

Impact of the COVID-19 Social Distancing Policy on the Exit and Entry of Stores in South Korea*

Min Hee You**, Yun Jeong Choi***, Jee Young Kim****

This study investigates how social distancing policy to curb the COVID-19 pandemic control affected the survival of stores in Korea. Using a Difference-in-Difference approach, we find that an increase in exit and a decrease in entry was more severe for stores in sectors and regions that faced stricter social distancing policy. In the district level analysis of Seoul, we find that high rent districts had a statistically significant drop in store entry while de facto mobility lessened a decrease in store exit. The results confirms that the vulnerability of stores and sectors is highly associated with social distancing and mobility.

JEL Classification: C50, D22, L20, L25, L29

Keywords: COVID-19, social distancing, firm survival, generalized DID, panel regression

1. INTRODUCTION

As of June 1, 2021, the reported cases of COVID-19 exceeded 170 million, with 3.69 million deaths globally.¹⁾ Accordingly, governments worldwide implemented various quarantine policies to reduce the spread of COVID-19. These measures included self-quarantines, border closings, travel bans, lockdowns, work from home, and school closures. Furthermore, the contagious nature of COVID-19 has made people engage in social distancing, which limits in-person social interactions. All of these measures have impacted the economy severely and forced many businesses to close, leading to an unprecedented disruption of commerce, business operations, and sales activities across most industries. Just after the outbreak began, the global

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1) As of January 10, 2022, approximately 307 million people have been infected with COVID-19 and 5.50 million deaths have been reported globally. All numbers are from <https://www.worldometers.info>.

economy sunk into a recession. The gross domestic product of Organisation for Economic Co-operation and Development (OECD) countries fell by 9.8% in the second quarter of 2020, larger than the decline of the global financial crisis of 2007-2008 (OECD, 2020).²⁾ The International Labour Organization (ILO, 2021)³⁾ estimated a significant drop in global employment in 2020 at 144 million jobs, compared with the pre-pandemic trend.

The economic shock of COVID-19 is unprecedented because of the suddenness and severity of the economic contraction experienced (Altig et al., 2020). Numerous researchers have examined the effect of COVID-19 on employment (Kalenkoski and Pabilonia, 2020; Lee and Yang, 2021; Kim, Koh, and Zhang, 2020; Aum, Lee, and Shin, 2020; Shin, Kim and Kim, 2021), sales (Shin, Kim, and Koh, 2020; Kim, Koh, and Lyou, 2020), stock prices (Ramelli and Wagner, 2020; Zhang et al., 2020; Chang and Meyerhoefer, 2020; Acharya and Steffen, 2020; Carletti et al., 2020), expenditure and commodity prices (Cox et al., 2020; Baker et al., 2020), and survival of small and medium enterprises (SMEs) (Gourinchas et al., 2020 ; Bartik et al., 2020).

South Korea (hereafter, Korea) also experienced a rapid decline during the first quarter of 2020 in the areas of retail sales, production, and the number of employees in the service industry such as food service, wholesale and retail trade, and transportation and storage industries.⁴⁾ The unemployment rate increased from 4.1% in January to 4.5% in May. The proportion of own-account workers among the self-employed in the first quarter of 2020 increased by 2.9%p compared to the same period of the previous year, which has been recorded as the highest number in the past five years.⁵⁾

Retail businesses are particularly vulnerable to COVID-19 disruptions. In sectors where face-to-face contact played a key role, the negative impact of COVID-19 was significant. Figure 1 shows how hospitality accommodations, food and beverage, amusement parks and other activities experienced a significant drop in the Service Activity Index whereas online sales and delivery showed dramatic growth.⁶⁾

The Korean government announced an initial version of the social distancing policy on March 22, 2020 to curb the spread of the pandemic. The policy of closures applied to non-essential businesses and public spaces, including religious facilities that were considered places of high risk to catching the infection. As the spread of the disease continued in August 2020, restrictions were tightened in the Seoul metropolitan area, where more than half of the Korean population resides. Operating hours were slashed for certain business sectors, such as restaurants and bars, and only takeout orders and delivery services were allowed.

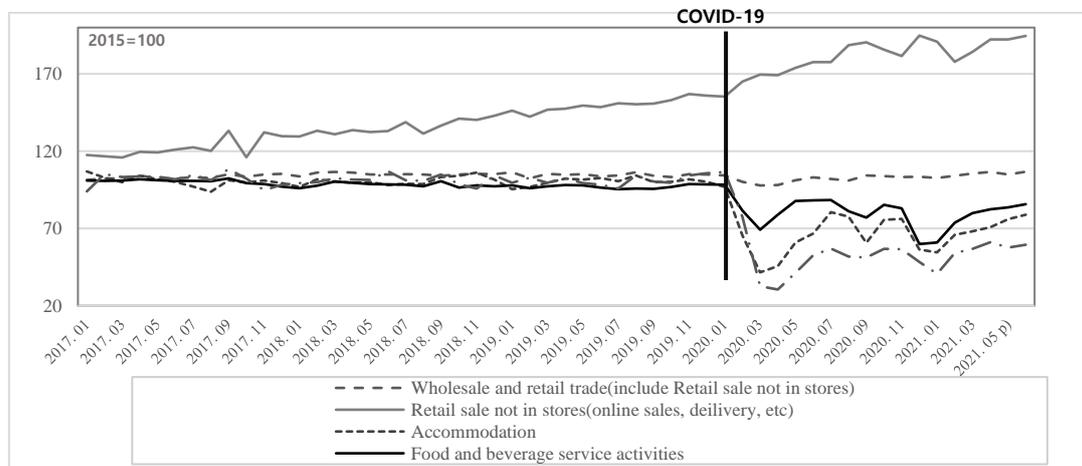
2) Quarterly National Accounts: Quarterly growth rates of real GDP, 26 Aug 2020, OECD.

