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Analysis of the Effect of Restaurant and Pedestrian Location Characteristics on the Survival of the Restaurant Industry*
: Focusing on Haeundae-gu

Son, Whee-Jin** · Kim, Hyun-Soo*** · Choi, Yeol****

Abstract

This study aims to examine the survival of restaurants, which represent a significant portion of small businesses in South Korea. The study was conducted in Haeundae-gu, Busan, South Korea, and utilized data from 5,457 restaurants that were operational between 2009 and 2019. To estimate the survival rate of the restaurants, the Cox proportional hazard model was employed, using a set of explanatory variables consisting of both operational and locational characteristics of the restaurants. Additionally, the study considered different types of restaurants and focused on the impact of walkable access to various destinations. The findings revealed that operational and locational attributes significantly influenced the survival of restaurants, with walkable access to destinations such as waterfront spaces and commercial clusters being a crucial factor. Notably, the survival of restaurants also varied significantly by type. The findings provide a valuable set of policy implications and environmental strategies that can be implemented to revitalize the local market for the restaurant industry.

Keywords   Walkability, Location Characteristic, Waterfront, Restaurant, Survival Analysis
주제어   보행성, 입지특성, 수변공간, 음식점, 생존분석

Ⅰ. Introduction

1. Background and Purpose of the Study

The Asian foreign exchange (financial) crisis of 1997 and the Global Financial Crisis (GFC) of 2007-08 generated much unemployment in South Korean society and led to indiscriminate business establishment by self-employed people. According to the Korea Economic Research Institute (2021), the ratio of self-employed people in the nation amounts to 24.6%, ranking it sixth among the 35 member states of the Organisation for Economic Co-operation and Development (OECD) and first in comparison with the Group of Seven (G7), or seven major nations of high economic level. The restaurant industry makes up 22.3% of the total number of independent businesses in the country. Business duration is below 1 year for 81.0% of the businesses, and, out of motives for business establishment, subsistence accounts for 82.6%. Judging from such facts, it is clear that most restaurateurs are small-income self-employed people (Kim, S.Y., 2014). However, the restaurant industry exhibits the lowest level of survival rates throughout all industries, with the survival

rates amounting to 28.5% and 17.7% within 3 years and 5 years of business establishment, respectively (Nam, Y.M., 2017). These figures imply that while the restaurant industry allows easy market entry because of its relatively low entry barrier, it is in contrast considerably low in sustainability. By accepting/embracing the spheres of production, consumption, and leisure in cities and local communities in a complex manner, restaurants serve as important elements promoting the construction of the foundation and the activation of the local economy (Park, J.A., 2011). Consequently, if and when the sustainability of the restaurant industry is weakened, an increase in social costs, such as a decline of commercial districts and instability in employment, can cause long-term recessions in the local economy (Korea Small Business Institute, 2015), thus demonstrating that the sustainability of the restaurant industry is a topic indispensable to South Korean society. The sustainability of the restaurant industry can be affected by numerous socioeconomic factors because of the unique characteristics of the industry: the diversity and trendiness of business types (Korea Agro-Fisheries & Food Trade Corporation, 2022). Out of them, especially closely related are location characteristics, which encompass the competitiveness of spaces (Tae, J.H., 2014).

An important factor that can determine the success or failure of businesses by up to 70-80% (Oh, H.C. and Song, Y.K, 2003) is advantageous locations, which positively affect the long-term survival of commercial facilities and serve as a major means of activating local commercial districts regardless of commercial facilities' physical scales or degree of agedness (Borchert, 1998; Fotopoulos and Louri, 2000; Kim, D.J. et al., 2018). Consequently, this study will seek to determine restaurant characteristic factors and pedestrian location characteristic factors that affect the survival of the restaurant industry in Haeundae-gu in Busan Metropolitan City. It will grasp significant influencing factors through empirical analysis making use of both data on the establishment and/or closure of restaurants in the area over 11 years and survival analysis and, through them, provide basic data to increase and prepare plans for the sustainability of the restaurant industry, which will be able to consolidate the substance of the local economy.

2. Scope and Structure of the Study

The spatial scope of this study, Haeundae-gu, is a special tourist area representative of Busan Metropolitan City and has the environmental characteristic that, with the seashore as the basis, diverse forms of waterfronts adjoin one another. This means that, going beyond simple physical spaces, commercial hubs, cultural and tourist hubs, and leisure activity hub including marine leisure and sports are distributed with a focus on waterfronts, and, on the basis of pedestrian networks and road environments connecting such hub, restaurants of diverse business types and scales aggregate (Busan Metropolitan Government, 2015). Because Haeundae-gu is the constituency in Busan Metropolitan City with the largest numbers of both floating population[1] and restaurants, the frequency of the establishment and/or closure of these businesses can be expected to be high as well. For such reasons, it was selected as the study area in this research, as shown in <Figure 1>.

