*Article*

# Changes in Consumer Behaviour in the Post-COVID-19 Era in Seoul, South Korea

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**Abstract:** To prevent the spread of COVID-19, the Korean government promoted strong social distancing policies and restricted the use of confined areas and spaces that are likely to cause widespread infection, including religious facilities. The policies affect the consumption behaviours of Korean citizens. The purpose of this study is to examine changes in the consumer behaviours of citizens following the outbreak of COVID-19 in South Korea. Using credit card data from January to June 2020 in Seoul, this study examines the changes in consumption by industry type. Consumption types were classified into education, wholesale and retail, online purchases, food service, leisure, and travel. The industry that was most affected was the travel industry, which did not recover following the decline in consumption due to COVID-19. To examine consumer changes in credit card transactions due to widespread infection, a correlation analysis was conducted between the amount of consumption according to credit card transaction data (card consumption) and the number of confirmed patients and policy implementation by step. For more detailed analyses, group infections in the Guro-gu and Yongsan-gu neighbourhoods were investigated. In Guro-gu, no significant results were found in the area experiencing massive group infection. In Yongsan-gu, a significant negative correlation in consumption and number of cases was found in Itaewon 1-dong, an area with mass infection, and a positive correlation was found in the surrounding areas. Nevertheless, no significant correlations between changes in consumer behaviours and effects of COVID-19 were found as a result of the analysis herein.

**Keywords:** post-COVID-19; consumer behaviour; mass infection; social distancing; Seoul, South Korea

## 1. Introduction

The global outbreak of novel coronavirus COVID-19 has changed the daily lives of citizens internationally. The anxiety level of the public has increased as COVID-19 turned out to be highly infectious, and many policies have been put into effect to control the spread of COVID-19 at international levels. Public health precautions include lockdowns, social distancing, and stay-at-home orders, all of which have been enforced at local, regional, and national levels. These policies have resulted in changes in daily routines of citizens all over the world, gradually changing robust socioeconomic models into noncontact societies. Many industry sectors have been highly impacted by such changes, especially trade and distribution of goods, education, and businesses. Online classes and video conferencing have emerged as preferable models to in-person meetings and classes, and the market for online shopping has expanded greatly.

In the specific case of South Korea, social distancing has been adopted as a primary guideline to slow the spread of infection. The most common example of a noncontact service in Korea is food delivery. Consumers prefer online ordering of food via mobile applications, with direct delivery to their doors. Moreover, delivery businesses have expanded services to groceries and errands, and consumption in these delivery services is expected to increase further as the pandemic continues [1].

When the Korean government raised the alert to the highest level, *Serious*, in late February 2020, employees were encouraged to work from home [1]. In the education sector, the start of the new school semester was postponed, and online classes have been conducted since. In addition, various forms of contactless activities are being conducted in South Korea.

However, the concept of noncontact transactions cannot be applied to all industries. As social distancing has lasted longer than expected, the economy has worsened, affecting many business sectors. Increased unemployment rates and decreased income levels have caused consumers to reduce their spending and to change their consumption behaviours [2]. In the United States, average shopping frequency has decreased from 4.4 times to 2.8 times in the era of COVID-19 [3]. The spread of COVID-19 has affected the shopping patterns of Koreans as well, with 41.7% of Koreans reporting grocery shopping more than twice a week prior to the outbreak, dropping to 22.0% in the era of COVID-19 (Table 1).

**Table 1.** Shopping frequency of Koreans before and after COVID-19.

|  | Once in 2 Weeks | Once a Week | More Than Two Times a Week |
| --- | --- | --- | --- |
| Before COVID-19 | 11.7% | 33.1% | 41.7% |
| After the outbreak of COVID-19 | 18.2% | 34.5% | 22.0% |

Many studies have investigated the effects of COVID-19 in terms of market conditions, changes in consumer behaviours, revenues, and mobilities. Similarly, this study examines changes in consumer behaviours in Seoul based on credit and debit card transactions following the outbreak of COVID-19. Changes in consumer behaviours in Seoul are examined in three spatial hierarchies: (1) overall trends in Seoul; (2) areas delineated as administrative "gus" (A *Gu* is a second-tier administrative division in South Korea) with mass infection and surrounding areas; and (3) areas delineated as administrative "dongs" (A *Dong* is the smallest level of administrative unit in South Korea, with its own office and staff members, branching from the primary division of districts (*Gu*)) with mass infection. Correlations between card spending and (1) number of confirmed cases and (2) activation of social distancing phases are analysed to investigate changes in consumption behaviours of Koreans.

## 2. Study Scope and Method

This study examines (1) changes in credit and debit card transactions before and after the outbreak of COVID-19 and (2) the consumption effects of mass infection on areas of origin and surrounding administrative areas. The spatial scope is Seoul, the capital city of South Korea, focusing on two administrative-defined gus in which mass infection occurred (namely, Guro and Yongsan, Figure 1). The temporal scope is the first week of January to the third week of June 2020. The total number of credit and debit card transactions was 37 million transactions. We examined the first two mass infection cases occurring in Guro (the Guro-gu call centre case) and Yongsan (the Itaewon club case).

This study focuses on the number of confirmed cases and consumption by industrial sectors in Seoul. The change in the number of confirmed cases could have a different effect on consumption by the industrial sectors, and the hypothesis is tested by analysing the overall trend of credit and debit card transaction data of *S Card* (*S Card* is one of Korea's debit and credit card companies, which ranked second in the number of card issuances in the first half of 2020 and ranked first in cumulative transaction until the third quarter of 2020.Therefore, *S Card* could represent the credit and debit card usage of Seoul citizens sufficiently). Next, changes in the card transaction records of areas with mass infection cases, Guro and Yongsan, are examined to understand the general trends of consumption before and after mass infection. Thirdly, the change in consumer behaviour is analysed on a smaller scale: the analysis focuses on the administrative dongs where the mass infection