3) *ILO Monitor: COVID-19 and the World of Work*, 7th Edition, 25 January 2021.

4) *KDI Monthly Economic Trends 2020*, Korea Development Institute, pp. 4-6.

5) Economically Active Population Survey, National Statistical Office's Economic Research Service, January 2021, KOSIS. Own-account self-employed stands for independent contractors without employees (OECD, 2014).

6) The Service Activity Index is defined as a weighted average of the real output of service sectors where the weights are based on shares in the value added. It is produced by the Korean Statistical Information Service.

Figure 1 Services Sector Activity Index

Source: Statistics Korea, Economically Active Population Survey.

and the characteristics of its region. Park and Yum (2020) suggest that social distancing policies should be based on regional characteristics and the type of business, and not be implemented uniformly. There are few empirical studies exploring the economic effect of the social distancing policy on the survival of stores in Korea.

This study investigates the direct impact of social distancing policies on the entry and exit of stores in the service sector. The results provide new empirical evidence on the evaluation of the COVID-19 related policy and yield relevant policy implications for pandemic-hit sectors and regions. The remainder of this study is organized as follows. Section 2 reviews the COVID-19 related social distancing policy of Korea; section 3 presents empirical models and results; and section 4 concludes the study.

2. SOCIAL DISTANCING POLICY IN KOREA

The Korean government implemented social distancing as a part of non-pharmaceutical interventions (NPI) to prevent community outbreaks. On March 22, 2020, a 15-day intense social distancing policy was implemented to limit the operation of religious, sporting events, and entertainment facilities. As daily numbers of confirmed COVID-19 cases dropped to single digits below 10, the social distancing policy turned into a more relaxed scheme after May 6.

On June 28, the social distancing policy was revised to be a level-based regulatory (3 levels) system based upon the average number of confirmed cases per week since there were no clear standards and guidelines for each stage of the regulation. On August 28, it was subdivided into 4 levels: level 1, 2, intensified 2, and 3. After November 7, it was revised to five levels with

each level having different standards and guidelines: 1, 1.5, 2, 2.5 and 3.⁷⁾ As the COVID-19 infection increased gradually again during the summer of 2020, the government raised social distancing level from level 1 to level 2 in the metropolitan area on August 16, and expanded it countrywide on the 23rd. From August 30 onwards, the social distancing level of the metropolitan area was strengthened to level 2.5 and maintained at this level until September 13. After September 14, the level was alleviated to level 2 for four weeks and the lowest level 1 remained for the following six weeks from October 12. However, on November 23, level 2 came into force again in the greater Seoul area and the level was intensified to 2.5 on December 7 until the end of the year in 2020.⁸⁾ Table 1 presents further details about the social distancing policies implemented in Korea.

As the social distancing level changed with the number of confirmed cases, the degree of restrictions varied from level to level. Level 1 was the stage of practicing daily quarantine with basic preventative measures applied, such as wearing facemasks in public. The restrictions on business hours of facilities were implemented from level 2. Under level 2, singing rooms (Noraebang in Korean), restaurants and coffee shops had to close to the public at 9 p.m. After 9 p.m., they could only provide takeout orders or deliveries. Clubs and bars were forced to shut down completely. When level 2 has been implemented since November 2020, the restrictions

Table 1 Social Distancing Levels and Restrictions

	Initial Distancing	Level 1	Level 1.5	Level 2	Level 2.5	Level 3
Implementation criteria	N/A	Everyday Life quarantine	The Local infection stage	Over 300 confirmed cases nationwide, lasting more than a week	The national average of 4-500 confirmed cases per week	A sharp increase in confirmed cases in level 2.5.
Main restriction	Only Bar and Clubs not allowed for 2 weeks.	Distancing in daily life	Limit the number of people using the stores	No business except takeout and delivery orders from 9 p.m.	No entertainment businesses allowed.	No business after 9 p.m.
Period (Seoul)	Week 12-32 (3.22-8.16)	Week 41-46 (10.12-11.22)	N/A	Week 33-34 (8.17-8.30) Week 37-40 (9.14-10.11) Week 47-48 (11.23-12.6)	Week 35-36 (8.31-9.13) Week 49-52 (12.7-12.31)	N/A

Note: All weeks and dates in the table are of 2020. Week 1 stands for 1.6 - 1.12 since a Monday-Sunday calendar was applied for the week dimension that can display the date of the week in our study.

7) Effective from July 1, 2021, five-tier stages of distancing policy revised into four stages to strengthen local government autonomy considering the infection reproduction index of the region.

8) Since December 21, 2020, the restrictions on the number of private gathering were added to the rules and only a maximum of four people was allowed in greater Seoul area.

Table 2 Number of Exit and Entry of Stores in Selective Business Sectors

	Entry				Exit			
	2019	2020	Change	%Change	2019	2020	Change	%Change
Coffee Shop	14,539	13,828	- 711	- 4.9%	8,526	8,824	298	3.5%
Singing Room	747	386	- 361	- 48.3%	2,187	1,619	- 568	- 26.0%
Pharmacy	2,170	1,511	- 659	- 30.4%	1,757	946	- 811	- 46.2%

on coffee shops were even more intensified and only takeout orders or deliveries were permitted. During level 2.5, events involving 50 people or more were banned and singing rooms were closed. The highest, level 3, forbid any events involving 10 people or more people, and facilities including restaurants and coffee shops to close, but was never implemented in 2020.