The temporal scope and the objects of this study were established as 5,457 restaurants that opened and/or closed during the period from January 1, 2009 to December 31, 2019. The standard for selecting this range was to minimize the effects of 2007-08, which saw the occurrence of the GFC, and 2020-21, which saw the full-fledged implementation of social distancing due to the impact of coronavirus disease 2019 (COVID-19). Because a large number of small-income
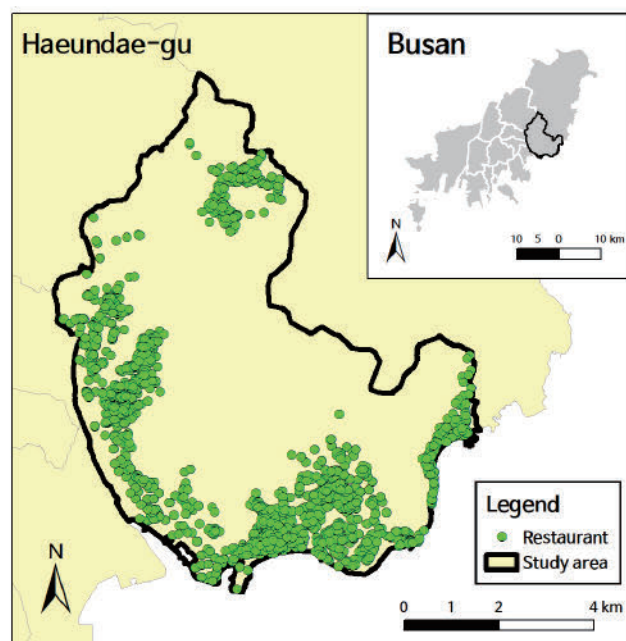

Figure 1. Study area

self-employed people work in the restaurant industry, this industry takes up an important share of the substructure of the South Korea's economic system (Noh, H.B. and Chung, 2016). As the economic impact of both the GFC and the pandemic was presumed to be considerable, these two periods were excluded.

As for the structure of this study: Chapter II reviews theory and earlier research related to this study; Chapter III explains the research data and analysis methods; Chapter IV details the results of technical and empirical analyses; and the conclusion in Chapter V presents a summary of the results of analyses, limitations, and implications.

II. Theoretical Examination and Review of Earlier Research

1. Theory on Pedestrian Locations

At present, no research has clearly determined the concept of pedestrian locations and related theory. Consequently, this study seeks to establish a theoretical concept of pedestrian locations on the basis of factors activating commerce harbored by walkability and locations. First, walkability refers to the ability to walk safely to a convenience facility within a distance considered reasonable and is one measure of determining how easily accessible on foot a particular area or facility is (Dovey and Pafka, 2020). Walkability encompasses many positive elements for not only the enhancement of urban residents' quality of life (QoL) but also urban spatial planning (Choi, D.J. and Suh, Y.C., 2014). A representative element is community cohesion. Cohesion contributes to the enhancement of considerable social capital and can provide diverse social benefits including the development of the local economy and an increase in property value (Litman, 2018). In addition, high walkability increases market demands in terms of commercial services and plays important roles in activating cities and local communities (Bohl, 2002).

Next, locations signify places that humans select to engage in economic activities. Deciding on the location of a particular economic activity is an important matter requiring the consideration of divers factors including natural, economic, cultural, transportational, and psychological ones. Commercial facilities' spatial location factors represent the qual-

ity of commercial districts adjoined by these facilities, and each characteristic of a location can have a variety of commercial effects (D. I. Consultant, 2019). Spatial location factors harbor representative characteristics such as aggregativity, clustering, and accessibility, which can have considerable effects on commercial facilities' survival and sustainability.

Such characteristics of walkability and location were combined, and the scope within a radius of 500 m from a particular location space was established as a pedestrian location. The standard for selecting this scope was the fact that the explanatory power was the highest for the relationship between a particular space and walking activities within a radius of 500 m and that many pedestrian areas such as station areas were based on a standard of 500 m in earlier research (Kim, D.O. et al., 2002; Sung, H.C. and Shin, J.Y., 2005; Sung, H.G., 2014).

2. Theory on Location Types

Out of diverse urban spaces aiding the activation of commercial facilities, representative location factors used in this study were waterfronts, city parks, large-scale stores, traditional markets, and subway station areas. Through their proximity to water, waterfronts are deeply linked to the lives of urban residents. Waterfronts' openness and publicness increase the aggregating effect where economic subjects and activities gather in a place. These spaces' links to diversion and rest raise street vitality with a market effect through tourism resources such as leisure and recreation and increase commercial facilities' economic effects (Korea Water Resources Corporation, 2018). City parks contribute to urban residents' community formation and promotion of amenity and function as public spaces satisfying leisure activities, consumption, and demands. They harbor commercial functions that can positively affect the activation of the local economy by strengthening not only environmental functions but also the locationality of the relevant areas (Kim, W.J. and Son Y.H., 2015). By providing ample goods and services, large-scale stores and traditional markets contribute to the enhancement of urban residents' QoL (SEMAS, 2018). Distribution and commercial facilities thus guarantee the success of commerce through place marketing where rest and culture are enjoyed (Suh, K.W. and Min, H.C., 2009; Kim, H.R. and Lee, J.J., 2011). Finally, concentrated in subway

station areas are certain spheres of influence (SOIs) in terms of the use of such facilities for the purpose of commuting to work or school. They are represented by floating population who has an economic impact on station area locations, and floating population naturally leads to factors for the activation of commercial facilities within station areas (Lee, J.E. and Mun, D.S., 2015).

