RIETI Discussion Paper Series 25-E-074

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RIETI Discussion Paper Series 25-E-074
August 2025

The Impact of the COVID-19 Pandemic on Business Performance in the Japanese Leisure Industry*

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Abstract

This study focuses on the Japanese leisure industry, including golf, bowling, and amusement and theme parks, to empirically evaluate the impact of the COVID-19 pandemic on business performance. Given the necessity for interpersonal interaction in the leisure industry, the restrictions on outings due to the COVID-19 outbreaks had a considerable impact on business operations. The novelty of this study lies in its integration of establishment-level microdata with geocoded location information and human mobility data collected as big data, to assess the impact of surrounding locations on business performance before and during the COVID-19 outbreak. Using establishment-level monthly panel data from January 2019 to December 2021, this study finds the direct negative effects of the COVID-19 outbreak on business performance. Interestingly, the COVID-19 pandemic led to structural changes in the relationship between business performance and weekday outings, suggesting behavioral changes in leisure activities.

JEL classification: D78, D83, R14, R38, R58
Keywords: Human Mobility, Business Performance, Leisure Industry, Geocoding, COVID-19

* We would like to thank Arata Ito, Nobuaki Hamaguchi, Eiichi Tomiura, and the participants of the RIETI DP Seminar for their helpful comments and suggestions. Any remaining errors are our own. This study uses microdata (questionnaire information) from the Current Survey of Selected Service Industries (Ministry of Economy, Trade and Industry) with permission under the Statistics Act of Japan. This study uses the National Open Data on Human Flow (1km mesh, by municipality unit origin), which are publicly provided the Ministry of Land, Infrastructure, Transport and Tourism. This study is an outcome of the research conducted under the project "Evidence-Based Policy Making for Regional Revitalization" undertaken at RIETI. This study was supported by JSPS KAKENHI Grant Numbers 21K01497.
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1. Introduction

The novel coronavirus disease (COVID-19) pandemic has precipitated a precipitous contraction in numerous economic sectors. As a characteristic of infectious diseases, there were concerns about the spread of infection through face-to-face contact, so the government requested that people limit their outings in the early stages of the COVID-19 outbreak. Prior to the advent of vaccines and treatments, non-pharmaceutical interventions (NPIs) constituted a pivotal element in the fight against infectious diseases (Prime Minister's Office of Japan 2020; Neil M et al. 2020; Brauner et al. 2021). Concurrently, NPIs have a substantial negative influence on business performance by reducing interpersonal contact (Kawaguchi et al. 2021; Fairlie and Fossen 2022). It was also observed that the economy would decline due to self-restraint in behavior due to the spread of infection (Watanabe and Yabu 2021; Ishii et al. 2022; Hata 2024). As a result, businesses based on infection through face-to-face contact in the service sector experienced a substantial economic downturn.

This study focuses on the leisure industry, including golf, bowling, and amusement and theme parks, to empirically evaluate the impact of the COVID-19 pandemic on business performance. Given the necessity for interpersonal interaction in the leisure industry, the restrictions on outings due to the COVID-19 outbreaks had a considerable impact on business operations, and its early recovery from economic downturn is important (Fang et al. 2021; Spennemann and Whitsed 2023; Villarreal 2024). Furthermore, this study aims to estimate the direct impact of the COVID-19 pandemic on business performance.

The novelty of this study lies in the integration of establishment-level microdata with geocoded location information and human mobility data collected as big data. This study particularly emphasizes the assessment of human mobility flows to evaluate the impact of surrounding locations on business performance before and during the COVID-19 outbreak.

This study contributes to the literature by showing that human mobility in nearby areas is a key indicator of business performance in the leisure industry. Restrictions on outings caused by NPIs reduce business performance. Additionally, newly confirmed COVID-19 cases directly decrease business performance. Combining these findings, even if there is a short-term decline in the number of people going out, reducing the number of infected individuals over the long term could potentially boost business performance. This idea aligns with Demirgüç-Kunt et al. (2021). As shown by Bartik et al. (2020) and Meyer et al. (2022), business owners' expectations are crucial for maintaining performance and investment. Therefore, the importance of NPIs that help lessen the long-term impacts of the pandemic is suggested.

The study also found that there were structural changes in the relationship between business performance and weekday outings before and during the COVID-19 outbreak. These structural changes were particularly evident on weekdays in the golf course and amusement and theme park industries, suggesting that people

might be more careful about their outing behavior as a self-restraint behavior. Regarding the structural change in a wide range of individual behaviors, it is discussed that COVID-19 infection changes consumer expenditure patterns (Kikuchi et al. 2023). It is also confirmed that during the COVID-19 pandemic, individuals responded differently to some demand-inducing policies, known as the Go To Travel and Go To Eat campaigns (Okubo 2022). Furthermore, changes in travel behavior and shifts in travel modes in response to COVID-19 outbreaks are also discussed (Brinkman and Mangum 2022; Chen et al. 2022).

The remainder of this study is organized as follows: Section 2 summarizes the datasets of Japanese service establishments and human mobility flows. Section 3 describes the empirical methods. Section 4 discusses the estimation results. Finally, Section 5 concludes.

2. Data

This study uses confidential establishment-level microdata from the Japanese service sector as surveyed by the Current Survey of Selected Service Industries (CSSSI). The Ministry of Economy, Trade and Industry conducted CSSSI monthly to comprehend the business trends of specific service industries, such as sales, and to utilize this information as a foundation for formulating judgments concerning short-term economic and employment trends until December 2024 (Ministry of Economy, Trade and Industry 2025). Additionally, the CSSSI was conducted to gather data to inform industrial structure policies, small and medium-sized enterprise policies, and the sound development of the service industry.

This study covers a survey period from January 2019 to December 2021, one year before the COVID-19 pandemic. To match the human mobility flow, this study focuses on the establishment survey of CSSSI, not on the firm survey. Therefore, this study deals with the four industries: golf courses, golf driving ranges, bowling alleys, and amusement and theme parks.