occurred and the neighbouring dongs. The results demonstrate whether the mass infection directly affects the consumer behaviour of the surrounding areas. Correlation analyses are conducted to verify the relationship between the card transaction amount and (1) the number of confirmed cases and (2) the phases of social distancing policies. A correlation coefficient and significance are used to support the findings statistically (Figure 2).
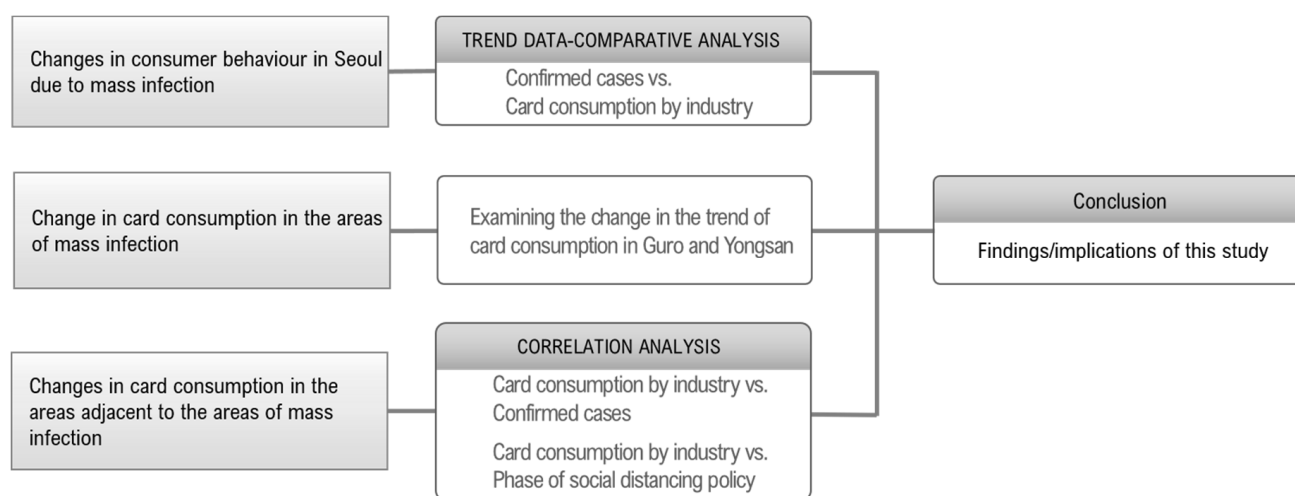


**Figure 1.** Study area.



**Figure 2.** Analysis framework.

## 3. Previous Studies

Despite the short period of time since the emergence of COVID-19, a number of studies have been conducted. In particular, several studies have focused on how global consumer behaviours have changed during the COVID-19 pandemic.

First, there are several studies that reflect consumer behaviours in Korea. Bae and Shin (2020) surveyed users of contactless services to examine their consumption patterns [1]. Overall, consumer behaviour trends have changed as a result of COVID-19 due largely to social distancing policies. E-commerce revenues have grown significantly, together with increases in the number of unmanned stores to reduce contact with other people. In the medical sector, telemedicine services have expanded, and the technologies supporting

these services are evolving. In the education sector, it is expected that technologies related to online classes will experience rapid growth.

Shin and You (2020) examined trends in trade and distribution, particularly increases in contactless spending due to the emergence of COVID-19 [4]. Online spending has increased, and industries capturing the highest proportions of consumer spending were online stores, food delivery services, and meal kit delivery services. It is highly likely that consumers will continue online-purchasing behaviours after the epidemic comes to an end, and noncontact consumption is expected to overtake the market.

Chang (2020) looked at the effects of the COVID-19 pandemic on consumer price changes in comparison to those if an outbreak of Middle East Respiratory Syndrome (MERS) in 2015 [5]. While consumer prices stabilised soon after the end of the MERS wave, COVID-19 is expected to have a prolonged effect. As the virus spreads widely and rapidly, fear of infection will impede stabilisation of consumer prices. National governments will be required to make efforts to stabilise consumer prices once the pandemic ends.

At the international level, several studies have analysed changes in consumer behaviours in the United States [6–8], Sweden [9], Denmark [9,10], New Zealand [11], Great Britain [12], Taiwan [13], and Qatar [14].

Alexander and Karger (2020) analysed mobile phone location data and consumer expenditures to determine the effects of shelter-in-place orders in the United States [6]. From March to mid-April, US travel decreased by 8%, and retail and wholesale sectors experienced a 19% decrease in revenues. Consumption in areas directly related to mobility and travel decreased significantly. In contrast, revenues in food delivery services increased.

Using US bank account information, Cox et al. (2020) investigated the effects of spending and saving during the COVID-19 pandemic from March to early April [7]. Consumption significantly decreased in comparison to the same period in 2019, as did expenditure on relatively low-prioritised goods. Overall spending dropped notably for all industries shortly after the outbreak of COVID-19, with gradual recovery observed over time. Spending on groceries has increased to pre-pandemic levels, and the rate of recovery has been greater than in other industries.

Grashuis et al. (2020) surveyed groups of customers with online shopping experience to analyse their characteristics [8]. They showed that the purchase of groceries increased as restaurants closed *and* restaurant dining was modified due to waves of COVID-19. Preferences for shopping over dining out were affected by the number of confirmed cases, and the respondents indicated that direct purchases from stores were the least efficient way to shop. The conclusion is that shopping preferences are likely to change according to the severity of COVID-19 infections.

Anderson et al. (2020) examined Danish and Swedish bank transaction data to evaluate the effects of social distancing [9]. Denmark implemented a lockdown policy at the national level, while Sweden did not. In both Denmark and Sweden, however, overall consumption decreased, although consumption in Denmark dropped by a greater margin in all age groups except for the 70s and older cohort. Also, in comparison to Sweden, Denmark showed a greater decrease in spending on all types of goods and in all consumer age groups, which could be attributed to the lockdown policy.

Anderson et al. (2020) evaluated the current economic conditions of Denmark using bank transaction data following the official announcement of COVID-19 as a pandemic [10]. Spending on general goods and medicines increased, while spending decreased significantly in all other industries. Travel, groceries, fuel, and telecommunications experienced large reductions in revenue. In terms of e-commerce revenue, general goods, trade and distribution of goods, and groceries increased, while travel-related industries experienced a great decrease.

Hall et al. (2020) investigated changes in spending due to COVID-19 based on bank transaction data in New Zealand [11]. Overall patterns in consumption changes were steady in January 2020 but declined greatly with the activation of lockdown policies at the end of March. Spending on medical treatment, department store shopping, and electronic

goods decreased significantly, with no observed recovery. However, spending related to groceries and beverages gradually recovered after a notable decline. With lockdowns ending, online shopping has increased gradually. Rates of growth in e-commerce sectors have also increased.

Jabbour et al. (2020) conducted a literature review on the effects of COVID-19 on the economy [15]. Infectious diseases caused by highly contagious viruses such as COVID-19 result in high insecurity in social supply systems. The supply of goods is not able to meet the needs of consumers, creating heightened stress for society in times of crisis. Accordingly, the government has a crucial role in stabilizing a country's economy.

Baker et al. (2020) analysed the effects of COVID-19 on household spending using regression analysis [16]. Variables included personal characteristics, income and political ideals, and transaction data measuring changes in household spending. In terms of personal spending, 40% of total consumption increased in early March, which was the early stage of COVID-19 spread in the United States. As the rate of spread increased in late March, however, total spending decreased by 25–30%. Spending on groceries and food delivery showed a slight increase. Different groups by household structure and age showed differences in spending patterns, while income groups showed similar tendencies.

Chronopoulos et al. (2020) examined British consumer changes from January to June based on data provided by Money Dashboard [12]. Consumer spending responses to COVID-19 varied notably depending on products, and groceries had a wider range of differences. During lockdown, spending decreased gradually until implementation of the *Stay Alert* policy in May. Consumption recovered to previous levels after one week. This implies that consumer behaviours in Great Britain are greatly affected by public health policies.

