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Uncovering Shifts in Online Market Shopping Behavior During Covid-19 Pandemic

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Highlights

- Lockdown period saw 97.4% of neighborhoods increase their online market sales.
- Higher socio-economic groups showed strong correlation with increased online market sales.
- This paper highlights the need for diverse marketing strategies for less adaptable groups.

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Abstract

This study investigates shifts in online market shopping behavior in Ankara, Türkiye, during three distinct stages of the COVID-19 pandemic: pre-pandemic, the period of stringent restrictions, and the subsequent easing of restrictions. Using online sales data from local supermarkets, we combine statistical and spatial analyses to evaluate how consumer behavior evolved and how it relates to socioeconomic and geographic factors. A non-parametric Kruskal–Wallis test identifies significant differences in online sales across the three periods, while Geographic Information Systems mapping visualizes the spatial distribution of changes at the neighborhood level. Correlation analyses reveal that online shopping activity is positively associated with higher socioeconomic status and education levels, with these relationships becoming more pronounced during the restriction period. The findings demonstrate that online grocery adoption surged under strict measures and partially stabilized afterward, with spatial patterns highlighting disparities between central and peripheral districts. By integrating statistical evidence with spatial visualization, this study provides insights into how crisis-driven shifts in consumer behavior intersect with social and geographic factors, offering a basis for future research and policy considerations in urban retail and e-commerce planning.

1. INTRODUCTION

The COVID-19 pandemic, which emerged in late 2019, has had a profound and global impact on various aspects of our daily lives. One notable area that has experienced significant transformation is our shopping behavior. Notably, the pandemic has led to a marked increase in the preference and popularity of online shopping, driven by health and safety considerations. Government-imposed restrictions, the implementation of social distancing measures, and limited access to physical supermarkets have collectively heightened the necessity and demand for online market shopping.

Researchers Harjoto and Rossi [1] underscore the notable spikes in demand for online communication channels, commerce, and healthcare services as a direct result of the pandemic. The situation has prompted a noteworthy shift, with approximately 46% of consumers reportedly resorting to online grocery orders for

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the first time since the onset of the pandemic [2]. This surge in online shopping can be attributed to the necessity of adapting to the evolving circumstances and safeguarding personal health amidst the ongoing global health crisis.

Pandemics throughout history have had far-reaching impacts on health and economies. The COVID-19 pandemic, like its predecessors, has disrupted the entire food supply chain, from production to consumption. Restrictions on movement, changes in consumer behavior, facility closures, and trade policy shifts have caused significant challenges. Some experts even draw parallels between this crisis and the Great Depression. Lessons learned from these historical events are essential for navigating these unprecedented challenges and ensuring food security.

Since the onset of the pandemic, numerous studies have been conducted to forecast the repercussions of COVID-19 on food chains and marketing. These studies delve into the causes and formulate future strategies. Articles abound on gauging the pandemic's impact on supply chains, agriculture, and the food sector, while also exploring measures to mitigate its effects. The significance of digitalization in tracking, comprehending, and managing the consequences of the pandemic is evident [3–17]. These studies collectively illuminate the evolving landscape and underscore the enhanced role of digitalization in monitoring, addressing, and mitigating the pandemic's impacts.

The COVID-19 pandemic has prompted a shift in consumer purchasing behavior, as evidenced by various studies [18–21]. Moon, Choe & Song [22] highlight the growing significance of untact shopping, a trend accelerated by industrial and technological advancements, which has become essential in the wake of the pandemic. Chenarides et al. [23] conducted a study in two US metropolitan areas, revealing that consumers turned to online services for shopping during the pandemic. To address these changes, studies have emerged to aid marketers, retailers, and advertisers in formulating strategies tailored to the altered purchasing behaviors [24–27]. Addo, Jiaming, Kulbo, Liangqiang & Li [24] examined post-COVID-19 purchasing behavior in Wuhan, China, using the fear lure theory of fluctuations. They collected statistics on the pandemic and personal protective equipment purchases, finding that fear's appeal is linked to dynamics in online purchasing during the COVID-19 pandemic.

Building a dependable and all-encompassing database to serve as a foundation for analysis during crises presents a significant challenge. Existing studies draw on two primary approaches: questionnaires and surveys, or utilization of real data from the literature. The former approach grants insights into shopping dynamics through individual preferences and experiences, while the latter approach offers a more explanatory view of tendencies and behaviors within larger groups and communities. Moreover, real data supplies intricate information about purchased items and alterations in consumer shopping patterns across diverse levels. It proves particularly valuable in scenarios where the execution of questionnaires and surveys is unfeasible.

Questionnaires and surveys have played a prominent role in capturing data during the dynamic and swiftly evolving pandemic period. Notable efforts have been made to collect essential data through questionnaires aimed at elucidating changes brought about by the pandemic [28]. Ben Hassen, El Bilali & Allahyari [29] conducted an online survey in Qatar to assess shifts in consumption patterns amid the pandemic. Two reference surveys – the West Michigan University Food Consumption Changes 2020 survey [30] and the UNSCN COVID-19 survey [31] were utilized for context. Disseminated through social media and email, the voluntary participants' responses were collected via Survey Monkey and analyzed using the Statistical Package for Social Analysis (SPSS) tool. This approach unveiled modifications in consumers' eating habits, shopping behavior, and interaction with food. Butu et al. [32] focused on consumers' purchasing behaviors concerning fresh vegetables from local producers in Romania following the state of emergency declaration. Socio-demographic factors related to this direct purchase were scrutinized before and after the state of emergency. Results indicated direct links between the state of emergency, changes in fresh vegetable purchasing behavior, and the digital transformation of short food supply chains. Li, Hallsworth & Coca-Stefaniak [33] engaged a survey-based approach on the WeChat social media platform, examining small businesses and farmer markets. While the former benefitted, the latter experienced customer attrition.