3. Earlier Research on Survival Analysis of Commercial Facilities

Research on influence of walkability on commercial facility survival is as follows. Nam, I.H. and Kim, J.I. (2000) have stated that an environment easily accessible to pedestrians is an important element of the development of commercial areas and facilities in cities and that such an environment leads to an increase in both floating population and economic demands. According to a study by Lee, J.A. et al. (2014), the wider sidewalks were and the more accessible by transportation commercial streets were, the more floating population walked. The more outstanding the pedestrian access system is in an area, the more developed are the conditions behind, which can be seen as a basic prerequisite for the activation of streets (Yang, W.H. and Jung, E.W., 2002). In addition, the cohesion of walkability has diverse social benefits such as raising street vitality and increasing commercial facilities' sales (Yun, N.Y. and Choi, C.G., 2013; Litman, 2022). These benefits are deeply related to high floating population, and such correlation is especially high in the restaurant industry (Im, H.N. et al., 2017). In addition, the variable of the improvement of the pedestrian environment through the removal of elements hindering walking and the enhancement of amenity has significant effects on not only the commercial environment but also an increase in both floating population and sales (Choi, H.S. and Kim, H.Y., 2009; Kim, D.J. et al., 2017).

Ensuing research on influence of business characteristics and location characteristics on commercial facilitiy survival is as follows. Business characteristics constitute a factor that can variously affect commercial facilities' survival. Variables mainly used in related earlier research are businesses' types and physical scales, membership in corporations or franchises, capital and assets, workforce, and presence or absence of parking lots. In research on the business characteristics of

overseas corporations, the greater the initial capital was, the more numerous the workforce was, and the larger the scales were, the higher were corporations' survival rates (Mata and Portugal, 1994; Agarwal and Audretsch, 2001; Lopez-Garcia and Puente, 2006; Nunes and de Morais Sarmento, 2012).

Likewise, in research on domestic corporations, the greater the physical scale of a corporation was and the greater the scales of capital and workers were, the higher was the survival rate (Lee, B.K. and Shin, G.C., 2005; Kang, M. and Lee, J.W., 2009; Ryu, J.Y. et al., 2014). Other survival analysis studies taking into consideration the characteristics of businesses in the restaurant industry are as follows. Kim, D.J. et al. (2019) have stated that business closure hazard ratios were higher for franchise restaurants than for non-franchise restaurants. In contrast, studies by Jung, D.G. and Yoon, H.Y. (2017) and Lee, J.R. and Do, N.Y. (2019) both exhibited contrary results where the survival rate was higher for franchise restaurants. Shin, W.J. and Moon, S.Y. (2011) have stated that the larger the area of the store was, the greater was the sales of coffeehouses, and sales can be seen as a factor positively affecting the survival of stores. Though the variable regarding the presence or absence of a parking lot has been used in all earlier studies mentioned above, all results were statistically insignificant and different from one another.

A determining factor important for the survival of commercial facilities, location, both spatial and geographical, wields influence that can sway the local economy (Christie and Sjoquist, 2012). Most domestic and overseas studies on location factors have focused on corporations, and the variables used in them have included proximity to cities, aggregation of identical business types, and accessibility to roads and subway stations. In earlier studies on overseas corporations, the greater was the scale of the corporate location area and the more aggregate was the distribution, the higher was the survival rate of a corporation, and survival rates were higher for corporations in urban areas than for those in non-urban areas (Fotopoulos and Louri, 2000; Flack, 2007).

Out of research on domestic corporations, a study by Choi, Y. and Park, S.H. (2014) stated that the shorter the distances to major city centers and roads were and the lower the altitudes of the geographical locations were, the higher

were the survival rates of manufacturing companies in Busan. Likewise, according to Ryu, J.Y. et al. (2014), survival rates are higher for small- and medium-sized enterprises (SMEs) in urban areas than for those in non-urban areas. In addition, the shorter the distances to a bus stop and a subway station are, the greater are the sales of retail stores (Choi, Y.N. and Jung, E.C., 2012; Jung, E.A. et al., 2015; Sung, E.Y. and Choi, C.G., 2017).

Though not numerous, studies on the domestic restaurant industry are as follows. Kim, D.J. et al. (2019) have stated that the greater is the scale of a road adjacent to restaurants, the more positive influence it has on these businesses' survival. Jung, D.G. and Yoon, H.Y. (2017) have claimed that the shorter the distances to a main arterial road and a subway station are, the higher is the survival rate of a restaurant. Likewise, according to a study by Lee, J.R. and Do, N.Y. (2019), the shorter the distance to a subway station is, the higher is the survival rate of a restaurant.

4. Uniqueness of the Study

A tourist attraction and a commercial district representative of Busan, Haeundae-gu is the home of customer-attracting facilities and cultural and tourist facilities on diverse scales, with commercial districts formed along the coastline as the main axis (Busan Metropolitan Government, 2015). Though Haeundae-gu thus harbors a regional characteristic where various services including residence, work, commerce, and culture and tourism are linked in a complex manner, absent has been empirical research on the area's commercial districts and facilities. In addition, according to a recent study, while research on the effects of walkability in diverse areas including parks, shopping centers, and subway stations on local commercial districts and facilities has been conducted (AURI, 2021), an understanding of waterfronts is greatly lacking. Based on this, the uniqueness of the spatial scope of Haeundae-gu can be demonstrated.

