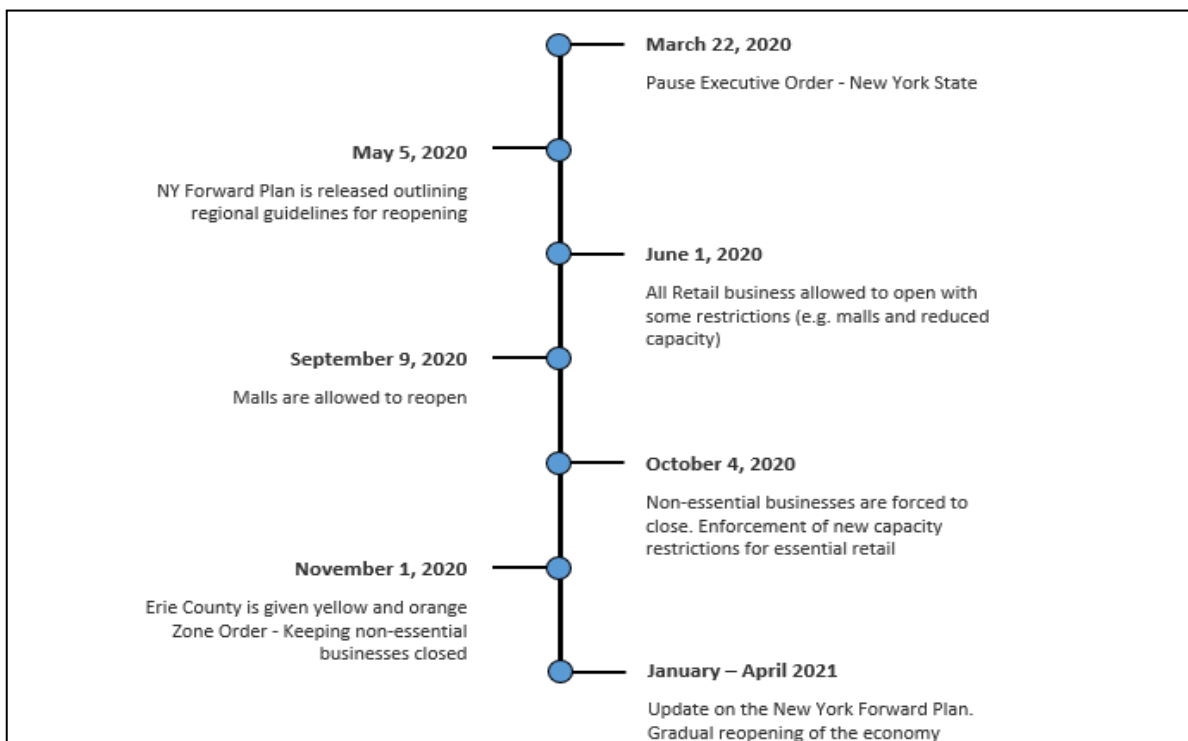


Figure 1. Summary of COVID stages in Erie County

mobile data now allows for the minutia of individual consumer behaviors to be investigated at a micro level.

2.3. Changes in consumer behaviours

Under the threats of COVID-19, consumers have changed (or been forced to change) their shopping habits to protect themselves from getting infected. Short-term changes including cooking at home more often, fewer grocery trips, and prioritizing convenience when choosing stores are becoming standard practices [34]. When shopping, consumers are prioritizing safer in-store environments, often seeking shopping destinations with mobile-based self-checkout systems [35]. Consumers are becoming more cautious when considering shopping destinations as in-store cleanliness and health & safety have also grown in importance for consumers [36]. To decrease the risk of getting infected, it has been documented that consumers are shopping less often at bricks and mortar locations, minimizing the amount of time spent in stores, avoiding standing in crowded places, and wearing gloves and masks while shopping [37].

In response to these changes in consumer behaviors, retailers have adopted new ways to enhance customer experience both in-store and online (i.e., adjusting daily store operations). Retailers are further prioritizing the introduction of new health and safety protocols to ensure consumer and employee safety. It has become common practice for retailers to offer free hand sanitizer, providing protective visors or face shields for cashiers, implementing social distancing measures between customers through floor signaling and graphic reminders, accepting only contactless payment to minimize the handling of cash, and requiring shoppers to wear gloves and/or face masks. Furthermore, due to the increasing demand in online shopping, many retailers have invested heavily in upgrading their online services to meet this need [38]. Researchers have started to investigate the effectiveness of these new shopping protocols. For example, Untaru and Han (2021) showed that there was a positive correlation between in-store protective measures and customer satisfaction [36]. Stores that strictly implement safety measures leave a positive effect on customer behavioural intentions, such as revisiting the store and positive word-of-mouth.