As per the cultural norms, anything beyond level 2 implied social distancing, entertainment facilities such as singing rooms ceasing operation after 9 p.m. During level 2.5, they were shut down completely. Businesses such as restaurants, movie theaters, and large grocery stores, where non-face-to-face operations are possible, could not operate after 9 p.m., but were allowed to have deliveries and offer takeout orders. Coffee shops had stricter restriction because they were only allowed to serve takeout orders or deliveries at all hours from November 23. When level 2 and level 2.5 restrictions were applied, economic damage of stores in regulated sectors such as coffee shops were economically challenged worse than others. Table 2 shows the comparison of the entries and exits of retail stores from 2019 and 2020 in selective service sectors.⁹⁾ The number of entries from 2020 has decreased in all sectors compared to the previous year, whereas an increase in the number of exits was only observed in coffee shops. Social distancing is essential to minimizing social contact, but the costs can be focused on certain groups. Our aim is to quantify the effect of COVID-19 represented as the entry and exit of stores using spatially disaggregated data.

3. EMPIRICAL MODEL

3.1. Data

This study utilized two types of data sets collected for 2019-2020 that covered the pre-COVID-19 pandemic period and the first year of COVID-19 pandemic period. First, the number of stores' entry and exit in selective business sectors were obtained using the Korean Local Administration Data Open System. The data included types of service sectors, name, address and opening and closing date of all stores operating in Korea. The weekly aggregated number

9) See more details on sector choice in the section 3.2.

of entries and exits from 2019 to 2020 was based on seventeen provinces and city fields (*si* and *do*) were used at national levels of analysis. To examine the impact of the social distancing policy, we chose targeted sectors: singing rooms subject to strict restriction and coffee shops affected by the social distancing policy but allowed to operate takeout orders or delivery. We chose pharmacies as counterfactual because they faced no restriction by the policy. The control variables, such as regional employment rates and regional population, were obtained from the Economically Active Population Survey of Statistics Korea.

For sub-regional analysis, 25 districts of Seoul were examined. Mobility and retail rents of district were considered as regional characteristics. Heterogeneity of mobility can affect stores' entry and exit decision in the presence of distancing restrictions. As a proxy of mobility, de facto population provided by Seoul's Open Data System was used in the model.¹⁰⁾¹¹⁾ De facto population represents the number of individuals recorded to the geographical area where they were present at a specified time. Rents were collected from the Business District Analysis Service of Stores of Seoul.¹²⁾ It had a value of 1 if the average rent in a district in 2019 is higher than the average rent in Seoul during the same period, and is 0 otherwise. The rents in eight districts out of 25 districts in Seoul- Jung-gu, Jongno-gu, Gangnam-gu, Mapo-gu, Songpago, Yongsan-gu, Seocho-gu, and Dongjak-gu-were higher than the average for both 2019 and 2020. The high (low) rent districts in 2019 maintained a high (low) rent during the pandemic period.

According to table 2, the total entry of stores decreased in all sectors such as coffee shops, singing rooms, and pharmacies during 2020 compared to 2019, whereas the number of exits varied by sector. Pharmacies and singing rooms showed a decrease in both entry and exit, but coffee shops showed more serious economic damage due to increased exit despite a decrease in entry. Table 3 shows descriptive statistics of the variables used in the analysis.

Table 3 Descriptive Statistics of Variables

National-level Analysis						
Variable	Definition	N	Mean	Std.	Min.	Max.
Dependent Variables						
<i>Exit</i>	Weekly number of exits in 17 provinces and metropolitan cities of Korea from January 1, 2019 to December 31, 2020	1,836	9.819	12.496	0	100
<i>Entry</i>	Weekly number of entries in 17 provinces and metropolitan cities of Korea from January 1, 2019 to December 31, 2020	1,836	15.936	17.213	0	98

10) Seoul's Open Data System provides de facto population data estimated by merging Long Term Evolution (LTE) signal data of Korea Telecom (KT) combined with public data of the Seoul Metropolitan Government.

11) <https://stats.oecd.org/glossary/detail.asp?ID=571>.

12) <https://golmok.seoul.go.kr/main.do>.

Control Variables						
<i>Employment Rate</i>	Monthly employment rate in 17 provinces and metropolitan cities of Korea	1,836	60.895	2.984	52.8	69.3
<i>Population</i>	Monthly number of populations in 17 provinces and metropolitan cities of Korea	1,836	2626.905	2803.365	256	11585
Sub-regional Analysis						
Dependent Variables						
<i>Exit</i>	Weekly number of exits in 25 districts(Gu) in Seoul from January 1, 2019 to December 31, 2020	2,600	1.640	2.229	0	52
<i>Entry</i>	Weekly number of entries in 25 Gu districts in Seoul from January 1, 2019 to December 31, 2020	2,600	1.947	2.092	0	16
Explanatory Variable						
<i>De facto Mobility</i>	Weekly mobility estimated by merging Long Term Evolution (LTE) signal combined with public data (unit: 100,000)	2,600	44.690	14.030	22.827	90.582
<i>Rent</i>	Takes a value of 1 if the average rent in a district of interest in 2019 is higher than the average rent of Seoul in 2019 and 0 otherwise	2,600	0.320	0.467	0	1
<i>Holiday</i>	Takes a value of 1 if there is holiday in a given week and 0 otherwise	2,600	0.039	0.192	0	1
<i>Cumulative COVID-19 Cases</i>	Weekly number of cumulative COVID-19 cases (unit : hundred)	2,600	0.640	1.435	0	13.32
<i>Distancing</i>	<i>D0</i> Takes a value of 1 for 2019 and Week 1-2 of 2020 and 0 otherwise (Before COVID-19 outbreak)	2,600	0.019	0.137	0	1
	<i>D1</i> Takes a value of 1 for Week 3-32 of 2020 and 0 otherwise (Level 0)	2,600	0.288	0.453	0	1
	<i>D2</i> Takes a value of 1 for Week 33-36 of 2020 and 0 otherwise (Level 2 and 2.5)	2,600	0.038	0.192	0	1
	<i>D3</i> Takes a value of 1 for Week 37-40 of 2020 and 0 otherwise (Level 2)	2,600	0.038	0.192	0	1
	<i>D4</i> Takes a value of 1 for Week 41-46 of 2020 and 0 otherwise (Level 1)	2,600	0.058	0.233	0	1
	<i>D5</i> Takes a value of 1 for Week 47-52 of 2020 and 0 otherwise (Level 2 and 2.5)	2,600	0.058	0.233	0	1

Source: 1) Korean Local Administration Data Open System, <https://www.localdata.kr>.