Chang and Meyerhoefer (2020) investigated the impact of COVID-19 on online grocery stores using Taiwanese e-commerce platform data in regression analysis [13]. Online store revenues increased by 5.7%, with an increase of 4.9% in number of customers. That analysis shows that purchasing of goods online is affected by the media and the content of online stores.

Hassen et al. (2020) surveyed changes in consumer perceptions and spending behaviours due to COVID-19 in Qatar [14]. It was reported that spending related to food increased with time at home. Consumption in types of food changed as well, with respondents preferring to purchase locally produced food rather than exported goods due to heightened safety concerns about groceries. Moreover, as social distancing has become part of the daily routine, purchasing goods from online stores is preferred to visiting stores.

The existing literature reports that the emergence of COVID-19 has resulted in a decrease in consumption, regardless of country. Spending has decreased in all industries, with the exception of food and daily necessities (which have shown rapid recovery in areas where rates of infection have improved). Spending in online sectors has increased, and local stores in neighbourhoods have not been greatly affected by COVID-19. Overall, consumption has declined regardless of pre-pandemic level of consumption, region, or country. To stop the spread of contagious diseases at urban levels, cooperation between the public and private sectors is crucial, as is appropriateness in government policies.

There have been several studies that examined the changes in sectors other than consumption behaviour because of COVID-19. The studies that examined changes in the education environment reported that the quality and satisfaction of public education have decreased. To overcome such issues, new ways of delivering classes more effectively, such as online lectures, have been introduced [17–19]. Studies have examined the trends in workplaces [20,21]. They reported that working from home has become a new trend to prevent widespread viral infections and that work efficiency depended on individual characteristics. It was found that COVID-19 certainly had some negative effects on the travel and tourism industry, and a vast number of citizens were willing to travel after the COVID-19 pandemic [22]. Lastly, some studies also evaluated the government policies and the responses of citizens [23–26]. Their results suggested that the government policies

slowed the spread of COVID-19; however, the policies decreased the consumption of citizens as well.

## 4. Analysis Framework

### 4.1. Confirmed Cases of COVID-19 and Mass Infection in Korea

The first case of COVID-19 in South Korea was confirmed on 20 January 2020; three days later, the first case in Seoul was confirmed. The first confirmed case of mass infection occurred in Daegu, known as the Daegu *Shincheonji* cult church case, and this case resulted in the first COVID-19 wave in South Korea. Spreading rapidly, the first wave reached other major cities in South Korea and heavily affected Seoul as well. The national government of Korea raised the alert level to *Serious*, the highest level, on 23 February as a response to the first wave [17]. A few weeks later, on 11 March, the World Health Organisation (WHO) officially declared COVID-19 a global crisis and pandemic [18].

The first case of mass infection in Seoul, occurring on 9 March, took place in an office building in Shindorim-dong, Guro-gu. Mass infection impacted places of worship, which increased the fear of mass infection in Seoul. The national government enforced social distancing on 22 March to prevent further spread of COVID-19. As a result, the spread seemed to slow, and the number of confirmed cases decreased to the single digits. However, another case of mass infection in Seoul took place in Itaewon-dong, Yongsan-gu, known as the Itaewon Club case, on 9 May. This mass infection resulted in the second wave, with continuous transmission in Seoul. Prolonging the COVID-19 crisis, the number of mass infection cases in Seoul increased due to breaches in the code of conduct in some businesses and religious organisations (Figure 3 and Table 2).
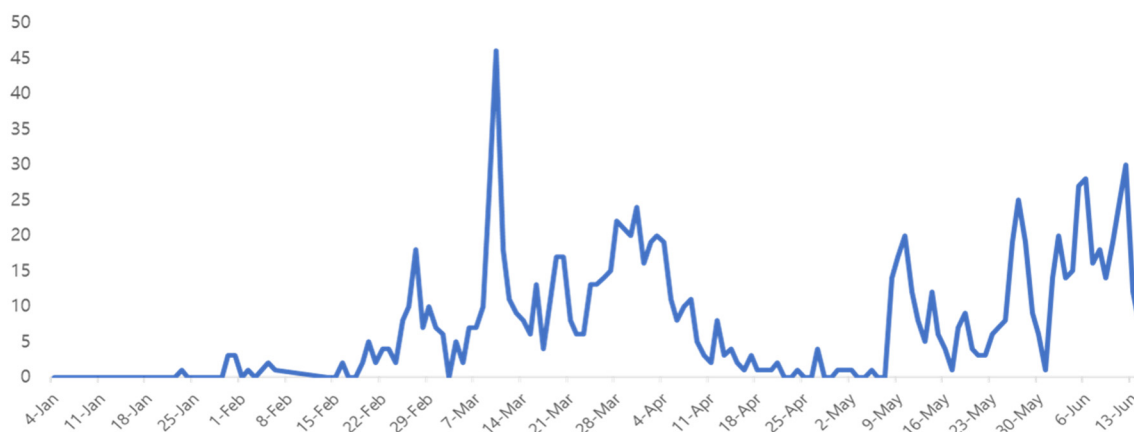


**Figure 3.** Number of confirmed cases in Seoul.

**Table 2.** Cases of mass infection in Seoul.

| Region | Mass Infection Cases | Accumulated Number of Confirmed Cases |
| --- | --- | --- |
| Guro-gu | Guro call centre case | 95 |
| Guro-gu | Church | 41 |
| Yongsan-gu | Itaewon-club case | 139 |
| Yangchun-gu | Table-tennis club | 43 |
| Gwanak-gu | Door-to-door sales | 119 |
| Dobong-gu | Day-care centre | 43 |

### 4.2. Credit and Debit Card Transaction Data

The credit and debit card transaction data used in this study are from the transaction record of *S Card*, provided by KT's Big Data Platform (The KT Big Data platform is run by

KT (Korea Telecom), one of the largest telecommunication companies in Korea. The big data platform provides a place to supply and download data for everyone) and serviced by DACON (DACON is a South Korean company that provides services in AI education and the ICT-based consulting field and operates an AI competition platform). The *S Card* data, dating from January to June 2020, contains a record of 3.7 million cases and are classified by administratively defined dong. The data do not contain all transactions that took place in Seoul during the period of analysis; purchases represent 22% of the total card transactions in Korea made via *S Card* in the first half of 2020. The amount of credit and debit card usage was divided into six industrial sectors and 261 subcategories, with the categories delineated by *S Card* and including education, retail, e-commerce, food and beverage, leisure, and travel (Table 3).

**Table 3.** Industry categories provided by *S Card*.

| Classification | Industry Subcategories |
|---|---|
| Education | Primary and secondary education, private education, and library |
| Wholesale and retail | Supermarket, department store, local shop, and convenient store |
| E-commerce | TV home shopping, online store, and payment gateway |
| Food and beverage | Restaurant, pub bakery, and café |
| Leisure | Cinema, karaoke, gym, sauna, and bowling centre |
| Travel | Hotel, travel agency, duty free, and airline |

*4.3. Correlation between Card Transaction Amount and Social Distancing Phase*

The effects of (1) the number of confirmed cases of COVID-19 in Seoul and (2) social distancing phase on card transaction expenditure were analysed. Consumer behaviours within areas with mass infection may have been affected by fear of spread of the virus. On the other hand, the restrictions of social distancing policies in various phases may have reduced consumer spending. Therefore, this study analyses the correlations between card transaction amount and (1) the number of confirmed cases and (2) level of social distancing in administrative dongs experiencing mass infection.