This study identified each establishment location on a 1 km × 1 km grid square map using geocoding software (Address Matching Tool, MAPPLE). The geocoding process was conducted offline to protect the confidentiality of the establishment-level microdata. After obtaining the mesh code for each establishment, this study merges each establishment with the mesh dataset of human mobility flow.

The dataset of human mobility flow is taken from the Geospatial Information Center (Ministry of Land, Infrastructure, Transport and Tourism 2025). The MLIT publicly provides National Open Data on Human Flow, which includes a current population dataset based on human mobility flow on a 1km-by-1km mesh in the period of January 2019 to December 2021.

Figure 1 shows the change in the number of outings based on the year-on-year log difference in Tokyo prefecture. Figure 1(a) shows where people concentrated in the daytime in April 2019. In Figure 1(b), the outing change rates in the central business district of Tokyo turned out to be negative after the COVID-19

outbreak. On the other hand, suburbs in Tokyo show positive outing change rates, suggesting that many workers stayed home in the initial period of the COVID-19 pandemic. Figure 1(c) shows that this situation remains unchanged between April 2019 and April 2021, suggesting that structural change in outings occurred before and during the COVID-19 outbreak.

Tables 1–4 present the descriptive statistics for the variables used in the empirical analysis regarding four industries: golf courses, golf driving ranges, bowling alleys, and amusement and theme parks. The dataset includes three types of variables: establishment, mesh, and prefecture.

This study generally considers outings within the 1 km by 1 km mesh grid. However, this study also expands the geographical scale of the mesh grid to include populations within a 3 km radius, as golf courses occupy a large geographical area. This geographical variable was created by the spgen command in Stata (Kondo 2017).

Monthly newly confirmed cases of COVID-19 are measured at the prefecture level. Some researchers may prefer the number of COVID-19 infections observed at the municipality level. However, the factors that restrict behavior include not only the number of infected people at the destination, but also the number of infected people in the place of residence. Therefore, this study uses the newly confirmed cases of COVID-19 at the prefecture level.

[Tables 1–4 and Figure 1]

3. Method

We estimate the regression model of business performance in the service sector as follows:

$$\log(Y_{iapt}) = \alpha \log(M_{at}) + \beta \log(1 + I_{pt}) + \gamma \log(E_{it}) + \mu_i + \eta_a + \psi_p + \tau_t + u_{iart}, \quad (1)$$

where Y_{iapt} is a set of variables for business performance, such as sales and number of users and entrants, of establishment i in 1 km by 1km mesh grid a of prefecture p in time t, M_{at} is the daytime population based on human mobility flows within single mesh grid a (or including surrounding mesh grids), I_{pt} is the monthly new confirmed cases of COVID-19 (observed since January 2020), E_{it} is the number of employees at the end of month of establishment i, μ_i is the establishment fixed effect, η_a is the location fixed effect, τ_t is the time fixed effect, and u_{iapt} is the error term. This specification is also adopted by Kawaguchi et al. (2022) in a similar form.

The parameters of our interest are α and β in Equation (1). The parameter α captures the extent to which local outings affect business performance. The parameter β captures the direct impact of COVID-19 infections on the business performance. This regression model remains valid before the COVID-19 pandemic

period. When $I_{pt} = 0$, this term disappears because it becomes zero.

The typical identification issue is that the unobserved fixed factors for establishment and location lead to a bias. For example, endogenous location choice is highly related to the mobility flows. Locations with higher human mobility attract more establishments, but highly productive establishments can survive due to high costs in those locations. Therefore, this study employs fixed-effect estimation to control for the fixed factors that affect business performance.

4. Results and Discussion

4.1. Golf Courses Industry

Table 5 presents the estimation results for eight dependent variables (number of member users on weekdays, number of member users on weekends, number of non-member users on weekdays, number of non-member users on weekends, sales of usage fees on weekdays, sales of usage fees on weekends, sales of caddy fees, and sales in restaurants and shops) in the golf course industry before and during the COVID-19 pandemic. The coefficient estimates in Table 5 are visualized in Figure 2.

Regarding the number of member and non-member users on weekdays, sales of usage fees, and sales of caddy fees, the daytime population within a 1 km mesh grid has a significantly positive impact on business performance before the COVID-19 pandemic. However, these coefficients on weekdays are less than half and not significant at the 5% level during the COVID-19 outbreaks. This change was not observed on weekends, indicating that the golf course industry experienced a notable decline in sales, especially on weekdays, in response to a decrease in the outings.

An increase in the newly confirmed cases of COVID-19 reduced all dependent variables, suggesting that reducing the COVID-19 infections matters for business performance in the golf course industry. The elasticity ranges from -0.047 to -0.095. For example, when the number of newly confirmed cases of COVID-19 doubles, sales of usage fees on weekdays decrease by 5.98%.

[Table 5 and Figure 2]

4.2. Golf Driving Range Industry

Table 6 presents the estimation results for three dependent variables (number of users on weekdays, number of users on weekends, and sales of usage fees) in the golf driving range industry before and during the COVID-19 pandemic. The coefficient estimates in Table 6 are visualized in Figure 3.

We find that the daytime population in the surrounding business locations is not significant at the 5% level in regard to number of users and sales of usage fees before and during the COVID-19 pandemic. This

result may be natural because, as only people with a purpose for using the facility visit, there is little statistical relationship between business performance and the population within the surrounding area.

An increase in the newly confirmed cases of COVID-19 reduced the number of users and sales of usage fees in Table 6, suggesting that reducing the COVID-19 infections matters for business performance in the golf driving range industry. The elasticity ranges from -0.030 to -0.036. For example, when the number of newly confirmed cases of COVID-19 doubles, sales of usage fees decrease by 2.47%.