Overall, survey-based studies underline reduced interest and preference for in-store shopping due to pandemic-related disease transmission concerns [34–37].

In addition to survey data, studies based on real data collected from in-store and online sales information and customer sociological data provide valuable insights [38,39]. Farrell, Wheat, Ward, & Relihan [39] aimed to discern the pandemic's impact on local trade across 16 distinct US cities by scrutinizing neighborhood-level dynamics. Analyzing consumer behavior and growth rates in online spending before and during the pandemic, they employed credit card transaction data from an anonymized sample of 11 million customers, along with neighborhood sociological characteristics. Their findings revealed a general increase in online shopping, yet disparities emerged between low-income and high-income neighborhoods due to their proximity to supply points. Chang & Meyerhoefer [40] explored the pandemic's influence on online food shopping demand using data from Taiwan's largest agri-food e-commerce platform. Correlating COVID-19 cases with online customer numbers, they identified varying demand increases based on specific agri-food categories, with smaller businesses benefiting more than large enterprises. Grashuis, Skevas & Segovia [41] aimed to comprehend customer preferences for purchasing methods, time intervals, minimum order requirements, and fees during the pandemic. They established a link between the trend in new COVID-19 cases and customers' grocery shopping preferences. Wagner, Schramm-Klein & Steinmann [42] adopted a multi-channel retailing approach to define and enhance the online retailing landscape, utilizing both an online survey and an experimental study. Their work demonstrated the influence of technology-related quality and context-related situational benefit on consumers' e-channel utilization. The study emphasizes that providing diverse e-channel touchpoints and digital shopping formats could enhance the shopping experience. In the current study, real data analysis is employed to assess the pandemic's impact on online shopping behavior. This approach unveils changes, socio-economic influences, and geographic dependencies in shopping patterns across different phases of the pandemic.

Demographic structure and consumption values play a pivotal role in shaping consumer behavior as the transition from in-store shopping to online shopping occurs [35,43–48]. Dominici et al. [49] explored the determinants of individuals' likelihood to engage in online food shopping through a logit model applied to a dataset of 34,488 participants from the Italian National Institute of Statistics multipurpose survey. Their study found that food-online consumers tend to be young, well-educated, female, residing in small families, and with a favorable overall economic condition. Situational factors like working hours, obesity, health problems, and regular sports engagement also positively influenced the likelihood of online food shopping. Buettner [44] examined online shopping behaviors across 30 European countries and identified education and financial situation as significant factors, while gender and age did not exhibit the same influence. The study by Moon, Choe & Song [22] highlighted the decline in offline shopping among self-perceived vulnerable groups during the pandemic in Korea. However, as the disease situation stabilized, population statistics ceased to be significant determinants of online shopping, yet a preference for online channels over offline alternatives persisted among the general population.

This study investigates the influence of the COVID-19 pandemic on online market sales by analyzing real-world online sales data from various chain-markets in Ankara, Türkiye. The research focuses on three distinct one-month time intervals: the pre-pandemic phase, the lockdown period, and the post-lockdown phase marked by reduced restrictions. The primary objectives involve assessing variations in online market sales across these three periods and within different districts of Ankara, thereby illuminating shifts in consumer preferences during the pandemic. Furthermore, an exploration of the socio-economic factors that underpin online shopping behavior is conducted at the neighborhood level. Through statistical analyses and spatial mapping, the study establishes the significance of its findings, shedding light on the intricate interplay between the pandemic and online shopping dynamics.

2. MATERIAL METHOD

2.1. Data

In this study, different kinds of datasets from several sources are used, including (1) the online market sales data, (2) demographical data such as population, education level, and socio-economic status at the neighborhood level and (3) the neighborhood shapefiles of the central districts of Ankara.

In Türkiye, numerous medium-sized and large supermarket chains have adopted online ordering and home delivery services to meet evolving consumer demands. To manage the technical infrastructure and operational requirements of such services, many of these markets collaborate with specialized software providers. Marketyo has been one of the leading omni-channel e-commerce solution providers in this space, partnering with many local supermarket chains across multiple provinces in Türkiye. The platform facilitated the digital transformation of local markets by enabling them to offer integrated online shopping and home delivery services, thereby expanding their customer reach and creating additional revenue streams. During the COVID-19 pandemic, Marketyo experienced significant growth, and its strategic value led to its acquisition by a major global player in online food and grocery delivery. This evolution highlights Marketyo's pivotal role in shaping consumer shopping trends and supporting the rapid expansion of online grocery retail in Türkiye.

This study focuses on analyzing the online sales data collected from 5 chain-markets operating across various districts and neighborhoods within Ankara, the capital of Türkiye. Notably, Ankara ranks as the second-largest province in Türkiye, boasting a population exceeding 5.6 million as of 2020. Around 89% of this populace resides within the central districts that compose the city of Ankara, forming the primary study area for this research. Given this concentration, the city serves as a robust representative sample of the broader country's population and demographics.

The online sales data obtained from the company comprises three distinct periods [50]. The first period encompasses one month prior to the official announcement of the first COVID-19 case in Türkiye on March 11, 2020, denoted as "Period-1: February 10, 2020 – March 11, 2020". The second period corresponds to a month characterized by stringent restrictions such as school closures, curfews, remote work, and distancing measures, coinciding with the first recorded COVID-19 case, termed as "Period-2: March 11, 2020 – April 11, 2020". The third period encapsulates one month during which the process of normalization initiates with the easing of restrictions, designated as "Period-3: July 1, 2020 – August 1, 2020". The timeframes and descriptions of these three periods are outlined in detail in Table 1. Furthermore, statistical insights derived from the complete sales data collected across these three time periods are presented in Table 2.