2) Economically Active Population Survey (Statistics Korea), <https://kosis.kr>.

3) Local Business District Analysis Service (Seoul), <https://golmok.seoul.go.kr/main.do>.

3.2. Entry and Exit of Stores at the National Level

To identify the impact of the COVID-19 outbreak, this study compares the changes in exit and entry of stores over weeks between 2019 and 2020 using the following generalized-Difference in Difference (DID) regression model (Chetty et al., 2020).

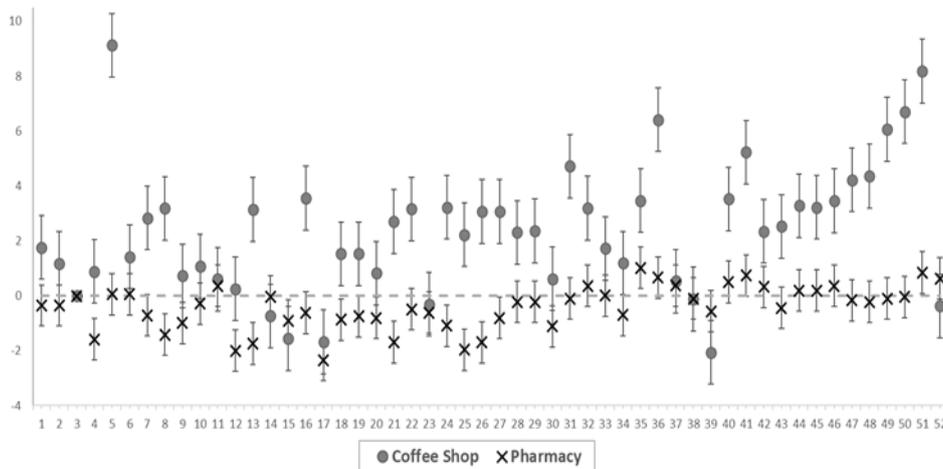
$$y_{it} = \beta_0 + \beta_1 YR2020_t + \sum_{k \neq 3} \delta_k I[Week_t = k] YR2020_t + \zeta X_{it} + \eta_i + \omega_t + \varepsilon_{it}. \quad (1)$$

The dependent variable y_{it} signifies the number of entry and exit of stores in the region i during week t . $YR2020_t$ is a dummy variable that takes a value of 1 for Year 2020. $Week_t$ denotes the week order within a calendar year. $I[Week_t = k]$ takes a value of 1 if $t = k$ ($k=1, \dots, 52$), and 0 otherwise. So δ_k represents the impact of the week k specific impact on entry and exit in 2020, capturing the effects of COVID-19.¹³⁾ X_{it} is a vector of control variables that have time-varying regional characteristics such as the regional population and employment rates. η_i and ω_t are the region fixed effect and the week fixed effect, respectively. ε_{it} is an error term.

The main interest is in the coefficient of the interaction variable, δ_k , representing the impact of social distancing and COVID-19 on stores' survival. Figure 2.1 shows the DID estimates in exit of coffee shops (target group) and pharmacies (control group) with a 95% confidence interval. The circle and x symbols stand for the DID estimates for coffee shops and pharmacies, respectively. A strong difference in the pattern of exits between two sectors is shown. The

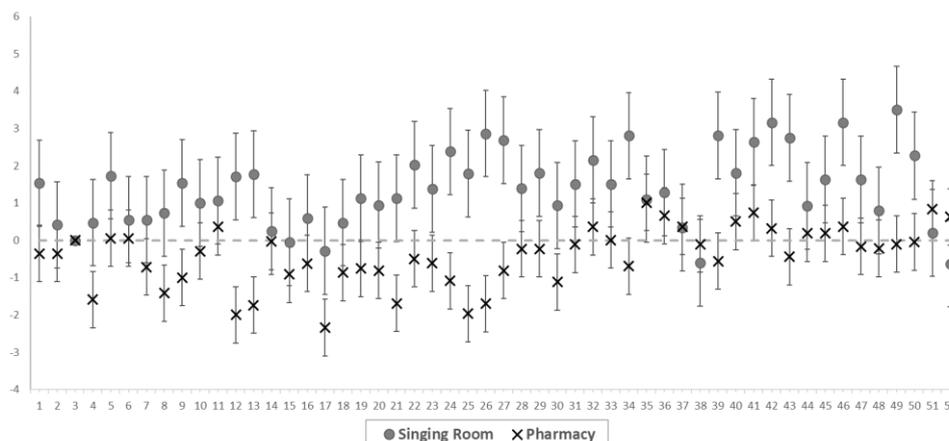
Figure 2.1 DID Estimates of Social Distancing Effect on Exit

(1) Coffee Shop vs. Pharmacy



13) The base week is week 3. So $\delta_3 I[Week_t = 3] YR2020_t$ is dropped.

(2) Singing Room vs. Pharmacy



Note: Black circle and X shape represent the estimated number of exits for coffee shops, singing rooms and pharmacy, respectively. Standard errors are clustered at the block-level. Caps indicate 95% confidence intervals.