Not all businesses are able to adapt to the changes in consumer behaviour, which ultimately make it difficult for some retailers to attract customers. This study looks at the differences in aggregated weekly customer behaviour data between independents and chained stores to provide empirical evidence into the fluctuations in demand for in-store shopping during the pandemic. By highlighting the potential differences between retail chains and independent stores, key vulnerabilities can be identified. This offers a potential critique on the restrictive government policies and how they might produce

different outcomes for different types of businesses. This is an area of limited research and as a result this study allows for a preliminary look into fluctuations in customer traffic and the potential effects that it might have on the demand for retail spaces.

3. Methodology

3.1. Study Area and Data

Erie County is located along the shores of Lake Erie in western New York State (Figure 2). Erie County is home to approximately 916,672 people making it the 9th largest county in the State [33]. The Buffalo metropolitan area accounts for 86% of the total population for the county [39].

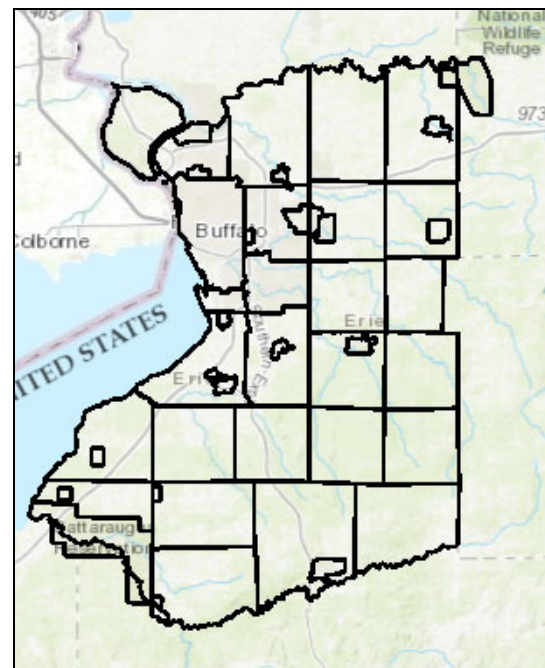


Figure 2: Erie County

The data included in this study was collected from SafeGraph which is a commercial provider of visitation pattern data derived from mobile devices. While SafeGraph does not offer pathing or trajectory data, it does provide aggregated visitation data for specific Points of Interest (POI). Weekly POI visitation numbers were collected for 602 food and beverage locations, in Erie County, NY from March 18, 2019 to February 22, 2021. These 602 locations make up the entire food and beverage (NAICS category 445) POI database available through SafeGraph in this study area.

3.2. Analysis

Multiple approaches were used to analyze the spatial temporal visitation patterns at different time scales. This research consisted of the following three tasks: (i) comparing weekly aggregated visitation patterns for the food and beverage retail sector; (ii) comparing weekly visitation patterns across different business types (i.e., chain vs independent); and (iii) identifying the effects of the pandemic on retail visitation patterns for both chains and independent retailers.

The analysis of unique visitor data between chains and independent food and beverage stores were compared before and during the pandemic. The POI data were placed into two groups, chain and independent. This data was further investigated to identify if differences existed around consumer shopping behaviours during the study period. This was done using a *paired two sample t-test*. With essential businesses being allowed to remain open, the t-test was used to identify whether differences existed in consumer visitation patterns pre and during the pandemic.

4. Findings

When comparing visitor counts pre and during the pandemic, there are some notable changes in visitor data (Figure 3). In March, June and August the visitor counts were higher during the pandemic than that of the previous year. The increase in March (29%) can be attributed to the increased demand in essential goods, panic buying and product hoarding. These were commonly documented experiences [40, 41] leading up to government sanctioned

lockdowns that were put into place at the end of March.