Table 1. *Time intervals and descriptions of the study periods*

Period	Description	Time interval
Period-1	Pre-Pandemic Period	February 10, 2020 – March, 11 2020
Period-2	Period of lockdowns	March 11, 2020 – April 11, 2020
Period-3	Period after lockdowns	July 1, 2020 – August 1, 2020

Table 2. *Basic statistics of Marketyo online sales data collection for Ankara province*

Property	Value	Description
Total sales/orders	57,921	The collection includes total of 57,921 online sales.
Days covered	90	The online sales cover a period of 90 days.
Grocery chains	5	The online sales are from 5 different grocery chains.
Districts & Neighborhoods	10 - 356	The grocery chains serve in 10 districts and 396 neighborhoods in Ankara province.
Consumers	24,784	The orders are placed by 24,784 different consumers.

The structure of the Marketyo online sales data is organized as a series of individual online order records. Each order is distinguished by a unique identifier and includes pertinent details such as customer

information, order date, location specifics encompassing province, district, and neighborhood details of the order, the overall order amount, and the payment method employed. An illustrative instance of an order record is provided in Table 3. As per the provided table, the specific online order identified as O123 was placed by customer C1000 on March 20, 2020. This particular order was dispatched to Ankara province, Çankaya district, Mutlukent neighborhood, with the customer opting to pay a total of 257 Turkish Liras through a credit card transaction.

Table 3. *Example of an order record*

Order ID	Order date	Customer ID	City	Distinct	Neighborhood	Order total	Payment type
O123	20-03-2020	C1000	Ankara	Çankaya	Mutlukent	257	Credit Card
O124	20-03-2020	C3000	Ankara	Mamak	Pınarbaşı	110	Credit Card
O125	20-03-2020	C5000	Ankara	Keçiören	Ayvalı	320	Credit Card
O305	06-07-2020	C1000	Ankara	Çankaya	Mutlukent	650	Cash
O306	06-07-2020	C7000	Ankara	Gölbaşı	İncek	75	Cash

Beyond the order-level attributes, it is crucial to outline the demographic profile of consumers, as purchasing behavior is strongly shaped by age and gender. Table 4 presents the distribution of online market orders across different age groups and genders during the three study periods. The results clearly demonstrate that consumers aged between 25–34 and 35–44 years constituted the largest share of online shoppers, particularly during the lockdown period (Period-2). In these groups, both male and female users showed a remarkable increase compared to the pre-pandemic phase. Younger consumers (<18) and older adults (65+) exhibited relatively limited engagement in online shopping, which may be attributed to lower purchasing autonomy and digital adoption barriers. Notably, the number of orders classified as 'Age not specified' was also substantial, reflecting potential limitations in the dataset. Overall, the demographic profile highlights that middle-aged consumers formed the backbone of online grocery adoption during the pandemic, while the lockdown period acted as a catalyst for increased demand across all age groups.

Table 4. *Distribution of online market orders by age group and gender across three pandemic periods*

Distribution by age and gender	Total number of Period-1 orders	Total number of Period-2 orders	Total number of Period-3 orders
<18	**246**	**611**	**260**
Unknown	15	55	32
Male	142	287	131
Female	89	269	97
18 - 24	**426**	**1725**	**671**
Unknown	16	193	72
Male	224	666	297
Female	186	866	302
25 - 34	**2203**	**9260**	**3710**
Unknown	81	887	310
Male	914	3882	1363
Female	1208	4491	2037
35 - 44	**2084**	**9480**	**3612**
Unknown	59	776	261
Male	916	4478	1418
Female	1109	4226	1933
45 - 54	**704**	**4362**	**1673**
Unknown	20	301	127

Male	327	1900	640
Female	357	2161	906
55 - 64	**215**	**2319**	**863**
Unknown	5	128	40
Male	97	1191	415
Female	113	1000	408
65+	**62**	**1227**	**341**
Unknown	2	41	9
Male	20	799	205
Female	40	387	127
Age not specified	**1545**	**5122**	**5200**
Unknown	291	1102	3582
Male	381	1393	479
Female	873	2627	1139
Total	**7485**	**34106**	**16330**

Figure 1 illustrates the demographic distribution of online market orders across the three study periods. The graphical representation highlights a sharp increase in orders during the lockdown period (Period-2) across all age groups, followed by a partial decline in the post-lockdown phase (Period-3), though values remained above pre-pandemic levels (Period-1). The 25–34 and 35–44 age groups stand out as the most active consumers, consistently recording the highest number of online orders in each period. In contrast, younger (<18) and older (65+) consumers remained less engaged throughout the pandemic. Gender-based patterns also indicate that both male and female consumers contributed substantially to the growth, with females slightly leading in overall volume. Furthermore, the overall trend indicates that middle-aged groups constituted the primary drivers of online grocery adoption during the COVID-19 pandemic.