## 5. Results

*5.1. Changes in Consumption Patterns in Seoul*

Card transactions made from January to June 2020 in Seoul were investigated by industry type. *S Card* transaction data delineate six industry sectors according to *S Card*'s industry classification. Because existing card transaction data tend to have weekly periodicity, trend lines on graphs indicate the moving average (MA) of seven-day cycles. The graphs are shown in Figure 4.

### Education

In education, card transaction amounts were consistently high before COVID-19. These amounts decreased gradually in February 2020. The overall trend is upward, yet uneven growth in both the negative and positive directions was observed during the period of analysis. In the early stages of the outbreak, because the influence and fear of COVID-19 were relatively small, students appeared to have attended private classes as usual. Revenue in the education sector showed a slight decrease in early March due to mass infection in Guro. However, the delay in the start of the new school semester and the launch of online classes are thought to be the reasons behind the increase in transactions involving private education. Parents of students may have considered online classes insufficient, turning their attention to private institutions and tuitions.
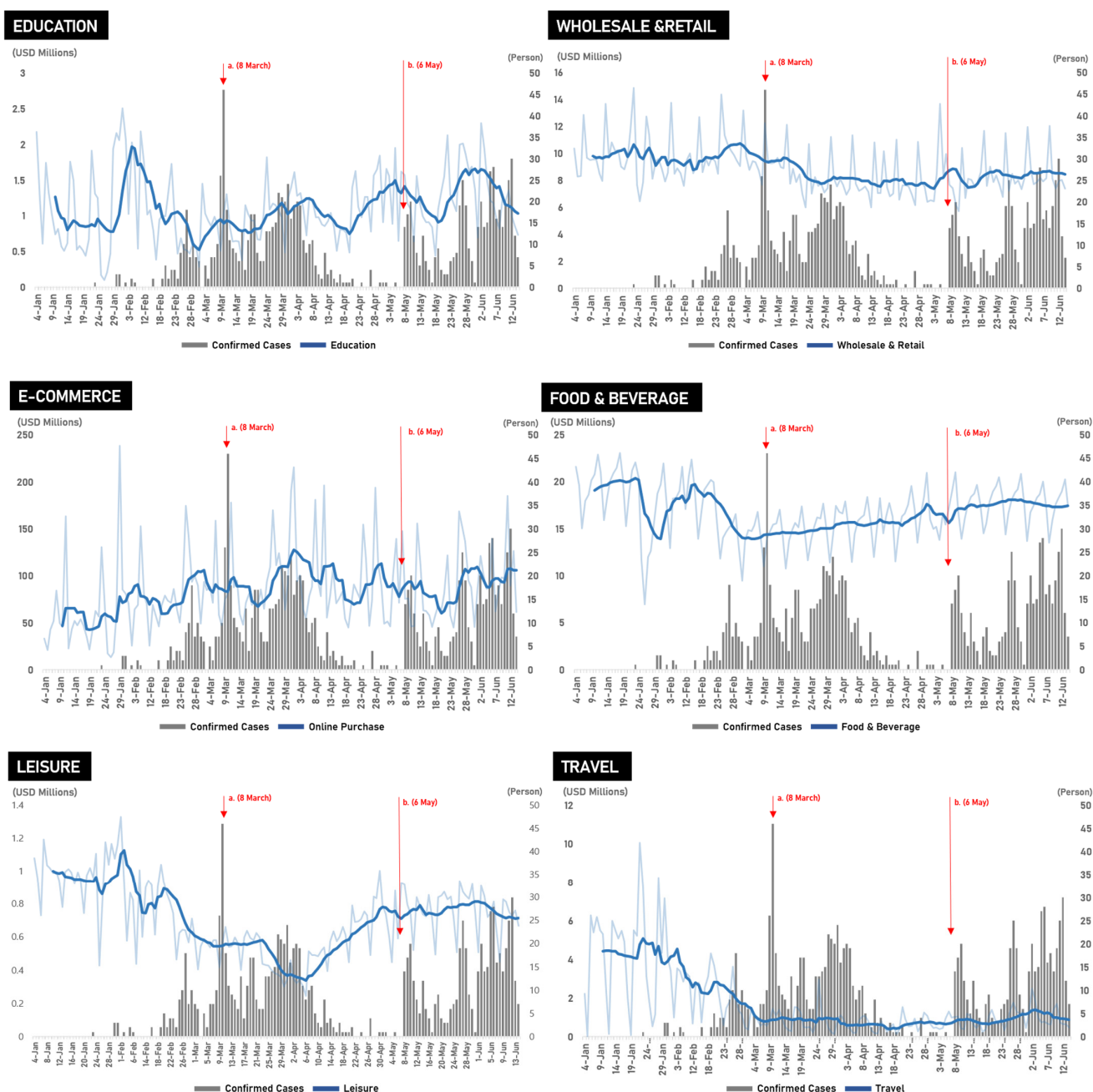
**Figure 4.** Relationships between card transaction amounts in different industry sectors and the number of confirmed cases in Seoul (a. Guro mass infection case and b. Itaewon mass infection case).

### Wholesale and Retail

Spending in wholesale and retail decreased slightly following the emergence of COVID-19, but the degree of impact was relatively small in comparison to other industries. This is similar to the cases of other countries. This may be understood as a change in customer preferences in terms of distance travelled for shopping. A sharp increase in demand for local stores and convenience stores in neighbourhoods was observed, whereas spending decreased in department stores and supermarkets. Analysis results for *W Card* transaction data showed a similar trend [27]. Spending in the wholesale and retail sector continued to decline after March 2020 due to social distancing policies but increased from mid-May to June. These results indicate that consumers prefer shopping at local stores and nearby convenience stores to visiting supermarkets located farther from their neighbourhoods.

### E-commerce

Overall trends in the e-commerce sector have shown gradual growth since the outbreak of COVID-19. Although there have been ups and downs since April due to slower spread, the overall trend is upward. Similarly, the Seoul Institute (2020) reports that online purchases have increased by the equivalent of 1.06 billion USD, with the increase continuing steadily from March to June. Also, the 2020 survey results from the Gyeonggi Research Institute indicate that online purchases are likely to increase continuously [1].

### Food and Beverage

Beginning in late February, a sharp decrease was observed in food and beverage services. This could be interpreted to mean that the public fear of contagion after the occurrence of the Daegu *Shincheonji* mass infection case strongly affected consumer behaviour. The Guro mass infection case and more restrictive social distancing policies (22 March) negatively affected consumption. Spending was maintained at lower levels. Examining offline card transaction data, the Seoul Institute (2020) found that revenue decreased sharply in March and recovered after April. The number of confirmed cases decreased notably in April. Thereafter, spending at restaurants and pubs gradually increased, reaching levels of recovery.