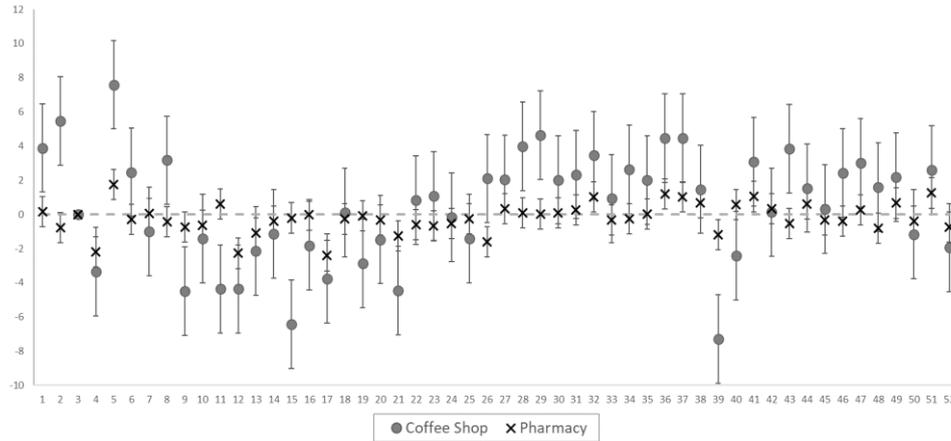
majority of the DID estimates of coffee shops, a regulated sector by the social distancing policy, show positive signs. It implies a higher number of exits of coffee shops across weeks during the pandemic period. On the other hand, most DID estimates of pharmacies are close to zero, which implies that their number of exits has little difference over weeks during the pandemic period. It is more notable after the 34th week of 2020 when social distancing was increased to level 2.5. Coffee shops showed a surge in business exits deviating from the pattern of pharmacies. The difference between singing rooms and pharmacies is similar to that between coffee shops and pharmacies. Both coffee shops and singing rooms were also regulated as high-risk facilities, and in most of weeks, singing rooms showed positive DID estimates compared to the previous year.

Figure 2.2 shows the DID estimates of coffee shops, singing rooms, and pharmacies for entry. The DID estimates of pharmacies are close to zero and statistically insignificant in most cases. It implies that the entries of pharmacies under no restrictive measure of social distancing stayed stable during 2020. In other words, while the entry of pharmacies decreased in 2020, it had not experienced neither decrease nor increase of entry over time during the pandemic period. However, in case of singing rooms, the majority of DID estimates for singing rooms are negative and become statistically significant after the first nine weeks. That is, less and less entry occurred as the pandemic continued. In case of coffee shops, the DID estimates for coffee shops shows negative signs from March when COVID-19 began and until the more relaxed scheme of the social distancing policy applied around May (the 8th week to 20th week). Fewer entries in the beginning of the pandemic were recovered in the later period.

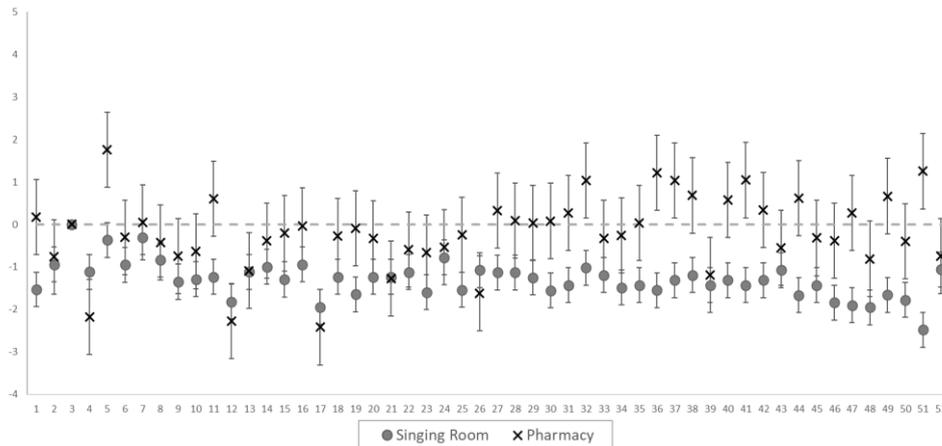
The difference between coffee shops and singing rooms in entry and exit implies that the intensity of social distancing rules has affected stores entry and exit decision. Singing rooms

Figure 2.2 DID Estimates of Social Distancing Effect on Entry

(1) Coffee Shop vs. Pharmacy



(2) Singing Room vs. Pharmacy



Note: Black circle and X shape represent the estimated number of exits for coffee shops, singing rooms and pharmacy, respectively. Standard errors are clustered at the block-level. Caps indicate 95% confidence intervals.

were subject to stronger distancing policy regulations than coffee shops and hence singing rooms' entry and exit might have been more affected than coffee shops.

3.3. Entry and Exit of Stores across Regions

This study further analyzes region-specific effect of social distancing by grouping the country into three regions: Seoul, Gyeonggi province, and the remaining regions. Out of all the regions observed, Seoul metropolitan area reported the largest number of COVID-19 cases and

maintained strong social distancing levels even when other regions eased social distancing. The empirical model was extended to incorporate region interaction terms, $region$, as follows:

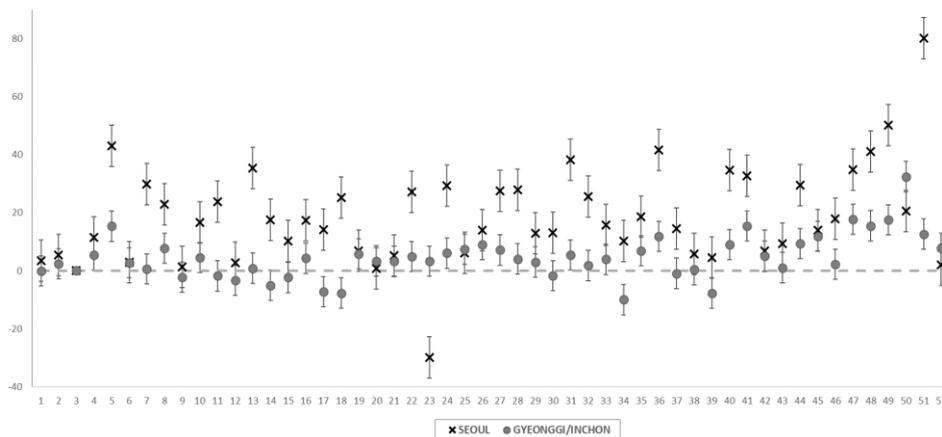
$$y_{it} = \beta_0 + \beta_1 YR2020_t + \sum \sum \delta_{kg} I[Week_t=k] region_g + \sum \theta_g YR2020_t * region_g + \sum \sum a_{kg} I[Week_t=k] YR2020_t region_g + \zeta X_{it} + \eta_i + \omega_t + \varepsilon_{it}. \quad (2)$$