[Table 6 and Figure 3]

4.3. Bowling Alley Industry

Table 7 presents the estimation results for five dependent variables (number of users, number of games, sales of usage fees, sales in restaurants and shops, and sales in auxiliary facilities) in the bowling alley industry before and during the COVID-19 pandemic. The coefficient estimates in Table 7 are visualized in Figure 4.

We find that the daytime population on weekdays is insignificant at the 10% level for all variables of business performance before and during the COVID-19 pandemic. On the other hand, the daytime population on weekends is significant at the 5% level for both the number of users and sales of usage fees, both before and during the COVID-19 pandemic. We confirm the structural change in sales in restaurants and shops before and during the COVID-19 pandemic. During the COVID-19 pandemic, outings on weekends became statistically insignificant for sales in restaurants and shops, suggesting that people refrained from eating and drinking to avoid the risk of infection.

An increase in the newly confirmed cases of COVID-19 reduced the number of users, the number of games, and the number of usage fees in Table 6, suggesting that reducing the COVID-19 infections matters for business performance in the golf driving range industry. The elasticity ranges from -0.035 to -0.043. For example, when the number of newly confirmed cases of COVID-19 doubles, sales of usage fees decrease by 2.95%.

[Table 7 and Figure 4]

4.4. Amusement and Theme Park Industry

Table 8 presents the estimation results for three dependent variables (number of entrants, sales of tickets, and sales in restaurants and shops) in the amusement and theme park industry before and during the COVID-19 pandemic. The coefficient estimates in Table 8 are visualized in Figure 5.

Regarding the number of entrants, sales of tickets, and sales in restaurants and shops, the daytime

population within a 1 km by 1 km mesh grid had a significantly positive impact at the 10% level both on weekdays and on weekends before the COVID-19 pandemic. Particularly, the magnitude of the outings on weekends is larger than that on weekdays.

We observe a structural shift in how outings affect business performance on weekdays. This effect becomes insignificant at the 10% level during the COVID-19 pandemic. This indicates a change in individuals' behavior regarding visits to amusement and theme parks on weekdays. Conversely, the impact on weekends remains significant and positive at the 5% level. This suggests that the amusement and theme park industry experienced notable sales fluctuations on weekends due to changes in outing preferences.

An increase in the newly confirmed cases of COVID-19 reduced the number of entrants, sales of tickets, and sales in restaurants and shops in Table 8, suggesting that reducing COVID-19 infections matters for business performance in the amusement and theme park industry. The elasticity ranges from -0.061 to -0.146. For example, when the number of newly confirmed cases of COVID-19 doubles, sales of tickets decrease by 7.08%.

[Table 8 and Figure 5]

5. Conclusion

Using establishment-level monthly panel data from January 2019 to December 2021, this study empirically assessed the impact of the COVID-19 pandemic on business performance in four service industries: golf courses, golf driving ranges, bowling alleys, and amusement and theme parks. Since face-to-face interaction is essential in service industries, this study clarified how the COVID-19 pandemic affected the leisure industry. This research is innovative in that it statistically evaluates the effect of restricting people's outings near business locations on performance during the outbreak by geocoding location information and linking it to human mobility data collected as big data.

The study provides evidence needed to balance infectious disease measures and economic activity. In the long term, to sustain business performance, the government should adopt policies to reduce infections by enforcing strong NPIs in the short term. This is because newly confirmed cases of the virus directly harm business performance over time. From both short- and long-term viewpoints, balancing infection control with economic activity is crucial.

This study has limitations related to policy implications. During the COVID-19 pandemic, financial compensation was provided to firms and workers for closing down as emergency measures to prevent the spread of the disease. However, there was no progress in discussions about fairness and equity in determining compensation for sales declines. Further research is needed to understand how policymakers decide on the

amount of compensation.

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Table 1. Descriptive Statistics for Golf Course Industry

Variable	Obs.	Mean	S.D.	P25	Median	P75
Establishment-Level						
log(Number of Member Users, Weekday)	6,073	6.0629	0.8925	5.6348	6.1654	6.6503
log(Number of Member Users, Weekend)	6,084	6.4025	0.7582	6.0776	6.4998	6.8721
log(Number of Non-Member Users, Weekday)	6,532	7.2586	0.7011	6.9207	7.3421	7.7066
log(Number of Non-Member Users, Weekend)	6,541	6.7139	0.6704	6.2916	6.7708	7.1747
log(Sales of Usage Fees, Weekday)	6,534	6.9108	0.8335	6.4505	7.0012	7.4765
log(Sales of Usage Fees, Weekend)	6,544	6.9947	0.6240	6.6733	7.0583	7.3920
log(Sales of Caddy Fees)	5,346	5.9763	1.3803	5.1818	6.4192	6.9856
log(Sales in Restaurants and Shops)	5,424	6.1190	1.1587	5.5891	6.4536	6.8926
log(Employment at the End of Month)	6,388	4.2005	0.5984	3.9703	4.2627	4.6052
Mesh-Level						
log(Daytime Population within 3 km, Weekday)	6,766	9.1415	1.6708	7.8995	9.1311	10.4141
log(Daytime Population within 3 km, Weekend)	6,819	9.2641	1.6042	8.0843	9.1168	10.4524
Prefecture-Level						
log(1 + Monthly Newly Confirmed Cases COVID-19)	6,880	4.3249	3.6737	0.0000	5.1120	7.6783

Note: The establishment-level monthly panel dataset covers the period from January 2019 to December 2021.