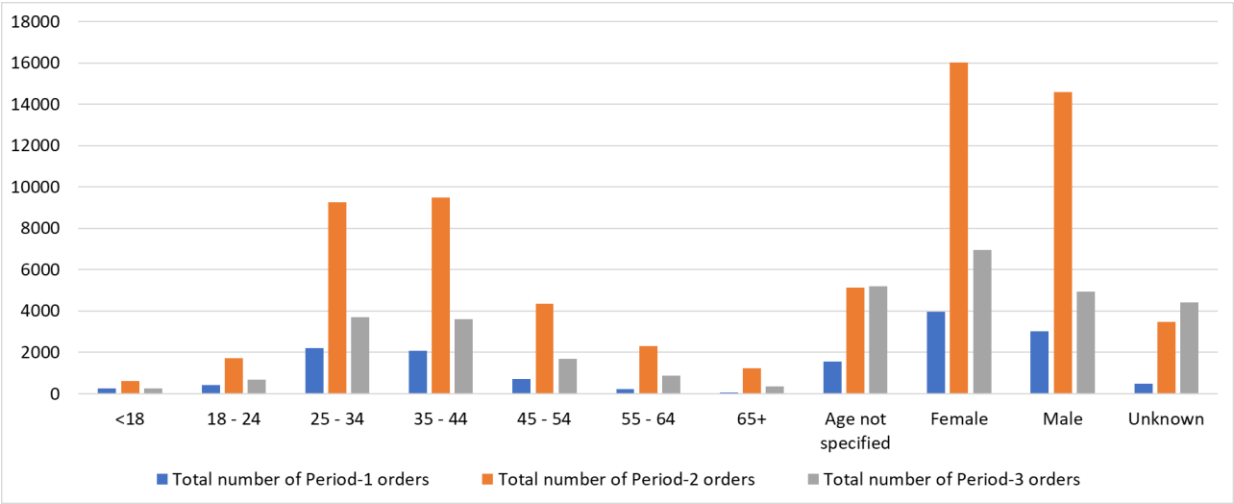


Figure 1. *Comparison of online market shopping behavior across age groups and genders in three pandemic stages*

In conjunction with the online market sales data, demographic and spatial data are incorporated to elucidate the correlation between online market sales and the socio-economic attributes of the neighborhoods. To achieve this, demographic information for the year 2019 from the Turkish Statistical Institute—comprising factors such as age, gender, population, purchasing power, education levels, and more—is merged with vector-based neighborhood data provided by Başarsoft. These datasets are employed in conjunction with market research data to provide a comprehensive analysis of the relationships under scrutiny.

2.2. Methodology

The core methodology of this study involves structuring the online sales data acquired from the company to align with the research objectives. Subsequently, the data is subjected to analysis encompassing sales counts, followed by the visualization of the analytical outcomes based on three distinct time periods and various districts. The interrelation between online sales and demographic attributes is explored through correlation analysis, employing SPSS v26. Meanwhile, the cartographic representation of the results is facilitated using ArcMap 10.8. The fundamental approach of the study is succinctly summarized in Figure 2.

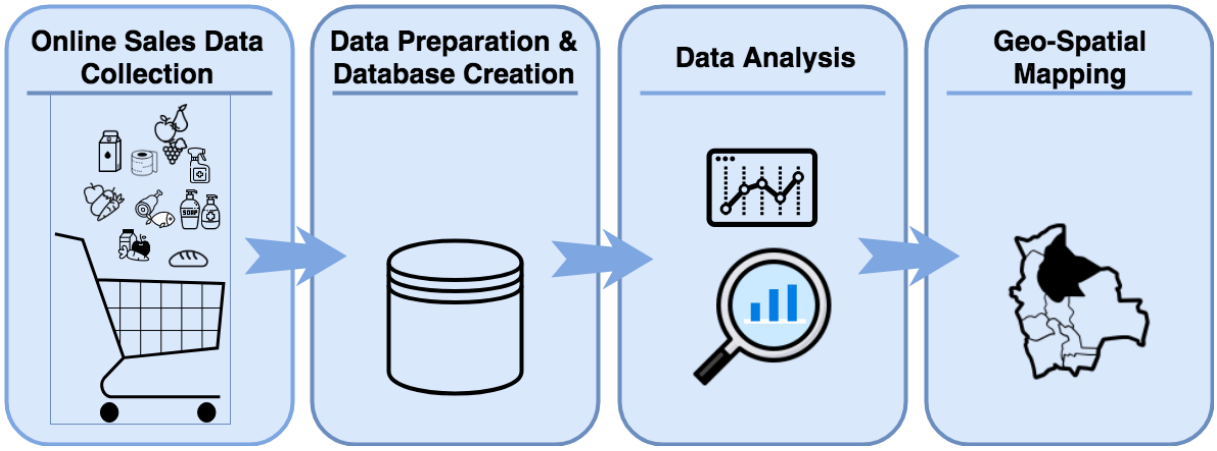


Figure 2. *Experimental methodology*

2.2.1. Analysis of the online sales

Online market sales data is derived from total sales data and. the raw data is filtered according to the dates in accordance with the three periods. Sum of all sales for each period is calculated at the neighborhood level.

The analysis consists of three primary segments. Initially, an examination of periods and districts is conducted to ascertain potential disparities in online sales. Subsequently, the alterations in online sales across neighborhoods between the specified periods are cartographically depicted, thereby visualizing the magnitude of change in online market shopping. Lastly, a comprehensive assessment is carried out to evaluate the connection between socio-economic indicators and online sales, thus uncovering the foundational factors influencing shifts in online sales at the neighborhood level.

- Statistical analyses of the change in online market sales and the variation among districts in three periods

An Analysis of Variance (ANOVA) is carried out to investigate potential differences in online market sales across periods and locations at the district level. ANOVA enables researchers to determine whether the mean scores of distinct groups or conditions exhibit variation [51]. Initially, the assumptions of ANOVA are assessed. It is observed that the normality assumption is violated, as evidenced by both the Kolmogorov-Smirnov and Shapiro-Wilk tests ($p=0.000$ for all three periods in both tests). The data exhibits positive skewness across all three periods. Consequently, to address the non-normality issue, the Kruskal-Wallis test, a non-parametric alternative to ANOVA, is applied. Goos and Meintrup emphasize the advantage of the Kruskal-Wallis test in handling non-normally distributed populations [52]. This test is suitable for comparing two or more groups, with the null hypothesis positing that the mean ranks are equivalent across all groups. The test statistics are presented below (Equation (1));

$$H = \frac{12}{N(N+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(N+1) \quad (1)$$

where H is the Kruskal-Wallis H Statistics
N is the total number of observations
n_i is the number of observations in group i,
R_i is the sum of the ranks in group i

The null hypothesis, indicating the same mean ranks across the groups are rejected for $H > \chi 2_{\alpha}$

- Mapping the shifts in online sales

The changes in online sales between period 1 and period 2, between period 2 and period 3, and between period 1 and period 3 are visually represented through mapping within a Geographic Information Systems (GIS) environment using ArcGIS software. To provide a meaningful perspective, the sales figures are normalized by dividing by 1000 persons, showcasing the sales per thousand capita figures. For effective visualization, the groups are categorized using natural breaks, aligning with the positively skewed data distribution.