### Leisure

Huge downward trends were observed in the leisure sector in association with the number of confirmed cases due to mass infection in the Daegu *Shincheonji* case. Transactions in cinema and karaoke account for a large portion of total card transactions in the leisure sector, explaining the sharp decrease in leisure consumption. It is understood that the virus spreads mainly through the respiratory system and that transmission is more likely in enclosed spaces. Consumers were likely to avoid visiting cinemas and karaoke rooms with poor ventilation. Similarly, *W Card* transaction analysis demonstrates that spending in gyms, karaoke rooms, and cinemas decreased significantly before a slight recovery in May [27]. Our *S Card* analysis likewise shows a slight increase in April, which is thought to be related to a decrease in the number of confirmed cases. Despite an increase in the number of confirmed cases in May, consumption in the leisure sector has recovered to some extent, indicating a renewal in visits to leisure-related places.

### Travel

Spending in the travel sector typically is relatively high toward the end of February due to public holidays such as Lunar New Year. In 2020, however, there was a sharp decline after the holidays. This suggests that travel-related activities were occurring normally before recognition of COVID-19 as a pandemic and implementation of social distancing policies. A significant decline was observed in March through the end of June. The global effects of COVID-19 decreased the likelihood of travelling nationally and internationally, which also had an impact on gross spending related to travel activities. This is the same as the analysis results of some previous studies [6,9]. Figure 4 shows the results of consumption changes in Seoul by industry type.

### 5.2. Changes in Consumer Behaviour in Areas with Mass Infection

Overall trends in each type of industry were examined in the previous section. Some industries experienced large changes due to the COVID-19 crisis, whereas others were not as affected. Certain businesses and sectors were affected more by policies such as social distancing and quarantine than by the number of confirmed cases. To examine the effective range of COVID-19, consumer behaviour changes in areas with mass infection were investigated in depth. The two specific cases of mass infection investigated are the Guro call centre and the Itaewon club cases. These waves began 9 March and 8 May, respectively.

Figure 5 shows the total amount in card transactions in Guro-gu and Yongsan-gu, where an overall decrease was not noticeable. This could imply that, even though these two administrative-defined gus encountered mass infection, there were no massive changes in

consumer behaviour. These results potentially indicate that cases of mass infection do not result in overall changes in consumption.
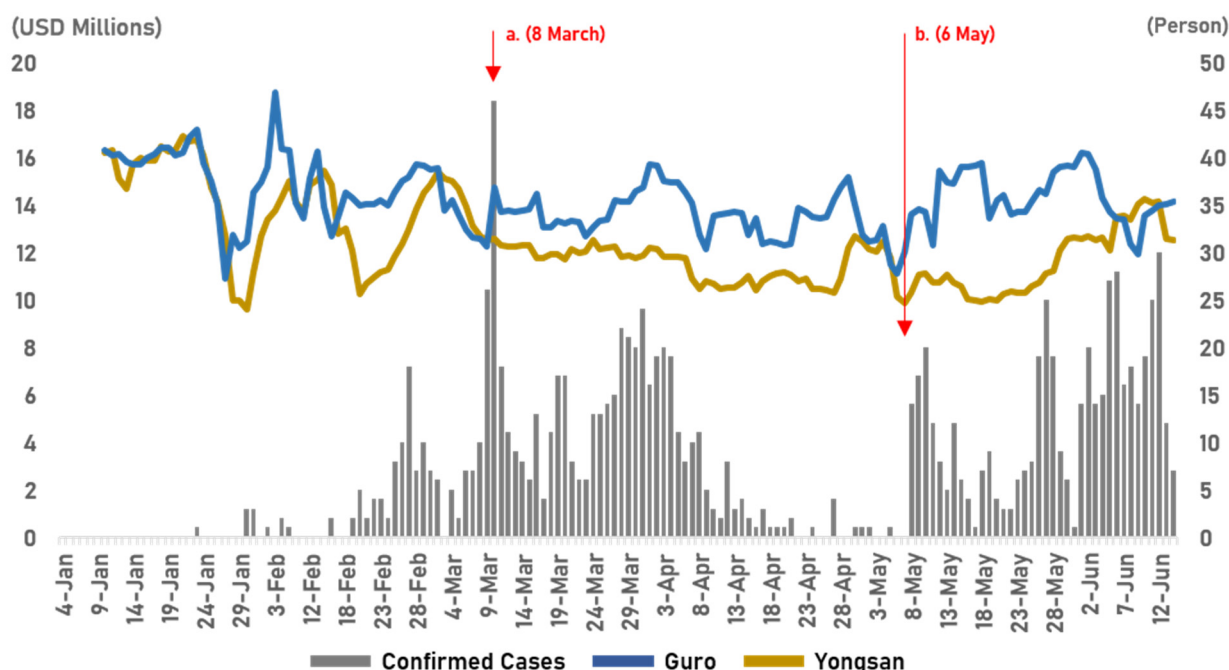


**Figure 5.** Relationships between the number of confirmed cases and card transaction amounts in gus with mass infection (Guro and Yongsan).

This study takes one step further and investigates changes that occurred in the administrative-defined dong where the mass infection took place together with the surrounding dongs. The Guro call centre case took place in Shindorim-dong, located in Guro-gu, and the Itaewon club case affected Itaewon-1 dong in Yongsan-gu. Adjacent dongs located near these two dongs also were examined in depth—Guro-2 and Guro-5 dong for the Guro call centre case and Itaewon-2 dong for the Itaewon club case. Figure 1 shows the location of these administrative dongs, and Figures 5 and 6 show the changing patterns in consumer behaviours in these areas.
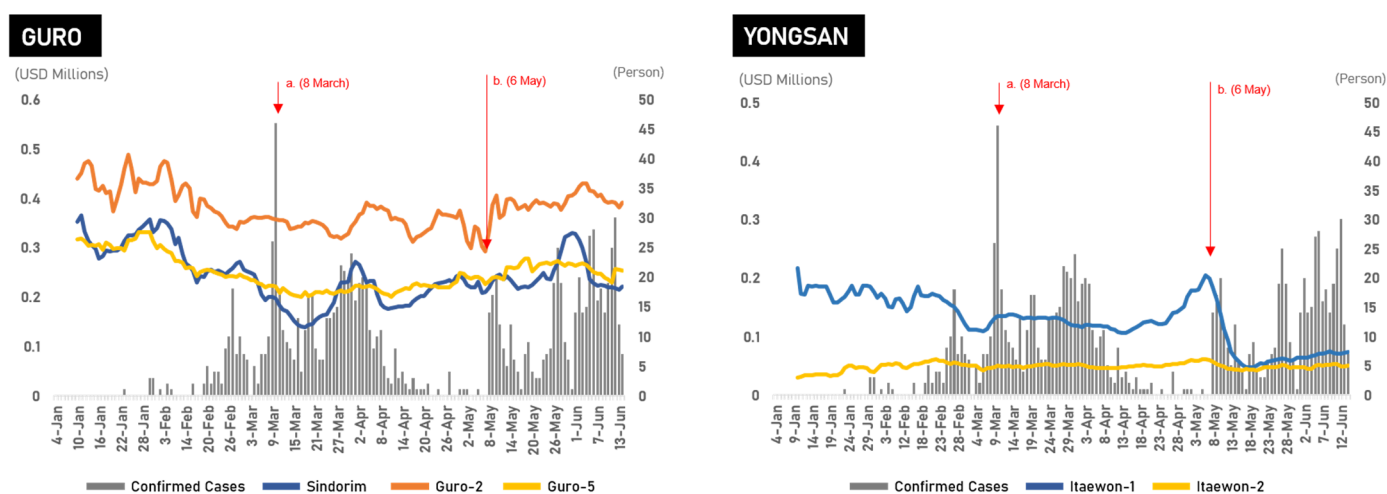