$region_g$ is a dummy variable that take a value of 1 where $g =$ Seoul, Gyeonggi. The base region is any remaining region, the base week is week 3, and the base year is 2019. a_{kg} captures heterogeneous effects of k th week in 2020 across regions. Figure 3 displays DID estimates of entry and exit of coffee shops and singing rooms by region. Coffee shops and singing rooms located in Seoul suffered most severely compared to other areas. The magnitude became larger after the strong social distancing measure was implemented in week 33. Exits of coffee shops and singing rooms increased more and entries decreased further. It led to much greater differences between Seoul and other regions.

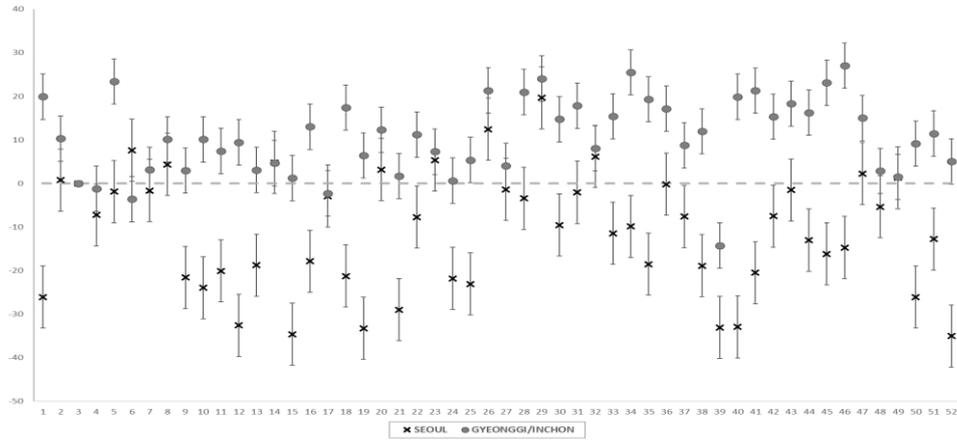
Overall, the empirical results at the national level and sub-region level indicate that the Covid-19 pandemic and the social distancing policy had heterogeneous effects across sectors and regions. Pandemic-hit sectors showed the different trend of entry and exit compared to non-targeted sectors. Even among targeted sectors, they were revealed to different degree of risks under the social distancing policy and it resulted in some differences in entry and exit trends. In addition, the effects vary from region to region, and among them, stores in Seoul suffered the most.

Figure 3 DID Estimates of Social Distancing Effect by Region

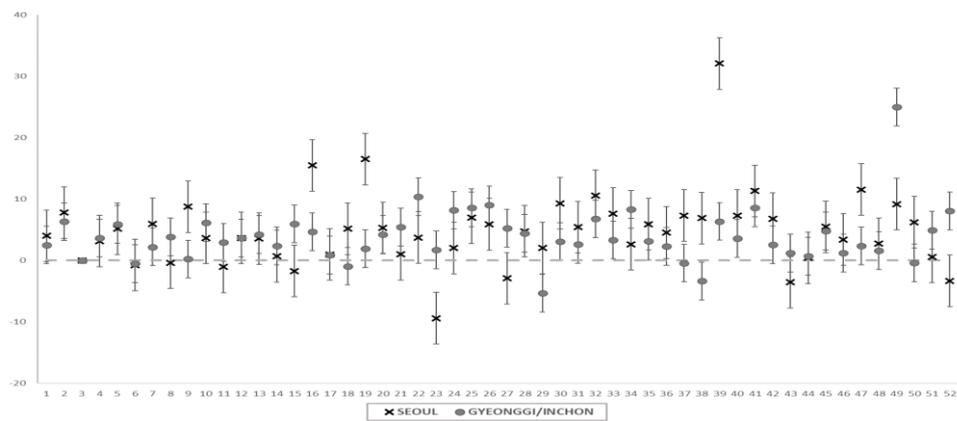
(1) Exit of Coffee Shop



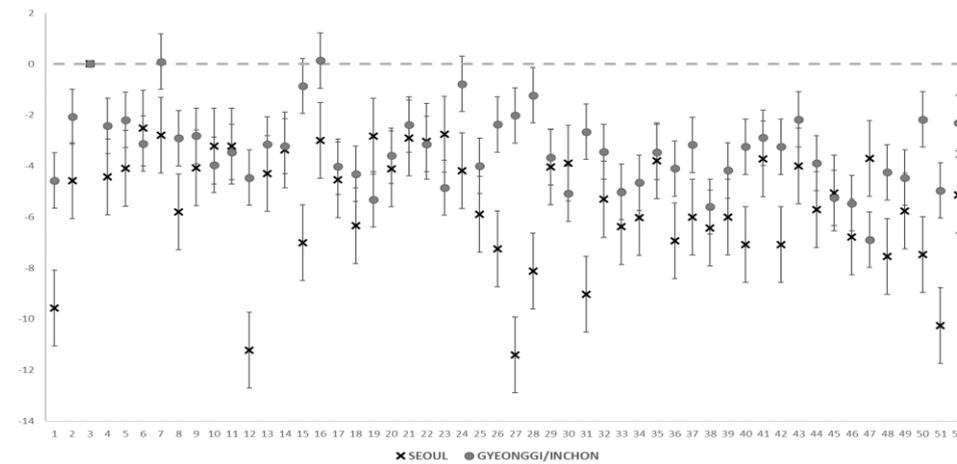
(2) Entry of Coffee Shop



(3) Exit of Singing Room



(4) Entry of Singing Room



Note: Black circle and X shape represent the estimated number of entries impact of the COVID-19 among Gyeonggi and Seoul. Standard errors are clustered at the block-level. Caps indicate 95% confidence intervals.