Moreover, most earlier studies examined above focused on corporations in an unbalanced manner and limited location characteristics to proximity to city centers and transportational accessibility. In contrast, survival analysis research on the restaurant industry that takes into account consideration diverse aspects of location characteristics is still insufficient, and the walkability of locations encompass-

ing restaurants likewise has not been examined. Consequently, this study will focus on effects of both restaurant characteristics and the hitherto overlooked pedestrian location factor on restaurant survival.

III. Research Data and Analysis Methods

1. Construction of Research Data and Variables

In this study, information on restaurants was obtained from local data provided by South Korea's Ministry of the Interior and Safety (MOIS), and data on a total of 5,457 restaurants were used.[2] As for the classification of restaurants into subdivided business types, restaurants were classified into Korean restaurants, foreign restaurants, businesses providing other light food, businesses providing alcoholic drinks, and businesses providing beverages, all in reference to the classes in the Korean Standard Industrial Classification provided by Statistics Korea (KOSTAT).[3]

The dependent variables of this study were established as each restaurant's survival period (operation period) and survival (or closure). On the basis of earlier research reviewed, appropriate independent variables were selected and classified into business characteristics ? and locational characteristic, which are as in <Table 1>.

Business characteristics consisted of the store area, franchise membership, and presence or absence of a parking lot. As for store areas, local data were used; as for franchise membership, the Korea Fair Trade Commission's (KFTC) franchise business information provision system was used; and, as for the presence or absence of parking lots, the building register provided by the Ministry of Land, Infrastructure and Transport (MOLIT) architectural administration system was used.

Location characteristic variables taking pedestrian locations into consideration were classified into the waterfronts, city parks, large-scale stores and traditional markets, and subway station areas, as mentioned in the previous chapter. The location of a restaurant was established within a radius of 500 m,[4] and pedestrian location areas were as in <Figure 2>. In addition, floating population per administrative neighborhood to which restaurants belonged[5] was used to take into consideration the walkability of individual restaurants. In addition, as for variables taking into consideration accessi-

Table 1. Variables

Division	Variable		Explanation	Unit	Source
Dependent variable	Survival duration		Period from the opening date to closing date	Days	Local Data (MOIS)
	Survival status		1: Event (closed restaurant) 0: Existence	-	
Restaurant characteristics	Store size		The size of a restaurant	m²	Local Data (MOIS)
	Brand type		1: Franchise membership 0: Otherwise	-	KFTC
	Parking lot		1: Parking available 0: Otherwise	-	MOLIT
Locational characteristics	Walkable area	Waterfront area	1: Located within 500 m of the coastline 0: Otherwise	-	Public Data Portal (BDI)
		City-park area	1: Located within 500 m of the city-park 0: Otherwise	-	Public Data Portal (BMC)
		Large-scale store area	1: Located within 500 m of the large-scale store 0: Otherwise	-	Public Data Portal (BMC)
		Traditional market area	1: Located within 500 m of the traditional market 0: Otherwise	-	Public Data Portal (BMC)
		Subway station area	1: Located within 500 m of the subway station 0: Otherwise	-	Public Data Portal (BMC)
	Pedestrian population		Pedestrian population in administrative dong (ln transformed)	People	SEMAS
	Main-road		The shortest distance to main-road	m	NSDI Portal (MOLIT)
	Middle-road		The shortest distance to middle-road	m	NSDI Portal (MOLIT)
	Small-road		The shortest distance to small-road	m	NSDI Portal (MOLIT)
	Land use type		1: Residential district 0: Otherwise	-	MOLIT

bility to transportation, roads were classified into main, middle, and small ones based on the standards of road scales and functions, and their distances from restaurants were used. As for such variables' distance values, after latitude and longitude coordinates were extracted through geocoding, ArcGIS buffer tool and near tool were used to take measurements. As for the final variable, in order to see the effects of land use characteristics on the restaurant industry, it was established on the basis of whether a restaurant was located in a residential area or a non-residential area.

2. Analysis Methods

In this study, in order to analyze factors affecting restaurant survival, survival analysis was applied. Survival analysis is a research method where the object of observation is tracked for a certain amount of time, the survival time taken to reach the occurrence of a particular event is analyzed, and factors affecting the occurrence of this event are sought for (Machin et al., 2006). In particular, there is the advantage of being able to include in analysis censored observations, where the occurrence of an event cannot be confirmed (Mills, 2010).