Table 2. Descriptive Statistics for Golf Driving Range Industry

Variable	Obs.	Mean	S.D.	P25	Median	P75
Establishment-Level						
log(Number of Users, Weekday)	5,907	8.4709	0.6765	8.0000	8.5190	8.9054
log(Number of Member Users, Weekend)	5,898	8.1101	0.6239	7.6967	8.1625	8.4906
log(Sales of Usage Fees)	5,907	6.9987	0.7787	6.5352	6.9763	7.4662
log(Employment at the End of Month)	6,076	8.0998	1.3209	7.4608	8.3028	8.8499
Mesh-Level						
log(Daytime Population within 1 km Mesh, Weekday)	6,079	8.2026	1.2502	7.5710	8.4329	8.9777
log(Daytime Population within 1 km Mesh, Weekend)	6,086	4.6387	3.8329	0.0000	5.2983	8.0637
Prefecture-Level						
log(1 + Monthly Newly Confirmed Cases COVID-19)	5,947	79.8517	49.6338	52.0000	70.0000	90.0000

Note: The establishment-level monthly panel dataset covers the period from January 2019 to December 2021.

Table 3. Descriptive Statistics for Bowling Alley Industry

Variable	Obs.	Mean	S.D.	P25	Median	P75
Establishment-Level						
log(Number of Users)	3,369	8.5182	0.7294	8.1391	8.5556	9.0118
log(Number of Games)	3,369	9.8038	0.7846	9.3654	9.8108	10.3724
log(Sales of Usage Fees)	3,369	6.6206	0.8034	6.1137	6.6386	7.2086
log(Sales in Restaurants and Shops)	2,923	3.7758	1.1608	3.0445	3.6636	4.6052
log(Sales in Auxiliary Facilities)	2,739	4.4104	1.5402	3.4012	4.8903	5.5215
log(Employment at the End of Month)	3,403	2.3419	0.8561	1.6094	2.4849	3.0445
Mesh-Level						
log(Daytime Population within 1 km Mesh, Weekday)	3,732	9.2812	1.0842	8.7089	9.0290	9.9138
log(Daytime Population within 1 km Mesh, Weekend)	3,732	9.2387	0.9616	8.6352	9.1269	9.8228
Prefecture-Level						
log(1 + Monthly Newly Confirmed Cases COVID-19)	3,732	5.1081	3.7329	0.0000	6.1841	8.2509

Note: The establishment-level monthly panel dataset covers the period from January 2019 to December 2021.

Table 4. Descriptive Statistics for Amusement and Theme Park Industry

Variable	Obs.	Mean	S.D.	P25	Median	P75
Establishment-Level						
log(Number of Entrants)	831	10.9255	1.3511	10.1266	10.8416	11.6611
log(Sales of Tickets)	878	9.5004	1.6586	8.5882	9.3883	10.2841
log(Sales in Restaurants and Shops)	849	8.6458	1.9679	7.4628	8.4589	9.5519
log(Employment at the End of Month)	920	5.7452	1.5513	5.0720	5.5947	6.2461
Mesh-Level						
log(Daytime Population within 1 km Mesh, Weekday)	924	8.1070	1.8527	6.5425	8.0590	9.2748
log(Daytime Population within 1 km Mesh, Weekend)	924	8.5161	1.4639	7.3746	8.5482	9.5537
Prefecture-Level						
log(1 + Monthly Newly Confirmed Cases COVID-19)	924	3.9648	3.6774	0.0000	4.0859	7.0638

Note: The establishment-level monthly panel dataset covers the period from January 2019 to December 2021.

Table 5. Estimation Results for Golf Course Industry

	Dependent Variable:							
	log(Number of Member Users, Weekday)		log(Number of Member Users, Weekend)		log(Number of Non-Member Users, Weekday)		log(Number of Non-Member Users, Weekend)	
	≤2019m12	≥2020m1	≤2019m12	≥2020m1	≤2019m12	≥2020m1	≤2019m12	≥2020m1
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(Daytime Pop. within 3 km, Weekday)	0.8473***	0.2134			1.1930***	0.2452*		
	(0.1476)	(0.1318)			(0.1561)	(0.1467)		
log(Daytime Pop. within 3 km, Weekend)			0.4732***	0.2202**			0.6940***	0.2493*
			(0.0938)	(0.1036)			(0.1106)	(0.1276)
log(1 + Newly Confirmed Cases of COVID-19)		−0.0519***		−0.0472***		−0.0704***		−0.0615***
		(0.0099)		(0.0070)		(0.0109)		(0.0090)
log(Employment)	1.0419**	0.9157***	1.2734***	0.7330***	1.2795***	1.1055***	1.3018***	0.7742***
	(0.4404)	(0.1620)	(0.3261)	(0.1198)	(0.4269)	(0.1564)	(0.2807)	(0.1266)
Time, Area, and Establishment Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1895	3929	1913	3967	2007	4121	2023	4160
Number of Establishments	177	186	177	186	188	197	188	197
Adjusted R^2	0.2701	0.2588	0.4048	0.3828	0.3959	0.3868	0.438	0.4211

Notes: Heteroskedasticity-consistent standard errors clustered at the establishment level are in parenthesis.

Table 5. Estimation Results for Golf Course Industry (*Continued*)

	Dependent Variable:							
	log(Sales of Usage Fees, Weekday)		log(Sales of Usage Fees, Weekend)		log(Sales of Caddy Fees)		log(Sales in Restaurants and Shops)	
	≤2019m12	≥2020m1	≤2019m12	≥2020m1	≤2019m12	≥2020m1	≤2019m12	≥2020m1
Explanatory Variables	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
log(Daytime Pop. within 3 km, Weekday)	1.4032***	0.2650			0.5575***	−0.2388	0.5674***	0.2083*
	(0.1628)	(0.1665)			(0.1384)	(0.1489)	(0.1858)	(0.1061)
log(Daytime Pop. within 3 km, Weekend)			0.7947***	0.2917*	0.6529***	0.5320***	0.6629***	0.5159***
			(0.1119)	(0.1512)	(0.1538)	(0.1235)	(0.1754)	(0.1086)
log(1 + Newly Confirmed Cases of COVID-19)		−0.0890***		−0.0761***		−0.0946***		−0.0482***
		(0.0123)		(0.0087)		(0.0111)		(0.0121)
log(Employment)	1.3564***	1.0751***	1.4170***	0.7973***	1.0785**	1.3085***	1.1772**	1.2973***
	(0.4651)	(0.1550)	(0.3313)	(0.1258)	(0.5251)	(0.2261)	(0.5023)	(0.2069)
Time, Area, and Establishment Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	2007	4123	2023	4163	1755	3485	1662	3384
Number of Establishments	188	197	188	197	166	169	156	164
Adjusted R^2	0.2701	0.2588	0.4048	0.3828	0.3959	0.3868	0.438	0.4211

Notes: Heteroskedasticity-consistent standard errors clustered at the establishment level are in parenthesis.