- The relationship between socio-economic indicators and online sales

The relationship between online sales and socio-economic characteristics in three periods is investigated with correlation analysis (Equation 2).

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{(x_i - \bar{x})^2 (y_i - \bar{y})^2}} \quad (2)$$

where r is the correlation coefficient
x_i is the i^{th} observation of the variable x
$\bar{x}$ is the mean value of x variable
y_i is the i^{th} observation of variable y
$\bar{y}$ is the mean value of y variable.

3. RESULTS

The analysis of online sales in Ankara was conducted over distinct time periods with a focus on different districts (Figure 3). The observations from Figure 3 reveal notable trends: during Period-2, characterized by restrictions and lockdowns, the number of online sales significantly surpasses that of Period-1, representing the pre-pandemic period. Additionally, during Period-3, marked by reduced restrictions, the count of online sales is also higher than that of Period-1. These observations strongly suggest that both the pandemic itself and the imposed restrictions have substantial impacts on online sales figures, leading to noticeable shifts in consumer shopping behaviors.

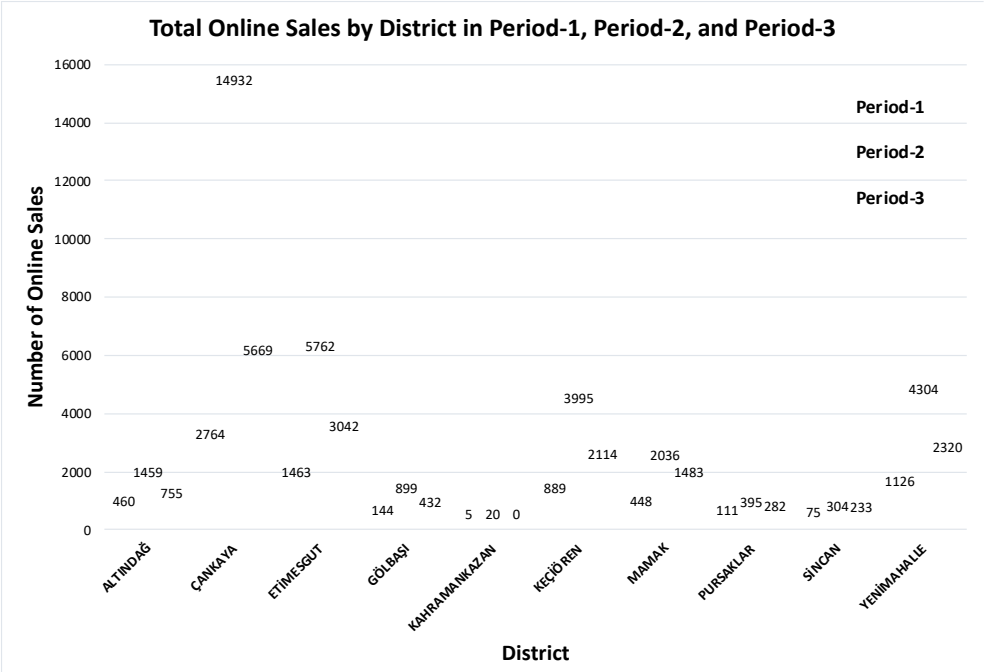


Figure 3. *Total online sales by distinct in Period-1, Period-2, and Period-3*

The Kruskal-Wallis test outcomes present compelling evidence of statistically significant distinctions in mean ranks among the three pandemic periods. The null hypothesis, which suggests uniformity in online market sales across each pandemic period, is convincingly rejected at the 0.05 α-level, with a calculated H(2) value of 190.10 and a p-value of 0.000.

Furthermore, the examination of online market sales extends to the districts of Ankara, revealing that these sales not only differ across periods but also exhibit significant variations among districts. This test is replicated for each pandemic period, considering 10 districts in total (N=356). The findings distinctly indicate variations in mean rank scores among districts for all three periods, affirming spatial significance in online sales at the district level: $H(9) = 67.35$, $p = 0.000$ for period 1; $H(9) = 86.78$, $p = 0.000$ for period 2; $H(9) = 60.04$, $p = 0.000$ for period 3. This underscores the importance of spatial context in understanding online sales dynamics across the different pandemic periods.

Subsequent to the identification of significant variations in online sales across periods and districts, a more intricate analysis is undertaken using GIS to visually exhibit the spatial distribution of online sales shifts at the neighborhood level. This comprehensive mapping involves 356 neighborhoods spanning 10 districts, focusing on the change in online sales per thousand population between different pandemic periods: Period 1 to Period 2, Period 2 to Period 3, and Period 1 to Period 3.

The initial map, illustrated in Figure 4, underscores the change from Period 1 to Period 2. It portrays that online market sales per 1000 capita experienced a notable upsurge from the pre-pandemic period to the pandemic lockdown period across almost all neighborhoods (97.4% of them). Notably, there are 8 districts with negative changes and 2 districts exhibiting no change. The concentrated increase in online sales is notably observed in the South-Western part of Ankara. This mapping effectively captures the shift in online sales patterns during the pandemic, providing valuable insights into spatial dynamics.