Generally, there are limitations to analyzing survival data with the general regression model because of the characteristic that, with these data, it is difficult to show a normal distribution regarding the survival period. In such cases, the analysis results can be derived through non-parametric methods without presuming special distributions; however, non-parametric methods have the disadvantage that effects on survival period cannot be analyzed in terms of multiple variables. In contrast, the Cox proportional hazards model, which is a semi-parametric method, is a technique optimized for analyzing the effects of multiple variables without
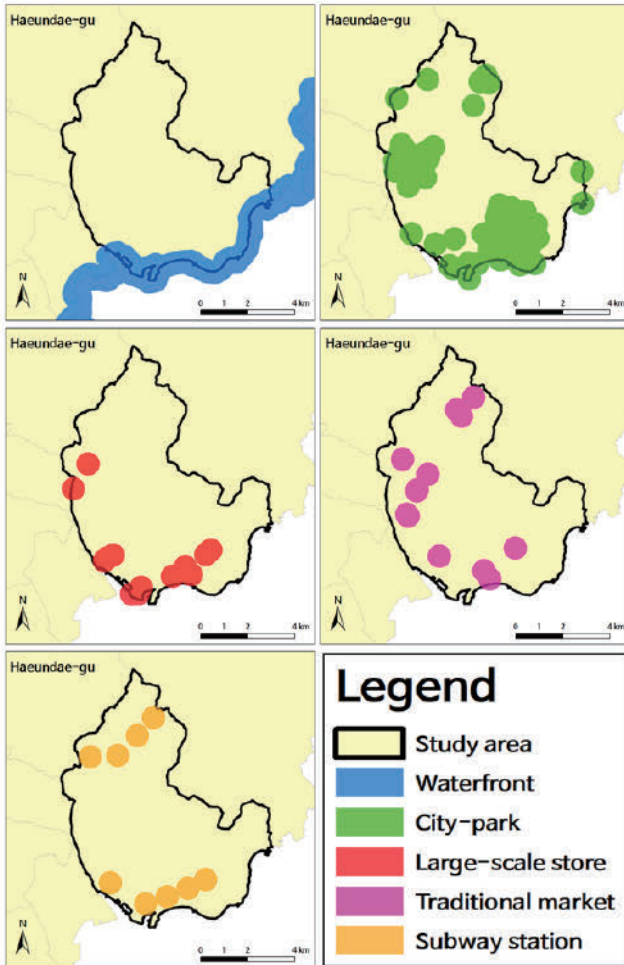
Figure 2. Regional distribution by locational factor

Figure 3. Estimation of survival duration

presuming special distributions and is widely used (Hosmer and Lemeshow, 1999).

The hazard function $h(t)$ of the Cox proportional hazards model signifies survival up to point t and the momentary event occurrence hazard ratio after point t. $S(t)$ signifies the probability of an event not occurring up to point t, and $f(t)$ signifies the probability of an event occurring at point t; the equation is as follows:

$$h(t) = \lim_{\Delta t \to 0} \frac{\Pr(t \leq T < t + \Delta t \mid T \geq t)}{\Delta t} = \frac{f(t)}{S(t)} \quad (1)$$

In this study, a particular event signifies the closure of a restaurant occurring during the analysis period. In the case of censoring data, where events did not occur during the analysis period, the occurrence of events was calculated as December 31, 2019, the terminal point of analysis, based on earlier research (Park, S.H. et al., 2015; Kim, J.H., 2016; Lee, J.R. and Do, N.Y., 2019). Consequently, the survival period
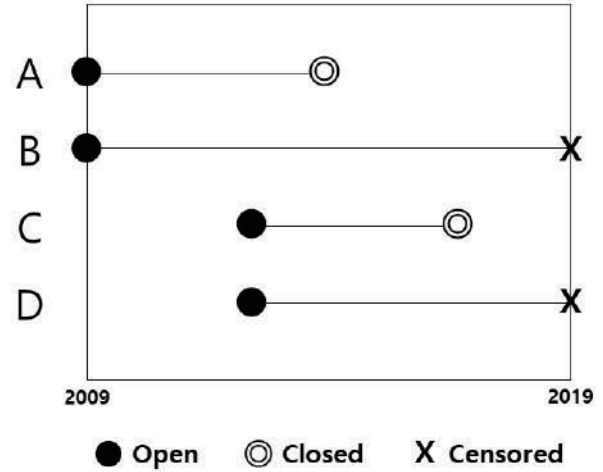
was as in <Figure 3>. Types A and C concern cases where businesses were established on or after January 1, 2009 and closed in or before 2020. Types B and D concern cases where businesses were established on or after January 1, 2009 but did not close. The point of business closure for types B and D was established as December 31, 2019, the terminal point of analysis:

Ⅳ. Analysis of Influences on Survival of the Restaurant Industry

1. Technical Analysis

The results of a basic statistical analysis of variables used in this study are shown in <Table 2> and <Table 3>. Out of a total of 5,457 restaurants, there were 1,928 (35%) Korean restaurants, 1,270 (23%) foreign restaurants, 949 (17%) establishments providing other light food, 503 (10%) establishments providing alcoholic drinks, and 807 (15%) establishments providing beverages. The average survival period (operation period), a dependent variable, was 1,389 days, and the figures were as follows: 1,410 days for Korean restaurants; 1,390 days for foreign restaurants; 1,153 days for establishments providing other light food; 1,308 days for establishments providing alcoholic drinks; and 1,152 days for establishments providing beverages. Depending on the business type, the difference among these figures amounted to a maximum of approximately 438 days. As for the results of survival (or closure), out of 5,457 restaurants, 2,045 saw the occurrence of an event (closure), thus taking up 38%.[6]

Table 2. Descriptive statistics (dependent variable)

Type	Observation	Event	Censored	Survival duration		
				Mean	Min	Max
Korean food	1,928	673	1,255	1,410.66	1	4,012
Foreign food	1,270	488	782	1,270.00	1	4,009
Other light food	949	406	543	1,590.22	1	3,977
Drinking	503	176	327	1,308.95	12	4,003
Beverages	807	302	505	1,152.66	2	3,981
Total	5,457	2,045	3,412	1,389.71	1	4,012

Table 3. Descriptive statistics (independent variable)