At the time of reopening (June 2020), once again, pandemic visitor numbers exceeded the counts from the previous year (14% increase). Shopping outings became more common in June when many of the stores' capacity restrictions were lessened or completely removed. During the fall months, COVID-19 counts began to rise and as a result, new restrictions were put into place, once again effecting the number of visitors within stores. The decline during the holiday shopping season was significantly less than what was experienced in pre-pandemic times (49% decline). This was largely explained by new lockdowns being enforced in November and December as a result of surging infection rates.

When investigating the differences between visitor counts from March 2019 – February 2021 there are fluctuations in the total number of visitors (Figure 4). With the WHO declaring the pandemic in March of 2020, this triggered a significant decline in the total count of visitors. Chain stores experienced a 53.3% decline in traffic between March and April 2020 and 53.3% between April 2019 and April 2020. For Independent stores, the decline was less extreme as visitor counts fell only 43% between March and April 2020. When comparing April 2019 to April 2020 independent stores experience a 52.5% decline in visitors. Through May and June, the total visitor count started to increase back to March totals. While counts for chain and independent retailers were relatively stable in the summer months (June-August), the second wave of the pandemic brought further declines in visitor counts (November -January).

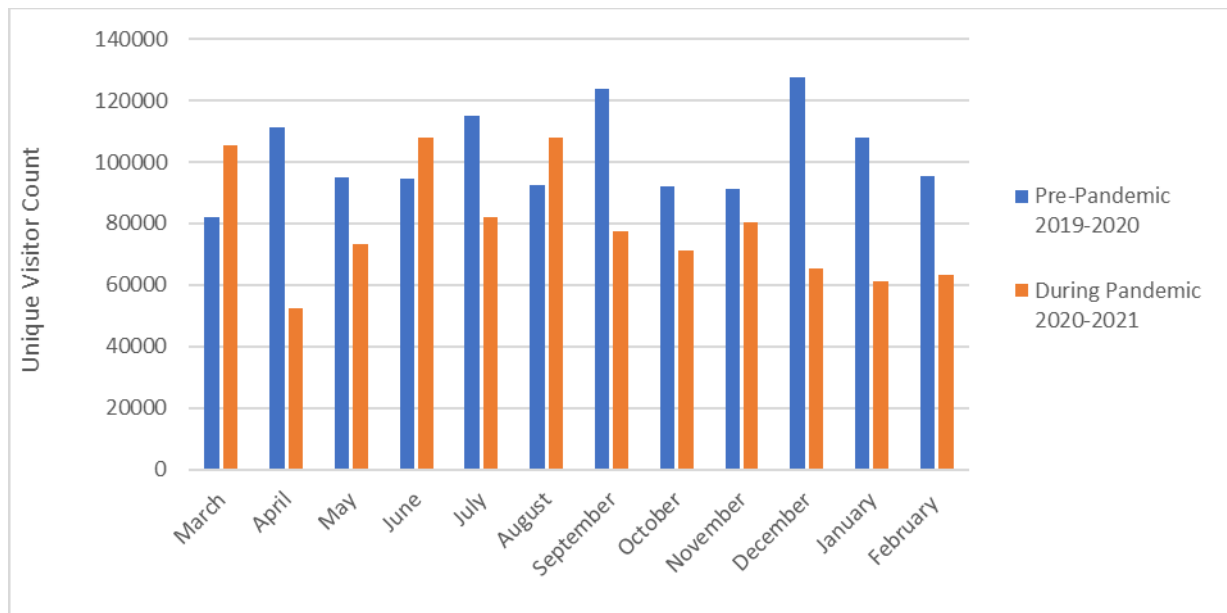


Figure 3. Visitor data for food and beverage stores

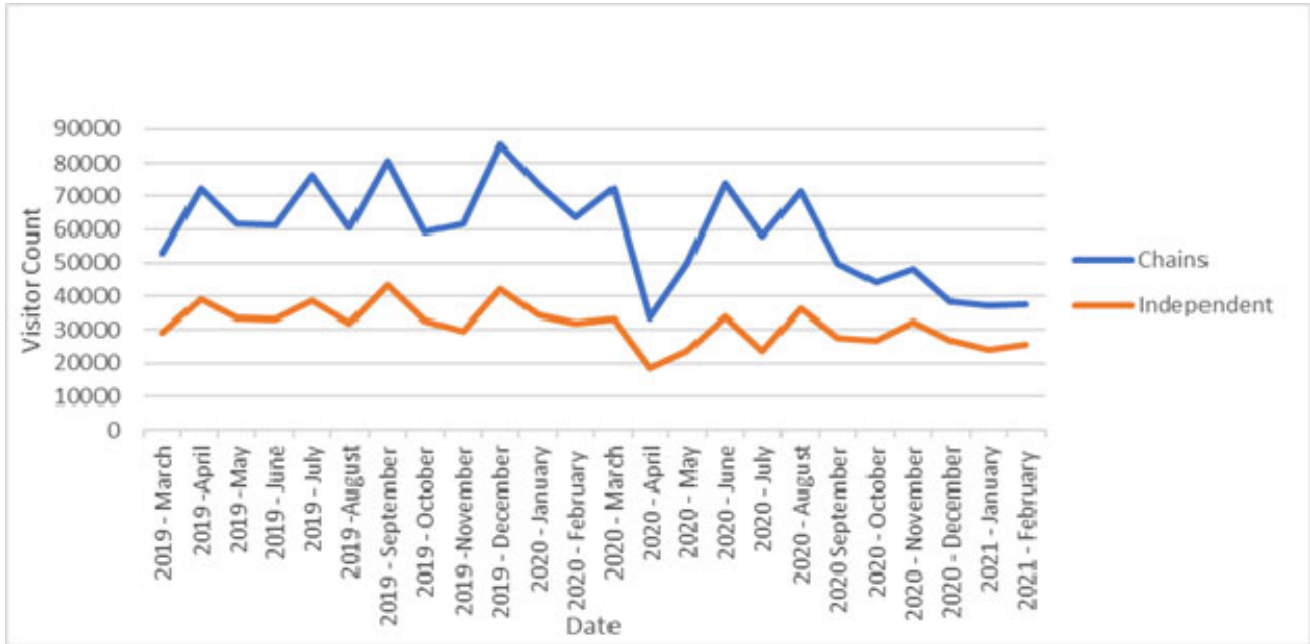


Figure 4. Chain and independent food and beverage stores visitor counts from March 2019 – February 2021