**Figure 6.** Relationships between the number of confirmed cases and card transaction amounts in dongs with mass infection and surrounding dongs (Guro and Yongsan).

In the case of Guro-gu, total card consumption in Shindorim-dong was slightly decreased from 9 March, while that in the neighbouring districts of Guro-2 and Guro-5 dongs was only affected a little. Yongsan-gu showed a similar tendency. Consumption in Itaewon-1 dong decreased considerably with the Itaewon club mass infection case, but Itaewon-2 dong was not affected heavily. This finding is believed to be the result of two weeks of business suspensions for restaurants and pubs in Itaewon-1 dong after the mass infection.

### 5.3. Correlation Analysis

The results presented in the previous sections suggest that consumer behaviour is affected by the total number of confirmed cases and policies such as social distancing rather than by incidents of mass infection. For this reason, correlation analysis was conducted to determine the relationship between the total amount of card transaction expenditure in each administrative-defined dong and (1) the number of confirmed cases in that area and (2) social distancing policies in action. The analysis results are summarised in Tables 4 and 5.

**Table 4.** Results of correlation analysis (Guro-gu case).

| Administrative-Defined Gus | Administrative-Defined Dongs | Confirmed Cases | | Phases of Social Distancing Policy | |
|---|---|---|---|---|---|
| | | Coefficient | Sig. | Coefficient | Sig. |
| Guro | 1. Sugung | 0.15 | 0.063 | 0.075 | 0.352 |
| | 2. Oryu-1 | −0.003 | 0.966 | 0.011 | 0.893 |
| | 3. Oryu-2 | 0.087 | 0.281 | 0.111 | 0.169 |
| | 4. Gaebong-1 | 0.066 | 0.414 | 0.06 | 0.457 |
| | 5. Gaebong-2 | −0.018 | 0.824 | 0.049 | 0.548 |
| | 6. Gaebong-3 | 0.013 | 0.877 | 0.132 | 0.103 |
| | 7. Gocheok-1 | −0.002 | 0.983 | 0.073 | 0.367 |
| | 8. Gocheok-2 | 0.06 | 0.456 | 0.102 | 0.207 |
| | 9. Sindorim | 0.091 | 0.262 | 0.095 | 0.24 |
| | 10. Guro-1 | 0.112 | 0.167 | 0.074 | 0.361 |
| | 11. Guro-2 | 0.194 * | 0.016 | 0.061 | 0.448 |
| | 12. Guro-3 | 0.303 ** | 0 | −0.055 | 0.497 |
| | 13. Guro-4 | −0.038 | 0.634 | 0.095 | 0.241 |
| | 14. Guro-5 | 0.019 | 0.814 | −0.002 | 0.981 |
| | 15. Garibong | 0.04 | 0.624 | 0.089 | 0.27 |
| Yangchun | 16. Sinjung-2 | 0.038 | 0.64 | 0.02 | 0.808 |
| | 17. Sinjung-6 | 0.09 | 0.266 | 0.114 | 0.156 |
| | 18. Sinjung-7 | 0.038 | 0.643 | −0.144 | 0.074 |
| Yeongdeungpo | 19. Munrae | 0.180 * | 0.02 | 0.181* | 0.025 |
| | 20. Dorim | 0.234 ** | 0.003 | 0.173 | 0.102 |
| | 21. Daerim-3 | 0.315 ** | 0 | 0.066 | 0.413 |

*: $p < 0.5$, **: $p < 0.01$.

| Administrative-Defined Gus | Administrative-Defined Dongs | Confirmed Cases | | Phases of Social Distancing Policy | |
|---|---|---|---|---|---|
| | | Coefficient | Sig. | Coefficient | Sig. |
| Yongsan | 1. Wonhyoro-1 | 0.052 | 0.521 | 0.05 | 0.538 |
| | 2. Wonhyoro-2 | 0.225 ** | 0.005 | 0.206 * | 0.01 |
| | 3. Yongmun | 0.138 | 0.086 | 0.229 ** | 0.004 |
| | 4. Hyochang | 0.122 | 0.13 | 0.147 | 0.068 |
| | 5. Chungpa | 0.113 | 0.162 | 0.055 | 0.493 |
| | 6. Hanganro | 0.214 ** | 0.007 | 0.044 | 0.586 |
| | 7. Ichon-1 | 0.04 | 0.617 | 0.044 | 0.584 |
| | 8. Ichon-2 | 0.134 | 0.098 | 0.215 ** | 0.007 |
| | 9. Namyeong | 0.049 | 0.543 | −0.022 | 0.79 |
| | 10. Huam | 0.056 | 0.486 | 0.087 | 0.281 |
| | 11. Yongsan-2 | 0.275 ** | 0.001 | 0.272 ** | 0.001 |
| | 12. Itaewon-1 | −0.378 ** | 0 | −0.178 * | 0.027 |
| | 13. Itaewon-2 | 0.112 | 0.164 | 0.147 | 0.068 |
| | 14. Hannam | 0.049 | 0.542 | 0.157 | 0.052 |
| | 15. Bogwang | 0.057 | 0.482 | 0.13 | 0.107 |
| | 16. Seobinggo | 0.052 | 0.521 | 0.187 * | 0.02 |

*: $p < 0.5$, **: $p < 0.01$.

Correlatipton analysis results for Guro-gu show that five administrative-defined dongs, Guro-2, Guro-3, Daerim-3, Dorim, and Munrae, had statistically significant correlations between the amount of card transaction-based consumption and number of confirmed cases in the area. It was expected that the card transaction amount would decrease with an increase in number of confirmed cases. However, the significantly positive result could suggest that the increase in confirmed cases does not affect consumer behaviour. Correlation analysis results between card transaction amount and phases of social distancing policies were statistically significantly positive for Daerim-3, Dorim, and Munrae-dong. Since the social distancing policy was applied to all of Seoul, it was expected that the card transaction-based amount would decrease as policy regulation increased. However, this relationship showed a positive correlation. This could imply that social distancing policies do not affect consumer behaviour, regardless of phase. Interestingly, Shindorim-dong, the origin of the Guro call centre mass infection case, showed no significant relationship in either analysis; instead, three neighbouring administrative-defined dongs, Daerim-3, Dorim, and Munrae-dong, had a significant positive relationship, with a relatively small correlation coefficient. Therefore, the Guro call centre mass infection case did not have a critical influence on consumer behaviour in neighbouring areas (Table 4).