Division	Variable		Freq	Mean	SD	Min	Max
Restaurant characteristics	Store size		5,457	104.95	170.01	4	3,783
	Brand type		1 : 1,535 (29%) 0 : 3,922 (71%)	-	-	-	-
	Parking lot		1 : 3,919 (71%) 0 : 1,538 (29%)	-	-	-	-
Locational characteristics	Walkable area	Waterfront area	1 : 1,543 (29%) 0 : 3,914 (71%)	-	-	-	-
		City-park area	1 : 4,420 (80%) 0 : 1,037 (20%)	-	-	-	-
		Large-scale store area	1 : 2,982 (54%) 0 : 2,475 (46%)	-	-	-	-
		Traditional market area	1 : 2,564 (46%) 0 : 2,893 (54%)	-	-	-	-
		Subway station area	1 : 2,570 (47%) 0 : 2,887 (53%)	-	-	-	-
	Pedestrian population		5,457	11.64	0.65	9.58	12.62
	Main-road		5,457	212.44	232.95	0	1,272.57
	Middle-road		5,457	94.70	119.11	0	1,099.68
	Small-road		5,457	155.50	165.58	0	818.64
	Land use type		1 : 2,708 (49%) 0 : 2,749 (51%)	-	-	-	-

Out of business characteristic variables, the store area was 104.95 m² on average, ranging from a minimum of 4 m² to a maximum of 3,783 m² and thus exhibiting a great disparity in scale. As for franchise membership, 1,535 restaurants were members (approx. 29%) and 3,922 were non-members (71%). As for the presence or absence of parking lots, 3,919 restaurants (71%) were in commercial buildings equipped with parking lots while 1,538 (29%) were not.

The basic number for the variable taking pedestrian locations into consideration out of location characteristic variables that 1,543 restaurants (29%) were located in waterfront pedestrian areas. Those located in city park pedestrian areas amounted to 4,420 (80%). According to calculations, 2,982

(54%) were in large-scale store pedestrian areas, 2,564 (46%) were in traditional market pedestrian areas, and 2,570 (47%) were in station area pedestrian areas. The average floating population (ln) amounted to 11.64 people, the average distance to a main road was 212.44 m, the average distance to a middle road was 94.70 m, and the average distance to a small road was 155.50 m, thus exhibiting differences in average distances according to the scale. Finally, as for land use characteristic, 2,708 restaurants (49%) were in residential areas while 2,749 (51%) were in non-residential areas, thus exhibiting similar ratios.

2. Empirical Analysis of Survival Factors

This study applied the Cox proportional hazards model to analyze factors affecting the survival of 5,457 restaurants in Haeundae-gu, Busan. A total of 13 business characteristic and location characteristic factors were used, and, as major variables, location characteristic variables taking pedestrian locations into consideration were selected. In order to verify the validity of the main variable setup, likelihood ratio verification was performed on a model where variables had not been entered (Model 1) and a model where variables had been entered (Model 2). According to the results, Model 2's log likelihood value more closely approximated 0, and the likelihood ratio statistic value (p<0.01) was confirmed to increase. This signified that the degree of influence from variables for the areas established on restaurant survival increased, or that the models' overall goodness of fit improved as variables were entered.

In the case of the Cox proportional hazards model, when the estimated regression coefficient had a positive (+) sign and the hazard ratio was greater than 1, as the relevant variable increased, the business closure hazard ratio rose. On the other hand, when the coefficient's sign had a negative (−) value and the hazard ratio was smaller than 1, as the relevant variable increased, the business closure hazard ratio dropped. As for the analysis of the resulting values, hazard ratios were used, and the results of the analysis are as in <Table 4> (total business types) and <Table 5> (subdivided business types).

First, when all business types for restaurants were analyzed for business characteristics, franchise membership and the presence or absence of parking lots were statistically significant. As for location characteristics, waterfront pedestrian areas, station area pedestrian areas, and distances to main roads, middle roads, and/or small roads had significant effects. Business closure hazard ratios were approximately

Table 4. Result of estimate analysis from Cox model (total restaurant)

Division	Variable		Model 1			Model 2		
		Haz. ratio	95% CI		Haz. ratio	95% CI	
			Lower bound	Upper bound		Lower bound	Upper bound
Restaurant characteristics	Store size	0.9997 **	0.9994	0.9999	0.9997	0.9994	1.0000
	Brand type	0.6476 ***	0.5821	0.7205	0.6286 ***	0.5643	0.7002
	Parking lot	1.1352 **	1.0197	1.2637	1.1627 **	1.0346	1.3068
Locational characteristics	Walkable area	Waterfront area				0.8499 ***	0.7630	0.9468
		City-park area				0.9392	0.8316	1.0607
		Large-scale store area				1.0714	0.9532	1.2042
		Traditional market area				1.0098	0.9134	1.1164
		Subway station area				1.1987 ***	1.0909	1.3171
	Pedestrian population	1.0594	0.9818	1.1431	1.0193	0.9429	1.1017
	Main-road	1.0002 *	0.9999	1.0004	1.0003 ***	1.0001	1.0005
	Middle-road	1.0003 *	0.9999	1.0007	1.0004 **	1.0000	1.0008
	Small-road	1.0005 ***	1.0002	1.0008	1.0006 ***	1.0003	1.0008
	Land use type	0.9392	0.8451	1.0437	0.9274	0.8239	1.0439
Log likelihood			-16,130.43			-16,114.30	
Chi-square			106.65 ***			138.90 ***	
N			5,457			5,457	