Table 6. Estimation Results for Golf Driving Range Industry

	Dependent Variable:					
	log(Number of Users, Weekday)		log(Number of Users, Weekend)		log(Sales of Usage Fees)	
	≤2019m12	≥2020m1	≤2019m12	≥2020m1	≤2019m12	≥2020m1
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
log(Daytime Pop. within 1 km Mesh, Weekday)	0.0651*	−0.0227			0.0215	−0.0040
	(0.0375)	(0.0209)			(0.0434)	(0.0253)
log(Daytime Pop. within 1 km Mesh, Weekend)			0.0376	−0.0226	0.0475	0.0153
			(0.0467)	(0.0214)	(0.0558)	(0.0343)
log(1 + Newly Confirmed Cases of COVID-19)		−0.0295***		−0.0359***		−0.0361***
		(0.0093)		(0.0082)		(0.0085)
log(Employment)	0.2833**	0.1178**	0.0812	−0.0109	0.0554	0.1446***
	(0.1230)	(0.0581)	(0.0752)	(0.0682)	(0.1050)	(0.0547)
Time, Area, and Establishment Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1807	3864	1809	3856	1807	3857
Number of Establishments	152	171	152	171	152	171
Adjusted R^2	0.2475	0.3647	0.4162	0.409	0.2683	0.2568

Notes: Heteroskedasticity-consistent standard errors clustered at the establishment level are in parenthesis.

Table 7. Estimation Results for Bowling Alley Industry

	Dependent Variable:									
	log(Number of Users)		log(Number of Games)		log(Sales of Usage Fees)		log(Sales in Restaurants and Shops)		log(Sales in Auxiliary Facilities)	
	≤2019m12	≥2020m1	≤2019m12	≥2020m1	≤2019m12	≥2020m1	≤2019m12	≥2020m1	≤2019m12	≥2020m1
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(Daytime Pop. within 1 km Mesh, Weekday)	0.0632	−0.0377	0.0946	−0.0731	0.1016	−0.0395	0.0187	0.2367	0.0018	−0.3686
	(0.0845)	(0.0835)	(0.0851)	(0.0816)	(0.0869)	(0.0794)	(0.1668)	(0.1957)	(0.1619)	(0.2416)
log(Daytime Pop. within 1 km Mesh, Weekend)	0.1396*	0.3079**	0.0983	0.2963***	0.1897**	0.3198***	0.5220***	−0.1933	0.1076	0.3758**
	(0.0723)	(0.1200)	(0.0740)	(0.1067)	(0.0790)	(0.1176)	(0.1950)	(0.1996)	(0.2363)	(0.1742)
log(1 + Newly Confirmed Cases of COVID-19)		−0.0350***		−0.0355***		−0.0432***		−0.0043		−0.0297
		(0.0104)		(0.0104)		(0.0113)		(0.0222)		(0.0270)
log(Employment)	−0.0179	0.1516**	0.0233	0.0748	0.0190	0.1260*	0.4220	0.3473**	0.6467	0.2943
	(0.0770)	(0.0684)	(0.0867)	(0.0687)	(0.1077)	(0.0672)	(0.2745)	(0.1675)	(0.4407)	(0.2840)
Time, Area, and Establishment Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	878	2490	878	2490	878	2490	806	2117	763	1975
Number of Establishments	75	119	75	119	75	119	69	102	66	96
Adjusted R^2	0.523	0.8401	0.4985	0.83	0.4944	0.8412	0.1008	0.406	0.2728	0.5153

Notes: Heteroskedasticity-consistent standard errors clustered at the establishment level are in parenthesis.

Table 8. Estimation Results for Amusement and Theme Park Industry

	Dependent Variable:					
	log(Number of Entrants)		log(Sales of Tickets)		log(Sales in Restaurants and Shops)	
	≤2019m12	≥2020m1	≤2019m12	≥2020m1	≤2019m12	≥2020m1
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
log(Daytime Pop. within 1 km Mesh, Weekday)	0.2439*	0.1233	0.2070***	0.1258	0.2984*	−0.0061
	(0.1332)	(0.1549)	(0.0646)	(0.1275)	(0.1652)	(0.1487)
log(Daytime Pop. within 1 km Mesh, Weekend)	0.4759***	0.5287***	0.6061***	0.4894**	0.5254*	0.5608***
	(0.1321)	(0.1056)	(0.1045)	(0.1975)	(0.2579)	(0.1548)
log(1 + Newly Confirmed Cases of COVID-19)		−0.0612*		−0.1060*		−0.1426**
		(0.0344)		(0.0546)		(0.0513)
log(Employment)	0.3958***	0.4761***	0.3312*	1.1699***	0.3792**	0.3302**
	(0.1287)	(0.1593)	(0.1777)	(0.2804)	(0.1810)	(0.1588)
Time, Area, and Establishment Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	299	532	311	567	299	550
Number of Establishments	25	26	26	26	25	25
Adjusted R^2	0.6597	0.6467	0.6613	0.6215	0.6171	0.5756

Notes: Heteroskedasticity-consistent standard errors clustered at the establishment level are in parenthesis.