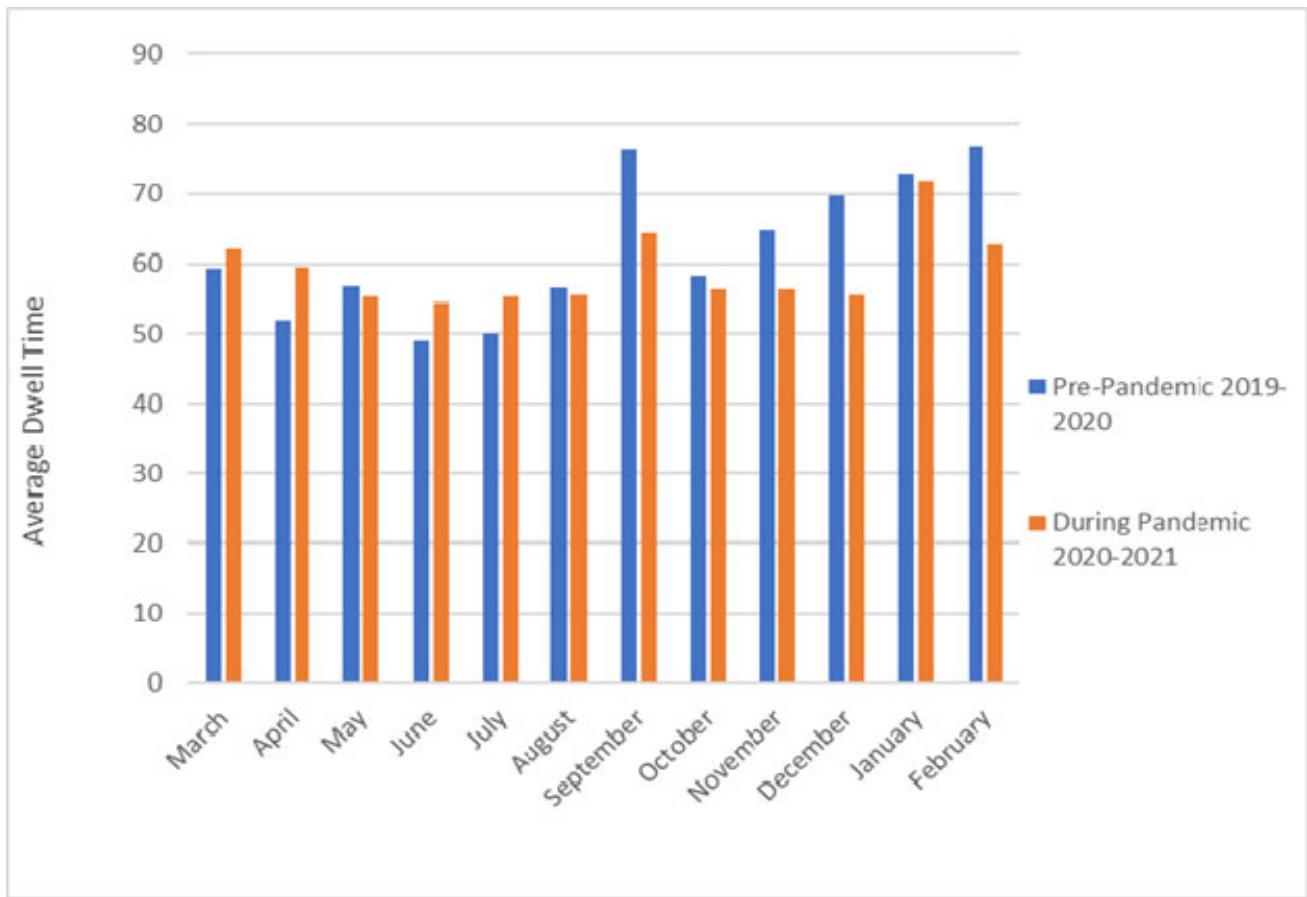


Figure 5. Average visitor dwell times for food and beverage retailers

In order to measure the differences in consumer visitation for independent and chained retailers pre and during the pandemic a paired t-test was conducted. The difference in visitor data for chain stores ($\bar{x} = 8121.1$; $\sigma^2 = 249333.7$) and independent stores ($\bar{x} = 6331.92$; $\sigma^2 = 616157.2$) was significant ($t = 15.45641$; $DF = 49$; $Sig = 0.01$). Independent stores experienced greater declines in visitors during the pandemic than that of retail chains.

While visitation data highlighted substantial changes during the pandemic, dwell times were relatively unchanged during the same period (Figure 4). There proved to be no statistical difference in the average consumer dwell times pre and during the pandemic for food and beverage retailers ($t=1.25$; $DF=11$; $Sig<0.1$). Therefore, there was no statistical difference in the amount of time that consumers spent in food and beverage stores.

5. Conclusion

With the virus continuing to spread across the world, this paper provides a look at the changes in consumer visitation patterns within essential retail spaces. Demand for in-store shopping has declined along with the different phases of government intervention. Those retailers deemed as 'essential' services, along with non-essential retailers, collectively experienced a shift towards curbside pickup and online orders as many consumers felt less comfortable being in physical spaces. Most critically, this paper assessed how essential retail travel was affected by government policy. Changes in customer visitation was largely linked to the government lockdowns experienced in Erie County.