On the other hand, the correlation between card transaction amount and the number of confirmed cases in Yongsan-gu showed a statistically significantly positive relationship in three administrative-defined dongs, namely, Yongsan-2ga, Wonhyoro-2, and Hangangro-dong, while Itaewon-1-dong had a significantly negative relationship. As Itaewon-1-dong is the origin of the Itaewon club case, this result implies that the number of confirmed cases directly affected consumer behaviour. However, the rest of the administrative-defined dongs in the area showed a positive relationship, implying increased consumption. It is possible that consumption in the neighbouring area increased as consumption in Itaewon-1-dong decreased, but the relatively smaller correlation coefficient suggests that the effect is small. Analysis results for correlations between card transaction amount and social distancing policy were statistically significant for six administrative dongs of Seobinggo,

Yongmun, Yongsan-2ga, Wonhyoro-2, and Ichon-2, and these administrative-defined dongs except Itaewon-1-dong had positive correlations (Table 5)

As the number of confirmed cases increased and as policy regulations became stronger in this area, card consumption decreased. Itaewon-1 is an origin of mass infection and experienced temporal business suspension due to the rapid spread of COVID-19. However, it is difficult to conclude that the number of confirmed cases and the phases of policy regulations had large effects on card transaction amounts because the correlation coefficient is relatively small.

## 6. Conclusions

This study examined changes in consumer behaviours in Seoul following the outbreak of COVID-19 and investigated the correlations between the amount in credit and debit card transactions and (1) the number of confirmed cases of COVID-19 and (2) implementation of social distancing policy in places where mass infection occurred. The findings and implications from the analysis are summarised as follows.

First, trade and distribution of goods decreased as did overall consumption, while amounts in credit and debit card transactions for online purchases increased gradually since the emergence of COVID-19 in Korea and worldwide. This is understood to signify a transition from offline grocery shopping to online purchasing of groceries and daily supplies. As trends in online purchases continue to expand, contactless shopping is expected to continue in the future.

Second, in the education, food and beverage, and leisure sectors, overall spending decreased following the emergence of COVID-19. However, each of these sectors demonstrated a tendency to recover as the number of confirmed cases dropped. This finding implies that the temporal drop in consumption in the early stages of the COVID-19 pandemic may have been due to anxiety and fears of uncertainties around the virus as well as implementation of intensely restrictive policies of self-isolation and social distancing. In particular, as the leisure sector showed the lowest revenue during phases of greater social distancing, it can be concluded that policy implementation had a large effect on consumer behaviour.

Third, the travel sector has been hardest hit by COVID-19. Travel spending has decreased since the outbreak of COVID-19, and as of June 2020, consumption in that sector has not recovered. The pandemic is likely to have the greatest impact on travel-related businesses.

Fourth, mass infection was shown not to have a great impact within the area of origin, resulting instead in a temporal decrease in spending within the area. Enforcement of social distancing policies had a much greater effect than the mass infection itself. Card transaction amounts in the places of origin of two cases of mass infection were analysed to examine the effects in the hierarchy of causes for changes in consumer behaviour. At the gu level, the changes in card transaction amounts were negligible. During the period of analysis, there was a slight decrease in card transaction amounts in the administrative dong with a case of mass infection, but the adjacent dongs were not affected. Therefore, the effective range of mass infection of COVID-19 is thought to be the size of a single administrative dong, and it does not have much impact at the gu level. The effects of COVID-19 on consumer behaviour were shown not to last very long after an incident of mass infection, with spending increasing gradually to recovery levels.

Fifth, consumer behaviour was heavily affected by the outbreak of COVID-19 in the early stages of the pandemic. After recovering to a certain spending level, however, the number of confirmed cases ceased to affect consumer behaviour. In addition, the decline in all areas of consumption is shown to have been due to fear and anxiety about rapid spread of the novel coronavirus, together with stringent government regulations. As the pandemic has persisted, consumption has recovered to some extent.

The result of this study suggests that consumer behaviour was not significantly affected by the mass infection of COVID-19. However, it was a result drawn from considering consumption behaviour, the number of confirmed cases, and the policy phases.

Factors such as the citizens' ability to cope with the policies and compliance with industry-specific quarantine rules may have also affected consumption behaviour. These factors have possibly provided an environment where citizens could safely continue consumption, regardless of mass infection or an increase in the number of confirmed cases. Consequently, consumption has not declined greatly, implying that the precautions taken by citizens and the policy were effective to a certain degree. Businesses and industries related to leisure and tourism experienced a sharp decline because they require travel and contact with other people. However, the citizens have coped effectively by practising personal hygiene and by following government guidelines, such as wearing face masks and washing their hands frequently. Also, because online activities have become widely activated after the COVID-19, there has been a new paradigm through online media, such as online shopping, working from home, and video conferencing.

COVID-19 has changed the lives of citizens around the world, and there has even been a new era of post-COVID-19. Before the pandemic, daily routines were full of encounters with other people. Communication meant meeting in person, and consumption also required contact. Travelling for any purposes was not a hassle. However, the post-COVID-19 era could be defined as a contactless society. Social distancing became a polite gesture, and wearing a face mask became a societal norm. Despite such unexpected changes, there have been many adaptations and sustainable developments. Online media and platforms have evolved rapidly to suit the needs of businesses and education. Groceries and food that we deliver using applications arrive within a day, and online classes and video conferences have become so common recently. These changes could be understood as procedures responding and adapting to the crisis we have confronted—creating much more resilient societies. COVID-19 has triggered a contactless era, and such changes that were triggered by contagious diseases could provide the opportunity to move towards our sustainable development goals.

This study is meaningful because it uses credit and debit card transaction data to evaluate consumption in varying sectors of industry and analyses correlations between card transaction amounts and (1) the number of confirmed COVID-19 cases and (2) policy implementation phases within areas of mass infection. However, this study has several limitations. First, instead of using the entire set of card transaction records during the period of analysis, *S Card* transaction data were used herein. The use of this specific dataset may have led to our particular findings (with different data potentially leading to different results). Second, the overall changing trend in consumption due to the COVID-19 pandemic could not be considered because the temporal range of the analysis was six months. Third, the number of confirmed cases and governmental policies were considered the variables affecting consumer behaviour in this study. Further studies could be conducted if the other possible variables are considered from the availability of a full dataset after the announcement of the end of COVID-19. Fourth, the spatial scope of this study was set to Seoul. A more generalised conclusion could have been drawn from consumer behavioural changes if the cases of cities in different countries and region could have been considered as a whole. Further studies could complement the limitations of this study by conducting comprehensive analyses in many cities around the world for the entire period of the COVID-19 era.