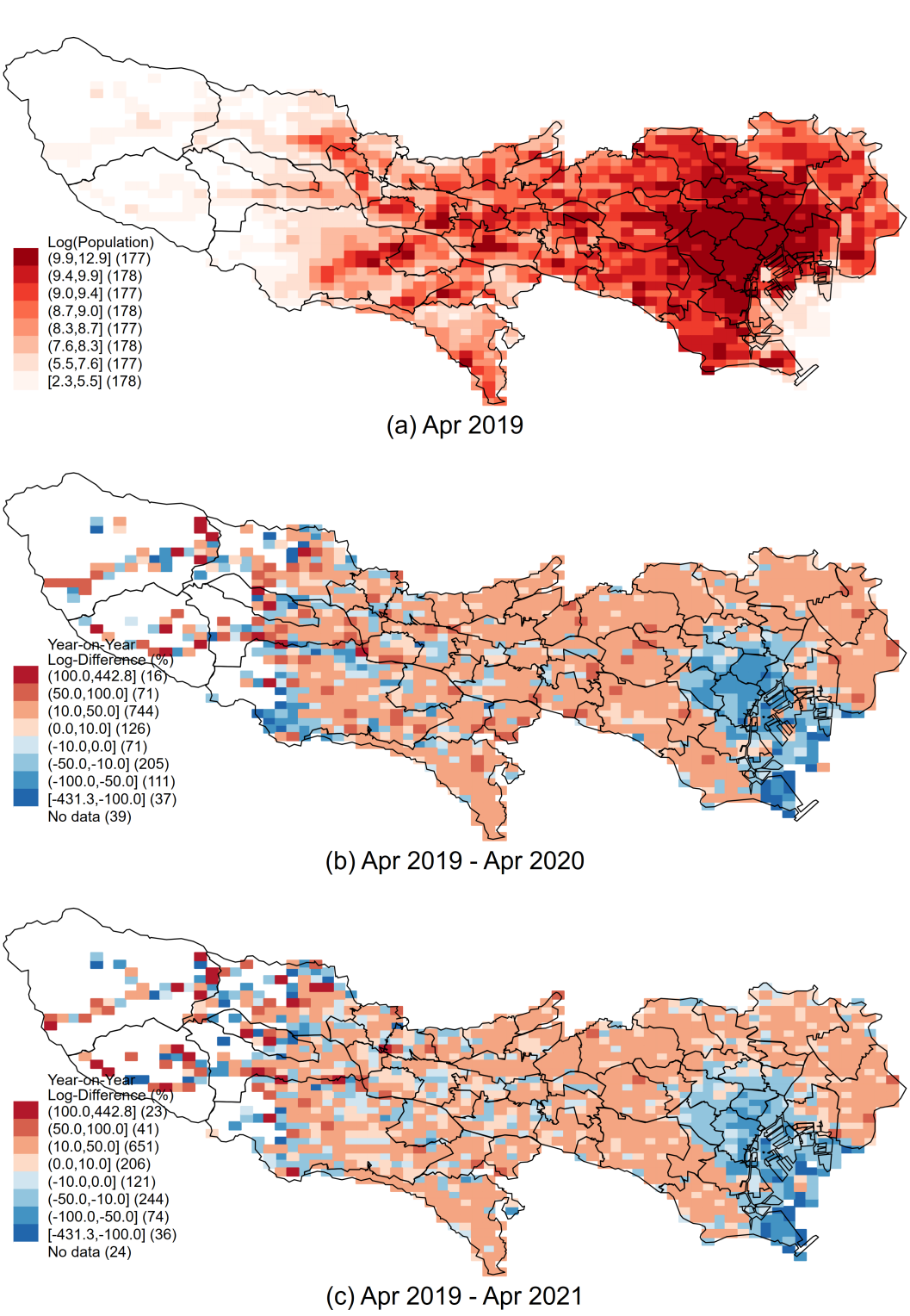
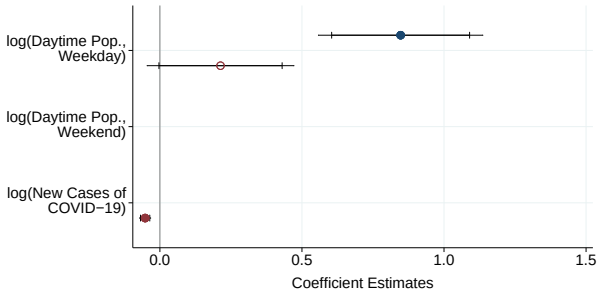
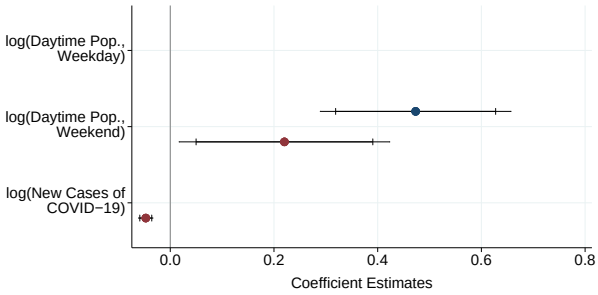


Figure 1. Outings Change Rates in 1km by 1km Mesh Grid during the COVID-19 outbreaks in Tokyo

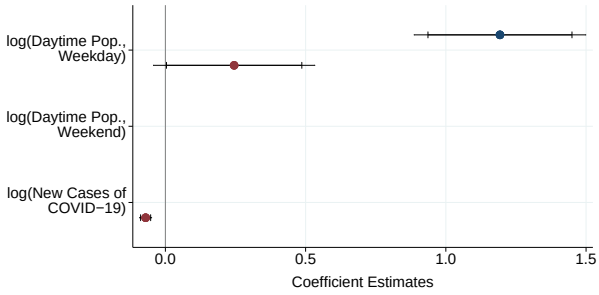
Note: Authors' creation based on the National Human Flow Open Data (MLIT).