3.4. Entry and Exit of Stores across Districts in Seoul

This section examines how a district's characteristics affected the impact of social distancing on entry and exit of stores. Among many characteristics, we focused on mobility and rents of a district that are one of the important factors to consider entry and exit of stores. Places with a higher degree of mobility are attractive for business owners that want to open a store. Places with higher rents are likely to be popular places that many people visit and are attractive as store locations. So using coffee shops' entry and exit in 25 districts of Seoul in the pandemic period of 2020, this paper analyses whether districts with higher rents or mobility would have a higher or lower number of entries and exits. The empirical model is as follows:

$$y_{it} = \beta_0 + \beta_1 Rent_{it} + \beta_2 Mobility_{it} + \sum_j \gamma_j Distancing_j + \sum_j \rho_j Rent_{it} * Distancing_j + \sum_j \delta_j Mobility_{it} * Distancing_j + \beta_3 C_{it} + \beta_4 H_t + \eta_i + \varepsilon_{it}, \quad (3)$$

where the dependent variable y_{it} indicates the number of stores entries and exits in district i of Seoul at week t ; $Rent_{it}$ is a dummy variable that takes a value of 1 if the rent of district i was higher than the average rents of Seoul;¹⁴⁾ $Mobility_{it}$ is de facto population which is used as a proxy of mobility in district i of week t ;¹⁵⁾ $Distancing_j$ is a dummy variable that takes a value of 1 for sub-period j ($j=1, \dots, 5$). The sample period of 2019-2020 was categorized into six sub-periods based on changes in social distancing policy;¹⁶⁾ C_{it} and H_t represent the cumulated number of COVID-19 infections in district i of week t , and a holiday indicator of week t , respectively. η_i controls unobserved district specific factors, and ε_{it} is the error term. The fixed effect model was utilized.¹⁷⁾

The Poisson regression model or negative binomial model can be used to estimate count data models. Although Poisson regression is widely used, the estimation can be biased if it violates the distribution assumption that the variance equals the mean (Dohse and Schertler, 2003). The negative binomial model accounts for the larger mean distribution of count data (Allison and Waterman, 2002). The number of exits and entries in this study had a large variance compared to the mean. Therefore, we applied a negative binomial regression for the robustness check. The estimation results are shown in tables 4 and 5.

Table 4 elaborates how regional characteristics gave an effect on coffee shops entry. The number of entries is positively associated with rent. The number of entries was higher by 1.358

14) Taking into account the endogeneity of *Rent*, we used the average rents of 2019. The empirical results do not change if we use the rents in the corresponding year, because the order of the average rents across districts tends to stay the same.

15) In this study, the average *de facto* population of week $t-1$ and week t in district i was used.

16) Social distancing policy was officially implemented in Seoul in August 2020. For the details of distancing group, refer to table 3.

17) According to the Hausman test, the p -value is 0.04 and it rejects the null hypothesis that there is no difference in coefficients between the fixed-effect model and the random-effect model.

Table 4 Impact of Social Distancing on Entry of Coffee Shops in Seoul

Entry	(1)		(2)	
	Fixed Effects Model		Negative Binomial Model	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Rent	1.358***	0.233	0.666***	0.116
Rent · D1	- 0.152	0.175	- 0.141	0.090
Rent · D2	- 0.546	0.372	- 0.403**	0.204
Rent · D3	- 0.734**	0.373	- 0.637***	0.249
Rent · D4	- 0.078	0.309	- 0.073	0.162
Rent · D5	- 0.200	0.317	- 0.183	0.176
Mobility	0.689***	0.229	0.165	0.103
Mobility · D1	- 0.015	0.054	0.030	0.024
Mobility · D2	- 0.051	0.124	0.055	0.058
Mobility · D3	- 0.180	0.127	0.112	0.072
Mobility · D4	- 0.073	0.107	0.030	0.048
Mobility · D5	- 0.085	0.126	0.078	0.059
D1	0.121	0.240	- 0.081	0.114
D2: L2-2.5	0.486	0.542	- 0.041	0.268
D3: L2	0.732	0.546	- 0.502	0.330
D4: L1	0.473	0.445	0.002	0.212
D5: L2-2.5	0.631	0.449	- 0.104	0.228
Holiday	- 0.570***	0.164	- 0.349***	0.098
Cumulated Infections	- 0.100	0.063	- 0.073**	0.032
Constant	1.039	0.224	- 0.204	0.388
Number of obs.	2,600		2,600	
F-value	50.81			
R2	0.455			
chi2			1,172.530	
Log likelihood			- 4252.941	

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5 Impact of Social Distancing on Exit of Coffee Shops in Seoul