Turning to the second map, depicted in Figure 5, which captures the transition from Period 2 to Period 3, a trend of decreased online sales becomes evident across the majority of neighborhoods (90.5% of them). This decline is observed during the shift from the pandemic lockdown period to the phase of reduced restrictions, except for 28 neighborhoods with a positive shift and 8 neighborhoods experiencing no change. An interpretation of these outcomes is as follows: As curfew restrictions are lifted, a preference for physical market visits over online shopping appears to emerge among the populace. This spatial representation offers valuable insights into the evolving shopping behaviors amidst changing pandemic dynamics.

Moving on to the third map, displayed in Figure 6, the analysis reveals a rise in online sales across multiple neighborhoods (86.3% of them) during the transition from the pre-pandemic period to the post-lockdown period. This trend is observed except for 34 neighborhoods experiencing a decrease and 18 neighborhoods witnessing no change in this regard. The cumulative insights suggest that the increase in online sales from Period 1 to Period 2 outweighs the subsequent decrease from Period 2 to Period 3. This signifies that the pandemic had an overall positive impact on the adoption of online market-shopping, as indicated by the spatial distribution of changes in purchasing behavior.

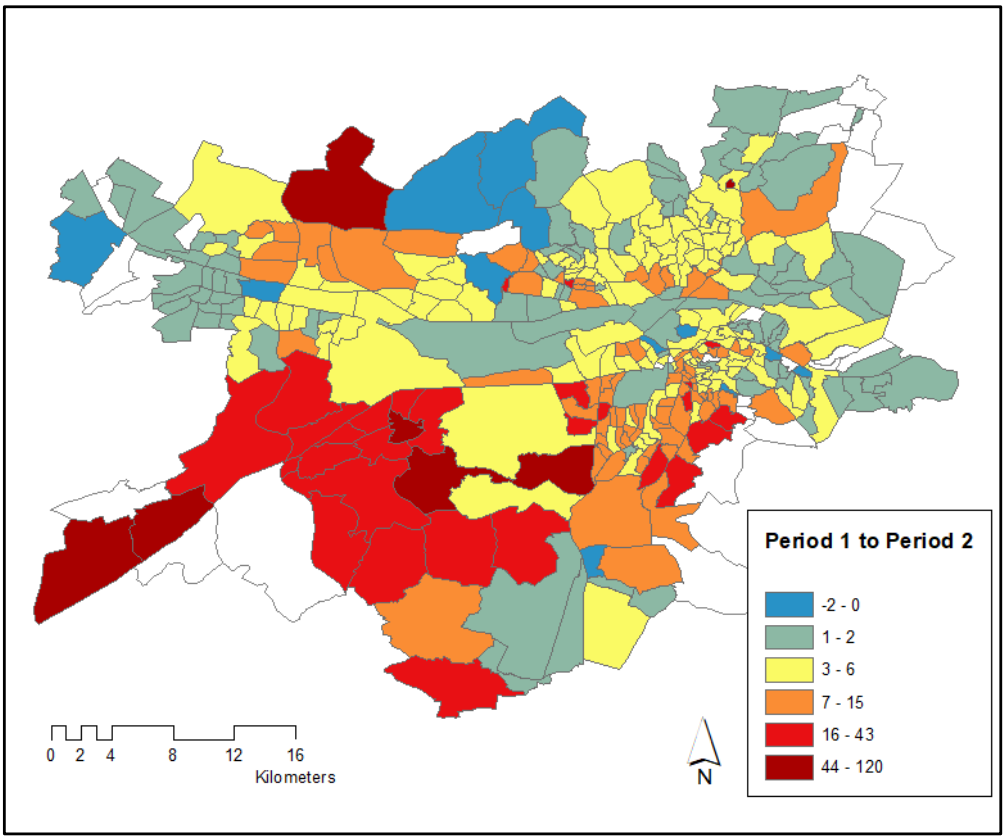


Figure 4. *Map of Period 1 to Period 2*

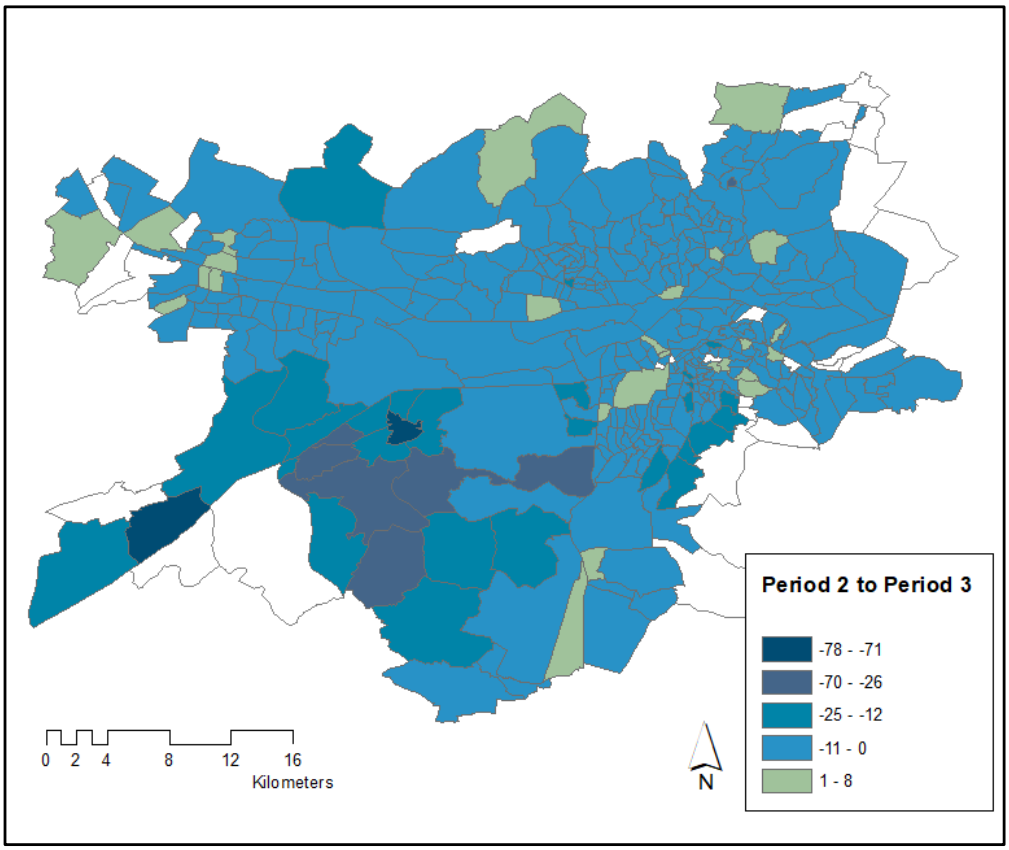


Figure 5. *Map of Period 2 to Period 3*

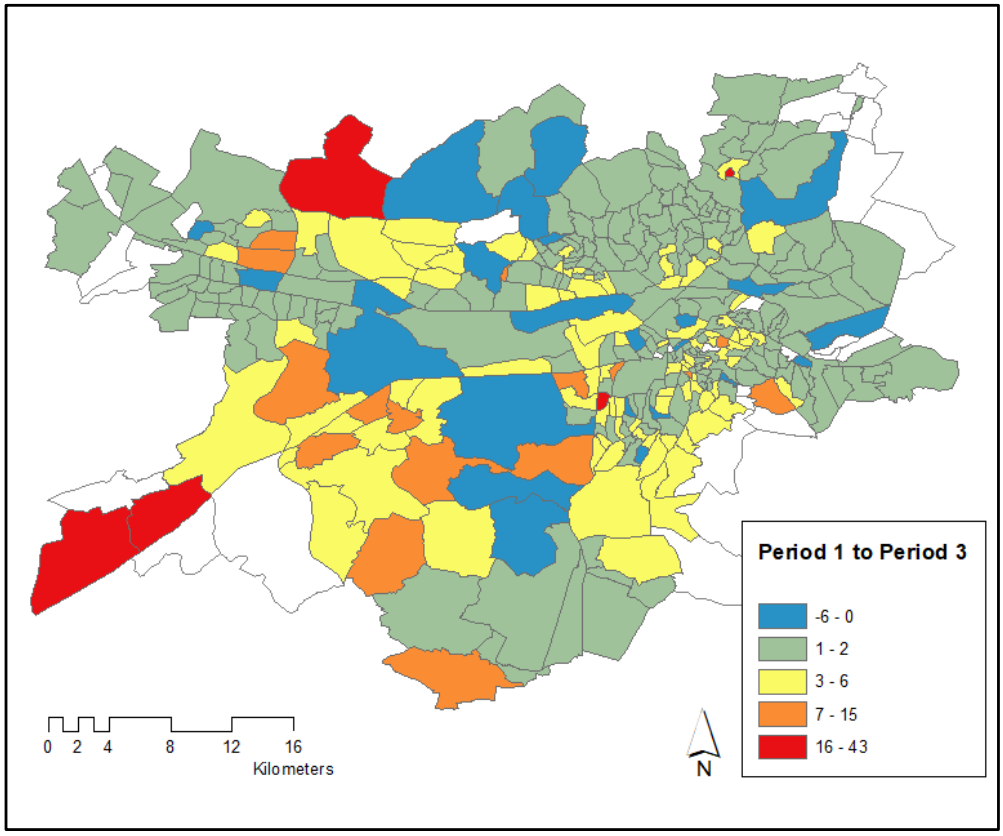


Figure 6. *Map of Period 1 to Period 3*

Consequently, the final phase of analysis seeks to delve into the underlying socio-economic dynamics driving online shopping behavior. To achieve this, the connection between online sales and various socio-economic indicators is scrutinized at the neighborhood level. The dataset encompasses 356 neighborhoods, each accompanied by its distinct socio-economic characteristics. Specifically, Socio-Economic Status (SES) groups and education levels are explored as pivotal socio-economic factors. Intriguingly, a positive correlation is discerned between these indicators and online sales across all three periods under investigation. This correlation implies that neighborhoods with higher SES groups and elevated education levels exhibit a heightened propensity for engaging in online market-shopping.