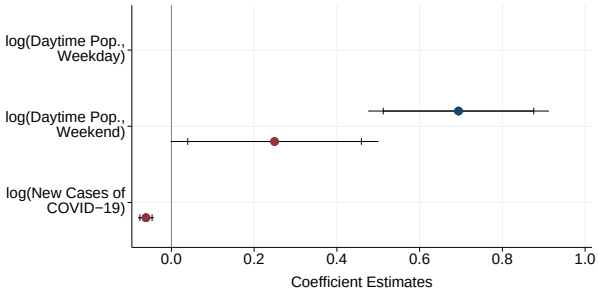
(a) log(Number of Member Users, Weekday)



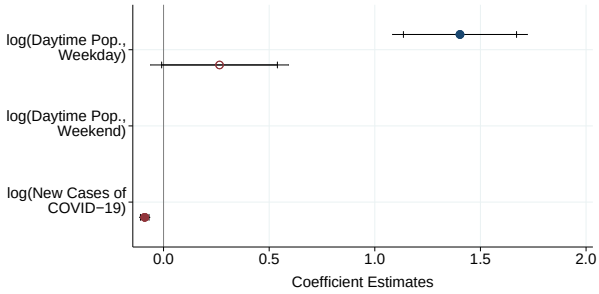
(b) log(Number of Member Users, Weekend)



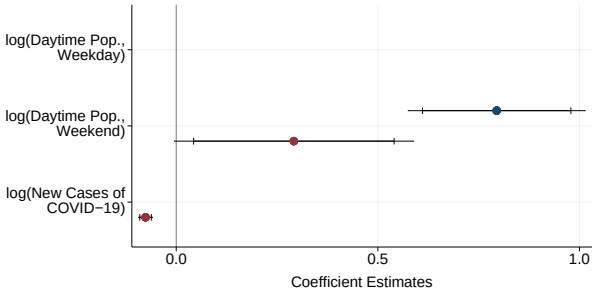
(c) log(Number of Non-Member Users, Weekday)



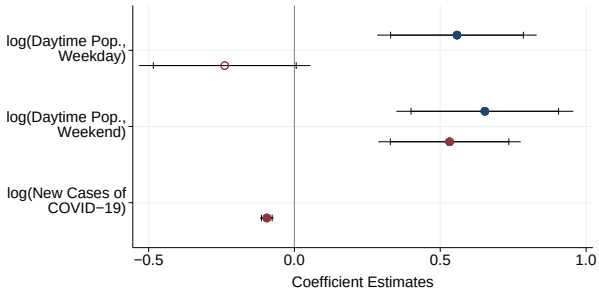
(d) log(Number of Non-Member Users, Weekend)



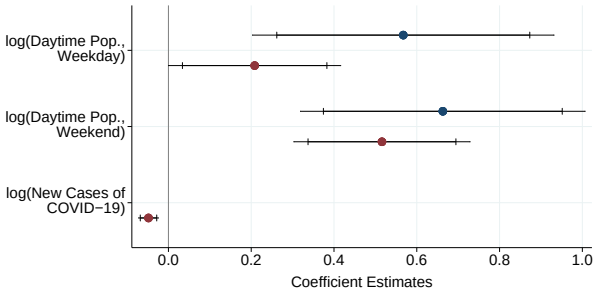
(e) log(Sales of Usage Fees, Weekday)



(f) log(Sales of Usage Fees, Weekend)



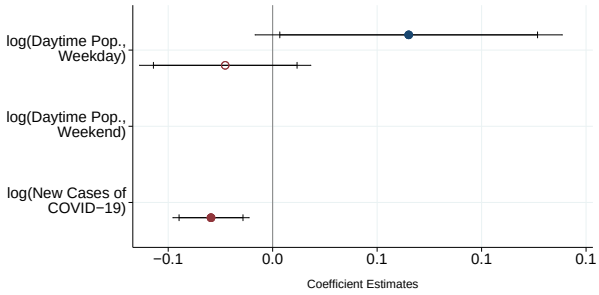
(g) log(Sales of Caddy Fees)



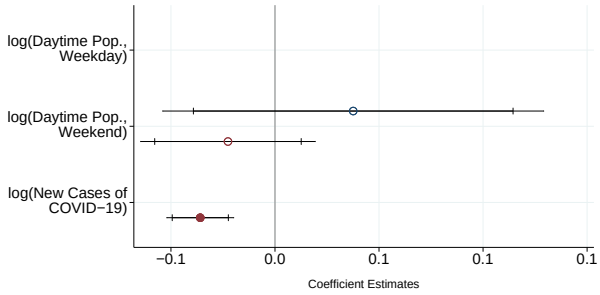
(h) log(Sales in Restaurants and Shops)

Figure 2. Coefficient Plots for Golf Course Industry

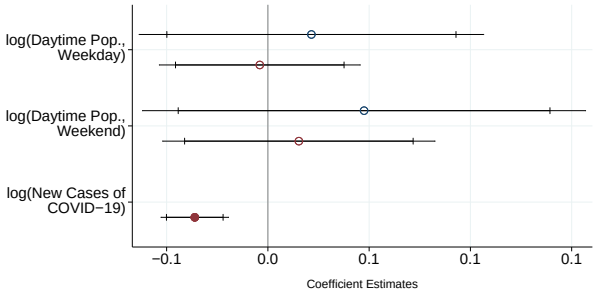
Note: Authors' creation based on Table 5. Circle markers represent point estimates. Bars and bars with caps represent 95 % and 90 % confidence intervals, respectively. The blue and red colors correspond to before and after the COVID-19 outbreaks, respectively.