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## References

1. Bae, Y.; Shin, H. COVID-19, Accelerating the Non-contact Society. *Gri Issue Anal.* **2020**, *416*, 1–21. (In Korean)
2. Lee, W. Social and Spatial Changes in Urban Environment and Policy in the COVID-19 Era. *Krihs Issue Pap.* **2020**, *763*, 1–8.
3. Arora, N.; Charm, T.; Grimmelt, A.; Ortega, M.; Robinson, K.; Sexauer, C.; Yamakawa, N. A Global View of How Consumer Behavior Is Changing Amid COVID-19. *Mcknsey and Company* April 2020. Available online: http://tinyurl.comly83vtejl (accessed on 26 October 2020).
4. Shin, K.; You, M. COVID-19, Non-contact Spending and Strategies for Local Shops. *Gri Issue Anal.* **2020**, *425*, 1–20. (In Korean)
5. Chang, M. The Effect of COVID-19 on Consumer Prices. In *Korean Institute of Finance Weekly Financial Brief*; Korean Institute of Finance: Seoul, Korea, 29 August 2020. (In Korean)
6. Alexander, D.; Karger, E. Do Stay-at-Home Orders Cause People to Stay at Home? Effects of Stay-at-Home Orders on Consumer Behavior. In *FRB of Chicago Working Paper*; Federal Reserve Bank of Chicago: Chicago, IL, USA, 2020; No. 2020-12.
7. Cox, N.; Ganong, P.; Noel, P.; Vavra, J.; Wong, A.; Farrell, D.; Greig, F. Initial Impacts of the Pandemic on Consumer Behavior: Evidence from Linked Income, Spending, and Savings Data. In *University of Chicago, Becker Friedman Institute for Economics Working Paper*; National Bureau of Economic Research: Cambridge, MA, USA, 2020; No. 2020–82.
8. Andersen, A.L.; Hansen, E.T.; Johannesen, N. *Sheridan, Adam, Consumer Responses to the COVID-19 Crisis: Evidence from Bank Account Transaction Data*; Centre for Economic Policy Research: London, UK, 2020; SSRN 3609814.
9. Andersen, A.L.; Hansen, E.T.; Johannesen, N.; Sheridan, A. Pandemic, shutdown and consumer spending: Lessons from Scandinavian policy responses to COVID-19. *arXiv* **2020**, arXiv:2005.04630.
10. Hall, M.C.; Prayag, G.; Fieger, P.; Dyason, D. Beyond panic buying: Consumption displacement and COVID-19. *J. Serv. Manag.* **2020**, Ahead-of-Print. [CrossRef]
11. Grashuis, J.; Skevas, T.; Segovia, M.S. Grocery shopping preferences during the COVID-19 pandemic. *Sustainability* **2020**, *12*, 5369. [CrossRef]
12. Chronopoulos Dimitris, K.; Marcel, L.; John, O.S.W. Consumer Spending Responses to the COVID-19 Pandemic: An Assessment of Great Britain. 2020. SSRN 3586723. Available online: https://ssrn.com/abstract=3586723 (accessed on 26 October 2020).
13. Chang, H.H.; Meyerhoefer, C. COVID-19 and the demand for online food shopping services: Empirical evidence from Taiwan. *Am. J. Agric. Econ.* **2020**. [CrossRef]
14. Hassen, E.T.; Bilali, E.H.; Mohammad, S.A. Impact of COVID-19 on Food Behavior and Consumption in Qatar. *Sustainability* **2020**, *12*, 6973. [CrossRef]
15. de Sousa Jabbour, A.B.L.; Jabbour, C.J.C.; Hingley, M.; Vilalta-Perdomo, E.L.; Ramsden, G.; Twigg, D. Sustainability of supply chains in the wake of the coronavirus (COVID-19/SARS-CoV-2) pandemic: Lessons and trends. *Mod. Supply Chain Res. Appl.* **2020**. Ahead-of-Print. [CrossRef]
16. Baker, S.R.; Farrokhnia, R.A.; Meyer, S.; Pagel, M.; Yannelis, C. How does household spending respond to an epidemic? Consumption during the 2020 covid-19 pandemic (No. w26949). *RAPS* **2020**, *10*, 834–862.
17. Aristovnik, A.; Keržič, D.; Ravšelj, D.; Tomaževič, N.; Umek, L. Impacts of the COVID-19 pandemic on life of higher education students: A global perspective. *Sustainability* **2020**, *12*, 8438. [CrossRef]
18. Edelhauser, E.; Lupu-Dima, L. Is Romania Prepared for eLearning during the COVID-19 Pandemic? *Sustainability* **2020**, *12*, 5438. [CrossRef]
19. Sobaih, A.E.E.; Hasanein, A.M.; Abu Elnasr, A.E. Responses to COVID-19 in higher education: Social media usage for sustaining formal academic communication in developing countries. *Sustainability* **2020**, *12*, 6520. [CrossRef]
20. Raišienė, A.G.; Rapuano, V.; Varkulevičiūtė, K.; Stachová, K. Working from Home—Who is Happy? A Survey of Lithuania's employees during the COVID-19 quarantine period. *Sustainability* **2020**, *12*, 5332. [CrossRef]
21. Kaur, T.; Sharma, P. A study on working women and work from home amid coronavirus pandemic. *J. Xi'an Univ. Archit. Technol.* **2020**, *XII*, 1400–1408.
22. Madani, A.; Boutebal, S.E.; Benhamida, H.; Bryant, C.R. The Impact of Covid-19 Outbreak on the Tourism Needs of the Algerian Population. *Sustainability* **2020**, *12*, 8856. [CrossRef]
23. Leal Filho, W.; Brandli, L.L.; Lange Salvia, A.; Rayman-Bacchus, L.; Platje, J. COVID-19 and the UN sustainable development goals: Threat to solidarity or an opportunity? *Sustainability* **2020**, *12*, 5343. [CrossRef]
24. McGrail, D.J.; Dai, J.; McAndrews, K.M.; Kalluri, R. Enacting national social distancing policies corresponds with dramatic reduction in COVID19 infection rates. *PLoS ONE* **2020**, *15*, e0236619. [CrossRef] [PubMed]
25. Yoon, S.; Ha, J. The effect of COVID-19 on the Caonsumption of Agrifood. In Proceedings of the Korean Food Marketing Association Summer Conference, Jeonju, Korea, 16 July 2020.

26. WHO, World Health Organization. Coronavirus Disease (COVID-19) Pandemic. Available online: https://www.who.int/emergencies/diseases/novel-coronavirus-2019?adgroupsurvey=\{adgroupsurvey\}&gclid=CjwKCAiAlNf-BRB_EiwA2osbxT1aCXsFCMunmIC6vrM5sfa0uNc1Lb7BYEEw6KlXVZSz96kKoyHjMxoCzxkQAvD_BwE (accessed on 14 December 2020).
27. Woori Financial Institute. *The Analysis of Consumer Behaviour after COVID-19 by Examining the Woori Bank Big Data*; Industry Watch: Sofia, Bulgaria, 2020. (In Korean)