Exit	(1) Fixed Effects Model		(2) Negative Binomial Model	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Rent	1.496***	0.279	1.156***	0.160
Rent · D1	0.155	0.210	0.147	0.101
Rent · D2	0.135	0.446	– 0.010	0.215
Rent · D3	– 0.263	0.447	– 0.106	0.231
Rent · D4	– 0.072	0.371	– 0.103	0.177
Rent · D5	0.701*	0.381	0.135	0.157
Mobility	0.728***	0.275	0.236*	0.123
Mobility · D1	– 0.204***	0.065	– 0.055*	0.029
Mobility · D2	– 0.055	0.148	0.019	0.068
Mobility · D3	– 0.388**	0.152	– 0.113	0.075
Mobility · D4	– 0.118	0.128	– 0.019	0.056
Mobility · D5	– 0.472***	0.151	– 0.218***	0.059
D1	0.613**	0.288	0.062	0.141
D2: L2-2.5	– 0.024	0.650	– 0.171	0.319
D3: L2	1.285**	0.655	0.348	0.345
D4: L1	0.237	0.533	0.040	0.255
D5: L2-2.5	1.878***	0.538	1.097***	0.228
Holiday	– 0.737***	0.196	– 0.659***	0.127
Cumulated Infections	0.177**	0.076	0.065**	0.031
Constant	2.018**	1.024	1.292***	0.470
Number of obs.	2,600		2,600	
F-value	27.19			
R2	0.309			
chi2			1,017.21	
Log likelihood			– 4,014.515	

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

where a district's rent is higher than the average rent of Seoul. Prime and popular locations for stores are likely to have high rent because rents reflect the value of a place. This implies that entry may occur more in places with higher rent.

It is noteworthy that the *Rent* effect declined when distancing policy was put in place. The coefficient of the interaction of terms between the social distancing policy sub-periods and *Rent* were negative. This implies that social distancing reduced entries in the rent-high district; especially when the coefficient was -0.734 and statistically significant during the period of week 37 to week 40 (period *D3*). Social distancing was raised from no measure to level 2 and 2.5 during the week of 33-36, and remained at level 2 during the week of 37-40. This offset effect was more noticeable when the negative binomial analysis was applied. The coefficients of *Rent · D2* and *Rent · D3* were -0.403 and -0.637 , which implies that the number of entries in the high rent district was decreased by 60.5% and 95.6% during periods *D2* and *D3*, respectively.

The other regional characteristic, *Mobility*, was also found to have a statistically significant and positive effect on store entries. The impact of mobility on stores' location strategies can be found in the literature that shows a positive association between consumer mobility and location choice of stores (Vanhaverbeke and Macharis, 2011; Loertscher and Schneider, 2011).¹⁸⁾ Meanwhile the business entry occurred less in weeks with a holiday. COVID-19 cumulated infection cases were also negatively associated with entries.

In addition, regional characteristics can also play a role in store exits. As shown in table 5, the number of exits was higher in the high-rent districts. *Mobility* was also positively associated with exits. Contrary to the empirical results of stores entries, the coefficients of distancing policy period remained significant to stores exits. Of all periods, week 37-40 of 2020 had the hardest hit and stores ended up having an increased number of exits by 1.878 and 1.097 in linear model and negative binomial model, respectively. Areas with higher than average rents were found to have greater financial hardships during this period, resulting in 4.075 ($1.496+0.701+1.878=4.075$) exits in the fixed effect model.

A negative value for the interaction term between *Mobility* and social distancing period *D1*, *D3* and *D5* would imply that the increase in store exits was alleviated if *Mobility* increased during the periods. The impact of *Mobility* on the decline in exit was the greatest during *D5* periods in the fixed model and the results of negative binomial model support the same results. Across all models, the number of store exits was found to decrease during holidays and to increase as cumulated number of infections increased.

18) Vanhaverbeke and Macharis (2011) used an agent-based model to find consumer mobility effectively impacts the spatial location of stores and the revenues of the chain retailer. Loertscher and Schneider (2011) found the retail chain's market share and profit are positively correlated with consumer mobility.

4. CONCLUSION

The Korean government implemented the social distancing policy as a part of its COVID-19 response. Social distancing is considered to be essential to curb the spread of infectious diseases but can inhibit economic activity leading to economic damage in regulated regions and sectors. Using the number of entries and exits between 2019 and 2020, this study estimates the effect of the social distancing policy on entries and exits of stores across sectors and regions.

The results of the generalized-DID model at national-levels of analysis indicated that the pattern of entry and exit of coffee shops and singing rooms are quite different from that of pharmacies in 2020. In comparison between Seoul, Gyeonggi province and remaining regions, Seoul suffered with less entry and more exits of coffee shops. Seoul has been the area with the toughest quarantine scheme because of its higher population density and the large number of COVID-19 infected patients.

Additionally, sub-regional analysis investigated entry and exit behavior of coffee shops located in Seoul, confirming regional characteristics played a role in entry and exit decision. *Rent* and *Mobility*, as important factors of business location choice, were positively associated with entry and exit of stores. However, during the pandemic, high rent districts had a statistically significant drop in entry when social distancing was put in place. De facto mobility of a district contributed to reducing exit. The robustness results of the negative binomial model provided consistent results.

This study contributes quantitative evidence of the negative economic effect of distancing policy on stores. There exists a trade-off relationship between the health and economy of quarantine policies on account of COVID-19. Quarantine policies, such as social distancing, limit the operation of businesses and thereby closely affect the survival of local businesses, the regional economy and the growth of the entire economy (Pai, 2020).

Minimizing economic shock requires quarantine rules that consider regional characteristics. Selective supports and policies should be implemented for certain types of businesses and regions vulnerable to pandemic. Sustainable policy principles should be prepared to cope with the recurrence of a pandemic situation in the future such as COVID-19. In addition, as COVID-19 becomes a long-term affair, the effect of social distancing policies may decrease if individual compliance with social distancing changes due to increased fatigue. Therefore, the comprehensive effect of the distancing policies needs to consider not only the costs but also the benefits of controlling infectious disease.

This study did not consider store specific characteristics due to data availability. Business owners' decision of entry and exit took place with many factors considered and the impacts of those factors influences over time, not instantaneously. A deeper analysis using individual data and dynamics is recommended for future studies.

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