***p<0.01, **p<0.05, *p<0.1

Table 5. Result of estimate analysis from Cox model (restaurant type)

Division	Variable		Hazard ratio by restaurant type				
			Kor	For	Oth	Drk	Bev
Restaurant characteristics	Store size		1.0003	0.9997	0.9986	1.0008	0.9991
	Brand type		0.5885 ***	0.6840 ***	0.6492 ***	0.4943 ***	0.4912 ***
	Parking lot		1.1131	1.4237 **	0.9456	1.2952	1.0076
Locational characteristics	Walkable area	Waterfront area	0.7278 ***	1.0602	0.8885	0.6828 *	1.0001
		City-park area	1.0439	0.6931 ***	1.1279	0.6937	0.9856
		Large-scale store area	0.9178	1.3582 **	1.0442	1.5837 **	0.8131
		Traditional market area	0.9675	1.3654 ***	0.8262 *	0.9472	1.0858
		Subway station area	1.1539 *	1.3129 ***	1.0539	1.4622 **	1.2638 **
	Pedestrian population		0.8849 *	0.9603	1.2596 ***	0.9172	1.1758
	Main-road		1.0003 *	1.0004	1.0004 *	1.0006 *	0.9998
	Middle-road		1.0002	1.0003	1.0006	1.0006	0.9999
	Small-road		1.0006 **	1.0001	1.0009 ***	1.0013 ***	1.0004
	Land use type		0.9420	1.0806	0.9344	0.8957	0.7796
Log likelihood			-4,609.42	-3,097.64	-2,518.14	-952.97	-1,775.26
Chi-square			51.19 ***	46.39 ***	47.71 ***	42.48 ***	51.36 ***
N			1,928	1,270	949	503	807

***p<0.01, **p<0.05, *p<0.1

0.62 times (38%) lower for franchise restaurants than for non-franchise restaurants and increased by approximately 1.16 times (16%) for restaurants located in buildings equipped with parking lots than for restaurants not located in such buildings.

In terms of location characteristics taking pedestrian locations into consideration, restaurants in waterfront pedestrian areas were approximately 0.84 times (16%) lower in business closure hazard ratios than those not in such areas. In contrast, restaurants in station area pedestrian areas increased in business closure hazard ratios by approximately 1.20 times (20%). In the case of the floating population variable, the more floating population there was, the higher was business closure hazard ratio, but this was not statistically significant. In addition, when transportation accessibility was taken into consideration, the greater the distance to a main road, a middle road, and/or a small road was, the more a restaurant's business closure hazard ratio increased.

The results of analysis of restaurants per business type are

as follows. First, franchise membership was estimated to lower business closure hazard ratios in all business types, decreasing by a minimum of approximately 0.68 times (32%) and a maximum of approximately 0.49 times (51%). Business closure hazard ratio increased by 1.42 times (42%) for foreign restaurant with parking lots.

As for locations in waterfront pedestrian areas, business closure hazard ratios dropped by approximately 0.73 times (27%) for Korean restaurants and approximately 0.68 times (32%) for establishments providing alcoholic drinks. As for locations in city park pedestrian areas, business closure hazard ratios dropped by approximately 0.69 times (31%) for foreign restaurants. As for locations in large-scale store pedestrian areas, business closure hazard ratios increased by approximately 1.35 times (35%) and 1.58 times (58%) for foreign restaurants and establishments providing alcoholic drinks. In traditional market pedestrian areas, business closure hazard ratios rose by approximately 1.36 (36%) for foreign restaurants but dropped by approximately 0.82 times

(18%) for establishments providing other light food. As for locations in station area pedestrian areas, business closure hazard ratios rose by approximately 1.15 times (15%) for Korean restaurants, approximately 1.31 times (31%) for foreign restaurants, approximately 1.46 times (46%) for establishments providing alcoholic drinks, and approximately 1.26 times (26%) for establishments providing beverages. When the effects of floating population were analyzed, as floating population increased, business closure hazard ratios dropped by 0.88 times (12%) for Korean restaurants but rose by 1.25 times (25%) for establishments providing other light food. Business closure hazard ratios rose for Korean restaurants, foreign restaurants, and establishments providing alcoholic drinks in terms of distances from main roads, and rose for Korean restaurants, establishments providing other light food, and establishment providing alcoholic drinks in terms of distances from small roads. Finally, in the case of land use characteristics, the more restaurants were located in residential areas, the more business closure hazard ratios presumably dropped for most business types, but the figures were statistically insignificant.

V. Conclusion

Survival analysis research so far has only addressed biased study subjects and limited internal and external factors. Consequently, this study sought to grasp factors affecting the survival of the restaurant industry by making use of not only restaurant characteristics but also area characteristics classified into more detailed categories of pedestrian location factors; a summary of the results of the analysis is as follows.