The Socio-Economic Status (SES) variable encompasses six distinct categories (A, B, C1, C2, D, and E), signifying varying levels of socio-economic status. SES A designates the highest socio-economic status group, while SES E represents the lowest. In this analysis, SES categories are examined on an aggregate level, and specific attention is paid to neighborhoods belonging to the highest two SES categories (SES A + SES B), as outlined in Table 5. Remarkably, a positive correlation is observed between online market sales and these uppermost SES categories. Notably, the strength of this correlation exhibits a gradual increase from the initial period to the third period under scrutiny.

Education levels are also subjected to analysis at the aggregate level, focusing on the population with university, Masters, and PhD degrees, which are collectively grouped as a "higher education" variable. The distribution of higher education across neighborhoods is presented in Table 5. Interestingly, higher education exhibits a discernible positive correlation with online sales. Notably, the strength of this correlation demonstrates an upward trend from period 1 to period 2, followed by a subsequent decline from period 2 to period 3.

Table 5. *Correlations among the online sales in 3 periods, and SES AB and higher education*

		SES_AB	Higher education
Period-1 online sales	Pearson Correlation	.615**	.676**
	Sig. (2-tailed)	.000	.000
	N	356	356
Period-2 online sales	Pearson Correlation	.639**	.753**
	Sig. (2-tailed)	.000	.000
	N	356	356
Period-3 online sales	Pearson Correlation	.642**	.743**
	Sig. (2-tailed)	.000	.000
	N	356	356

4. DISCUSSION

The findings from this study highlight significant variations in online market sales across three distinct pandemic periods: the pre-pandemic period, the lockdown period characterized by strict measures, and the post-lockdown period marked by reduced restrictions. These variations underscore the profound impacts of the pandemic-related measures. Notably, the second period, marked by the most stringent restrictions, witnessed the highest levels of online market sales. In the third period, which saw some relaxation of restrictions such as age-specific curfews and weekend lockdowns, online market sales exhibited a decrease compared to the second period, although they remained notably higher than the pre-pandemic period. This underscores the dynamic shifts in consumer behavior in response to evolving pandemic-related measures.