(a) log(Number of Users, Weekday)



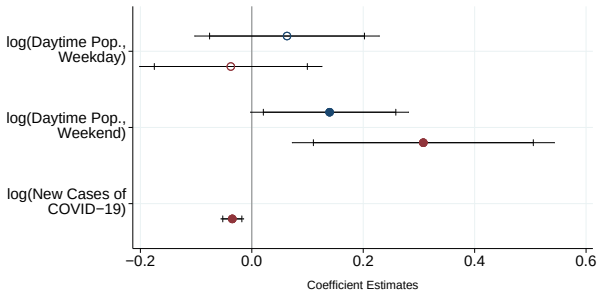
(b) log(Number of Users, Weekend)



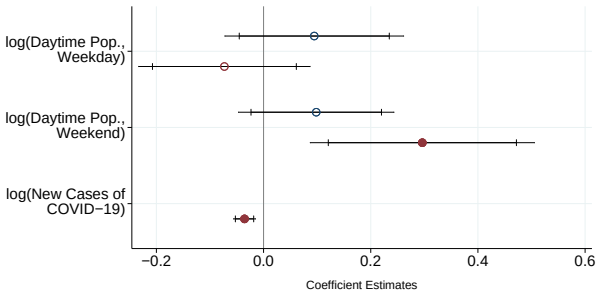
(c) log(Sales of Usage Fees)

Figure 3. Coefficient Plots for Golf Driving Range Industry

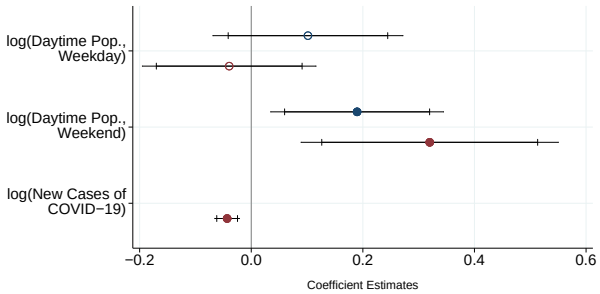
Note: Authors' creation based on Table 6. Circle markers represent point estimates. Bars and bars with caps represent 95 % and 90 % confidence intervals, respectively. The blue and red colors correspond to before and after the COVID-19 outbreaks, respectively.



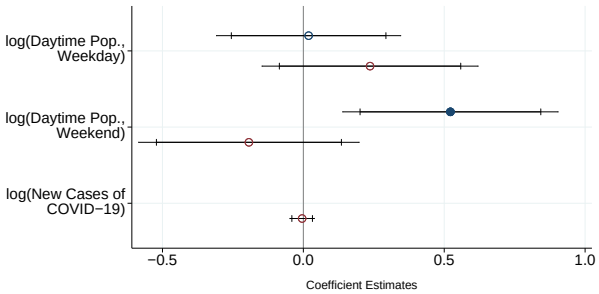
(a) log(Number of Users)



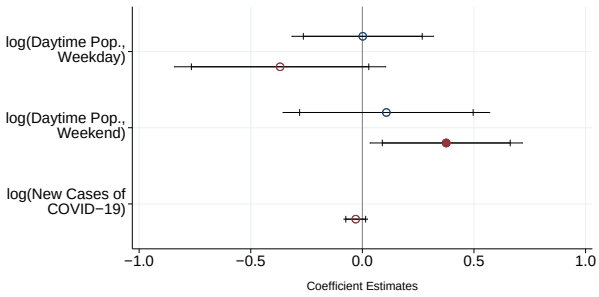
(b) log(Number of Games)



(c) log(Sales of Usage Fees)



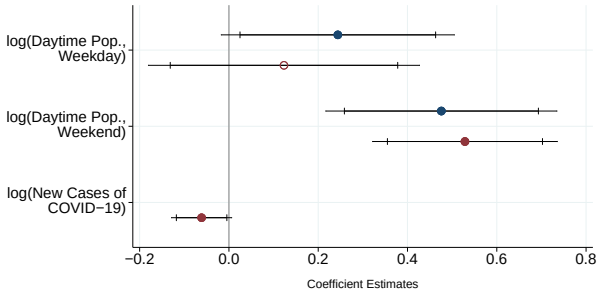
(d) log(Sales in Restaurants and Shops)



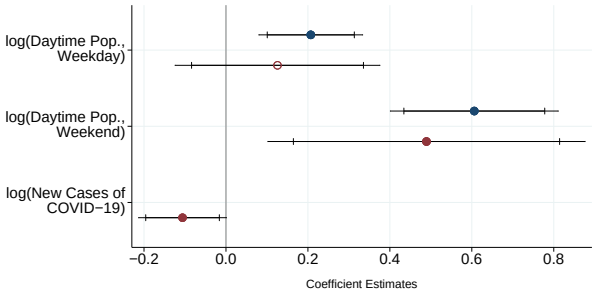
(e) log(Sales in Auxiliary Facilities)

Figure 4. Coefficient Plots for Bowling Alley Industry

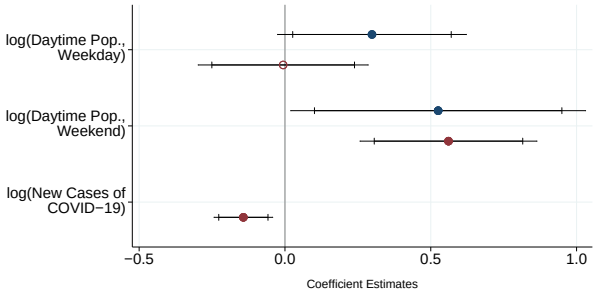
Note: Authors' creation based on Table 7. Circle markers represent point estimates. Bars and bars with caps represent 95 % and 90 % confidence intervals, respectively. The blue and red colors correspond to before and after the COVID-19 outbreaks, respectively.



(a) log(Number of Entrants)



(b) log(Sales of Tickets)



(c) log(Sales in Restaurants and Shops)

Figure 5. Coefficient Plots for Amusement and Theme Park Industry

Note: Authors' creation based on Table 8. Circle markers represent point estimates. Bars and bars with caps represent 95 % and 90 % confidence intervals, respectively. The blue and red colors correspond to before and after the COVID-19 outbreaks, respectively.