Out of business characteristics, as for membership in franchises, the survival period was longer for franchise restaurants of all business types. As for the dining (food service) industry, the existence of diverse business types because of the nature of the restaurant industry and the unique characteristic of trendiness both can cause excessive competition (Korea Agro-Fisheries & Food Trade Corporation, 2002). In an overly competitive market, the value and competitiveness of a franchise brand is a factor that increases the sustainability of the restaurant industry (Lee, J.R. et al., 2019). Though franchise membership can be a means of temporary stabilization according to partial results, this implies the necessity of strategies and plans for collaboration and

mutual benefits between franchise and non-franchise restaurants for the long-term sustainability of the dining industry. In contrast, restaurants equipped with parking lots yielded results differing from the expectation that, by providing convenience to customers using them, these businesses would increase in survival rates. This signifies that other, external factors hindering restaurant sustainability were more important than the convenience of parking lots. Restaurants equipped with parking lots tended to pay relatively higher rents than did those not equipped with such facilities (Min, C.K. and Kang, C.D., 2021), and this signifies that parking lots can act negatively on restaurant survival.

Locations within waterfront pedestrian areas were revealed to be a factor positively affecting restaurant survival. Most commercial facilities including restaurants are aggregative, tending to gather in particular areas (Borchert, 1998). In comparison with other business types, the restaurant industry especially exhibits relatively close distribution and is often aggregative (Lim, B.H., 2007). Appropriately aggregative commercial districts provide environments where the numbers of floating population and consumers increase because of the formation of customer streams (Lee, K.M. et al., 2014). Based on this, the element of customer attraction harbored by waterfronts' aggregativity presumably serves as a factor raising restaurant survival rates (Jung, S.H. and Hwang, S.S., 2002; Korea Water Resources Corporation, 2018). In addition, disparate business closure hazard ratios were estimated for all business types in city park pedestrian areas, large-scale store pedestrian areas, and traditional market pedestrian areas. In particular, in the case of station area pedestrian areas, rising business closure hazard ratios were revealed, in contrast to the results of earlier research expected. This means that effects on individual business types vary according to the characteristics of pedestrian areas in which restaurants are located. Presumably, even with identical infrastructures, effects on the survival of restaurants can differ according to the characteristics of individual areas or streets (Lee, S.R. and Yang, H.J., 2019), and this implies the need to grasp in detail survival rate increases and vulnerable elements per area.

In sum, the restaurant industry is responsible for not only small-scale commercial districts but also consumption and demand in the local economy and forms a large axis of urban industries as well. To overcome the crises of long-

term recessions and slumps, prolonging or strengthening the survival of the restaurant industry, or the sustainability of business operation, can be an important solution. Consequently, the results of this study are expected to promote plans for a sustainable restaurant industry, and thus to be used as basic data for the establishment of local economy stabilization policies.

This study is significant for having conducted survival analyses after applying the element of walkability to hitherto overlooked spatial location factors. However, it has the following limitations.

First, the scope of 500 m within pedestrian location areas established through the use of ArcGIS buffer and near tools cannot truly reflect the scope of movement that is actually walkable. The physical structure and characteristics of the pedestrian environment such as pedestrian-only roads and crosswalks are factors affecting pedestrians' satisfaction (Pyo, S.Y. et al., 2015; Lee, S.R. and Yang, H.J., 2019). Meanwhile, this study is limited in that it experienced difficulty obtaining detailed data on the pedestrian environment in the entire area of Haeundae-gu.

Second, to examine the effects of pedestrian location areas intensively, the temporal scope of this study was established as 2009-19. However, the pandemic that broke out in 2020 and the ensuing financial crisis had an immense impact on local commercial districts and is expected to bring great changes to the survival and operation of both local commercial districts and the restaurant industry (Lim, H.J. and Choi, S.B., 2022). In particular, the effects of pedestrian locations addressed in this study are expected to be strongly related to changes in consumer behavior as a result of social distancing, and later research will be able to address topics such as the survival or resilience of commercial districts and stores due to external impact if and when it takes the pandemic period into consideration..

Note 1. Schematized data provided by the Busan Metropolitan City Big Data Platform were referred to (https://bigdata.busan.go.kr/).

Note 2. Out of data for 5,809 restaurants, overlapping ones found in particular neighborhoods, data for omissions to record areas and business types, and data for the one-time opening of stores at exhibition halls and event venues were excluded from analysis.

Note 3. Out of business types belonging to the restaurant industry and the alcoholic drink establishment industry, cafeterias within organizations as well as catering and mobile restaurants were excluded from analysis due to considerably low frequency of business establishment and closure.

Note 4. The point of business closure and the temporal scope of location characteristic variables for each restaurant were established in consideration of time-varying covariates. For example, the large-scale store location variable for a restaurant that closed in 2013 was coded and analyzed as data excluding large-scale stores that opened in 2014.

Note 5. As a proxy variable to indicate the volume of walking in the study areas, floating population data were used. Floating population data are daily average estimates produced by estimating with cells in units of 50 m through the use of the telecommunications company SKT Telecom's mobile phone signals. Through the Small Enterprise and Market Service's (SEMAS) commercial district information system (SEMAS, 2023), data were collected per administrative neighborhood in the study areas and calculated. Because these data were not provided throughout the research period, data from 2015, when data were obtainable and which was the midpoint of the research period, were used for analysis.

Note 6. While the business closure ratio here is somewhat lower than the figures reported in earlier research and reports, it is so presumably because this is a statistical value not only for a particular commercial district concentrated with restaurants but also for the entire Haeundae-gu. Research by Min, C.K. et al. (2021), too, yielded a similar business closure ratio for a comparatively large area. Even in this study, the business closure ratio likewise will rise when only central commercial districts in Haeundae-gu are addressed.

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