Furthermore, the analysis extends to the district level, revealing notable variations in online-shopping behavior across the three periods. This highlights the correlation between residents' geographical location and their preference for online shopping during all three periods. A more intricate examination of spatial trends at the neighborhood level underscores the widespread increase in online shopping across nearly all neighborhoods between the pre-pandemic period and the pandemic period characterized by tight restrictions. This increase is particularly pronounced in neighborhoods situated in the south-western and southern parts of the city, which comprise the Çankaya district. As restrictions eased, a general decrease in

online sales emerged, although sales remained elevated compared to the pre-pandemic period. This suggests a sustained inclination towards online shopping even as offline channels became more accessible due to the relaxation of measures. The spatial analysis thus illustrates the nuanced interplay between pandemic-related measures, geographic location, and consumer behavior.

To conclude, a significant relationship is evident between online shopping behavior and socio-economic status as well as education levels. This observation aligns with the findings from Buettner's [44] study. Individuals belonging to higher socio-economic groups and possessing higher levels of education exhibit a stronger correlation with increased online shopping activity. Importantly, this correlation persists across all three examined periods. Such patterns can be attributed to the greater purchasing flexibility and technological proficiency of these demographic segments. Their capacity to adapt to changing circumstances and navigate digital platforms likely contributes to their heightened engagement in online shopping throughout the pandemic and its various phases.

This study does come with certain limitations that need to be acknowledged. One such limitation stems from the potential occurrence of discrepancies between the individuals who placed online orders and the actual recipients of those orders, potentially leading to variances between delivery addresses. Furthermore, the study's reliance solely on the Marketyo mobile application presents another limitation, as it fails to provide a complete representation of the entirety of online shopping behaviors. The absence of web-based ordering data restricts the study's ability to offer a comprehensive understanding of the broader landscape of online shopping practices. These limitations should be taken into account when interpreting the findings and drawing conclusions from the study.

5. CONCLUSION

This study does come with certain limitations that need to be acknowledged. One such limitation stems from the potential occurrence of discrepancies between the individuals who placed online orders and the actual recipients of those orders, potentially leading to variances between delivery addresses. Furthermore, the study's reliance solely on the Marketyo mobile application presents another limitation, as it fails to provide a complete representation of the entirety of online shopping behaviors. The absence of web-based ordering data restricts the study's ability to offer a comprehensive understanding of the broader landscape of online shopping practices. These limitations should be taken into account when interpreting the findings and drawing conclusions from the study.

Online market sales exhibit variations across three distinct periods and among the 10 districts within Ankara. A meticulous mapping analysis conducted at the neighborhood level reveals a pervasive increase in online market sales across nearly all neighborhoods following the onset of the pandemic. Notably, the most prominent surge occurs during the lockdown period, where 97.4% of neighborhoods witness an uptick in online sales. Subsequently, although a decrease in sales is observed after the lockdown measures are eased, a substantial 86.3% of neighborhoods still maintain higher online sales compared to the pre-pandemic stage. This trend underscores the inclination of customers to sustain online market shopping even after the accessibility of offline channels is restored.

Furthermore, the study establishes correlations between online sales and socio-economic indicators. The highest socio-economic groups exhibit a positive correlation with online market sales, with the relationship intensifying notably in the third period. Similarly, a correlation is discerned between the population possessing undergraduate or graduate degrees and online market sales, with the strongest association observed during the second period.

In conclusion, the pandemic significantly influences consumer behavior, with the distribution of consumers in various regions and their social attributes playing a pivotal role in shaping this behavioral pattern. The outcomes, aligning with the altered consumer behavior during the pandemic, elucidate the neighborhoods and demographic groups that are more likely to readily embrace online shopping in the event of potential lockdowns. These findings highlight the necessity for diverse marketing policies and strategies to cater to the everyday requirements of neighborhoods and groups with potentially lower adaptability to online

shopping. Such insights offer valuable guidance for effectively addressing the evolving consumer landscape and devising targeted approaches to meet the distinct needs of different segments of the population.

In addition to the aforementioned findings, this study underscores the significance of utilizing real-world data as a dependable and all-encompassing source for similar research endeavors carried out during crises characterized by restricted personal interactions, either by design or due to governmental directives. The study further highlights the efficacy of leveraging online shopping as a means of collecting pertinent data through mobile applications. This approach proves particularly valuable in situations where "untact" (contactless) data collection is either preferred or mandated. By showcasing the reliability and feasibility of employing authentic data in such contexts, the study advocates for the continued utilization of real-world information to inform and shape research outcomes during times of crisis.

In the future, this study's scope can be extended to encompass more intricate factors, such as the specific categories of goods ordered online, providing deeper insights into customers' preferences during periods of crisis. Additionally, a comprehensive analysis of the logistics required to expedite delivery times can be conducted by leveraging the insights obtained from the online shopping map. By delving into these aspects, future research could offer a more nuanced understanding of consumer behavior and operational dynamics, thereby enriching the overall insights derived from the study. Due to changes in the data provider's structure, access to more recent datasets is currently limited; incorporating newer data in future studies would enable a more up-to-date analysis of consumer behavior and online grocery dynamics in Türkiye.

CONFLICTS OF INTEREST

No conflict of interest was declared by the authors.

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