While all retail has experienced changes in demand and consumer interaction, there are some clear differences that exist between chain and independent retailers. Independent grocery retailers are more vulnerable as they experienced greater declines in visitor counts within this study period. If these independent retailers lack online channels to continue to engage with their consumers, this loss in business can result in major financial burdens.

While there is a large body of literature examining business failures, specifically the why and how companies fail [42, 43], the findings of this study contribute to research into the impact of COVID-19 on the retail industry. This paper provides a snapshot into the nature and extent of fluctuations in customer visitation patterns between chain and independent stores through cycles of restrictive government policy.

5.1. Limitations

This study has several limitations. The first limitation exists around the geometry associated with the geofences. Delineating geofences is a manual and often subjective

process therefore leading to potential errors around the inclusion and exclusion of certain data points. The geofences for this data, in GIS form, were not made available and therefore could not be validated for accuracy. This made it difficult to validate the level of precision with polygon delineation. Another limitation is associated with the incompleteness and inconsistency in the data. The visitor counts were very low at the individual store level, therefore data had to be aggregated to broader categories (chain vs independent, as opposed to specific retailers). Lastly, assumptions are made around the data points as it is assumed that all recorded individuals are consumers in the stores, which is difficult to validate. While POI data with predefined geofences is more widely available for academic research, detailed point data at the individual-level is needed to be able to refine research methodologies to address detailed spatial-temporal questions.

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