Survival characteristics of food and beverage businesses in a gentrified commercial area—A case study in Seoul, Korea

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ABSTRACT

Commercial gentrification is a common cause of urban transformation in modern cities. Former residential and industrial areas are being transformed into commercial ones specializing in the food and beverage (F&B) industry because of their unique atmosphere. However, F&B businesses in the gentrified commercial areas are prone to intense competition for survival that debate on the emerging commercial street's sustainability. Thus, this study analyzed F&B street businesses' survival characteristics where commercial gentrification has occurred. The research site was selected among Seoul's commercial streets by performing data analysis. The Cox proportional hazards model and urban spatial indicators were used to analyze the factors affecting survival time. The research findings were as follows: First, physical attractiveness, such as openness or visual accessibility, lowered the closure risk. Second, accessibility to cultural facilities or open spaces was beneficial for the nearby F&B demands; however, it occasionally intensified the competition. Finally, competitive businesses' agglomeration increased the closure risk, while non-competitive ones' agglomeration and diversification decreased it. This research's results could be useful for policymakers in promoting a more sustainable business environment for F&B entrepreneurs.

1. Introduction

Buildings in residential or industrial districts are being transformed into restaurant businesses, thus forming new commercial streets [1–5] (Seoul Metropolitan Government, 2015). These streets' old houses and factories provide a distinctive atmosphere that entrepreneurs attempt to develop into unique places. This phenomenon has emerged as a new type of space for young people's cultural consumption and leisure activities as social media has gained importance among them.

Creating new commercial districts causes a rapid change in cities' populations, economies, and societies. Thus, empirical studies have been conducted on various aspects. Researchers who focused on the sociodemographic aspect of rapid commercialization regarded the change as gentrification's commercial form [6–8]. Nevertheless, those who emphasized commercialization studied the region's physical modification and the commercial spread pattern owing to commercialization [2,3]. However, insufficient research is available on how the commercial area's expansion affects individual stores' operation, life, and death.

Nonetheless, as the concept of sustainability acquired social importance, research on economic sustainability and resilience was conducted in the small-scale retail industry. Some researchers performed survival analysis on restaurant businesses as the retail ones;

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furthermore, in Seoul, Korea, restaurants' survival characteristics were examined [9,10]. However, the variables that reflect the commercial gentrification's characteristics, such as the physical street environment, accessibility to cultural facilities and public spaces, and the distribution characteristics by restaurant business type, were insufficiently considered.

Therefore, this study analyzed the survival characteristics of businesses in areas where commercial gentrification has occurred, focusing on the specialized restaurant industry. The areas where restaurant businesses were clustered and commercially gentrified in Seoul, Korea, after 2010 were selected for this research. The derived cases were reclassified according to their characteristics. The factors affecting survival characteristics were analyzed through the Cox proportional hazards (PH) model using urban variables such as urban form, spatial structure, accessibility to urban facilities and spaces, and agglomeration economy factors. Additionally, a literature review was conducted to identify the characteristics of gentrified commercial areas and the factors affecting restaurant businesses' survival characteristics. These have been disregarded in the existing literature. Finally, urban design and planning implications were provided for enhancing the economic sustainability of recently gentrified commercial areas, considering the changes in citizens' consumption and activity patterns.

2. Literature review

2.1. Definition, cause, and phases of gentrification

As a powerful force to change the downtown's social and spatial structure, Glass et al. [11] introduced the concept of gentrification to explain the re-influx and involuntary migration of the middle and low-income classes in downtown London, respectively. Gentrification is accompanied by creating high-class spaces in the city center and the upward trajectory of the living population; it has occurred over the past 50 years across various subjects, regions, and countries [12–14].

Gentrification is understood from three perspectives. The first is its policy aspect. This effectively explains gentrification as a policy and business method that originated in Europe and America. Hackworth and Smith [15] argued that the gentrification defined by Glass et al. [11] has been developed through variations in Western countries in Europe and the United States. This approach can be described as "the three waves."

The first wave was induced by public-led urban slum reconstruction projects before 1973. Blue-color laborers' residences became slums as the industrial era deteriorated; moreover, an aggressive public intervention was conducted to attract middle-class capital and employment [12]. Second, gentrification served as an anchor of various urban developments. During this period, the role of the art community was emphasized as key to inducing gentrification. New York's South of Houston Street, Tribeca, and the Lower East Side are the representing examples of the era [15]. However, in the gentrification-induced areas, the opposition groups formed by the low-income class and the social activists who supported them started the degentrification movement. They began to accuse the negative aspects of gentrification [16]. Third, the scale of private capital increased, the cultural factors observed in the previous small-scale developments deteriorated, and the public sector's involvement intensified compared to the previous period. Additionally, the degentrification movement weakened as the working class decreased owing to the previous period's gentrification.

The second viewpoint is based on gentrification's cause. This is meaningful as it presents gentrification's theoretical perspective and empirical indicators. The study that has provided the most conclusive explanation is the active debate between David Ley and Neil Smith from the 1980s to the 1990s. This debate established a model from the economic perspective of demand and production to explain gentrification today [6,17–19].

The consumer side argues that the urban population's socioeconomic change, caused by the advent of the post-industrial era and increased commuting costs outside the city, affects the land use change, thus causing gentrification [18–20]. From the producer side, gentrification occurs in the economic structural relationship between macroeconomics and capital investment. The rent gap theory states that the latter occurs when the difference between the potential and the actual capitalized ground rent, that is, the rent gap, is maximized [21]. Subsequently, Smith and Williams [22] explained gentrification with several driving forces, such as "suburbanization and the rent gap," "de-industrialization," and "centralization and de-centralization of the capital."

The third viewpoint is understanding according to the pattern of occurrence. Since the 2000s, gentrification's aspects have increasingly diversified. Thus, researchers tended to introduce classification according to the type of phenomenon. In general, gentrification types have been classified according to the aspect of advanced space; moreover, the representing types include residential, commercial, tourism, and eco-gentrifications.

First, residential gentrification is the most traditional type, characterized by transforming slums or industrial areas near the city center into residential spaces for the white-collar middle class. It is mainly because of the advent of the post-industrial era, where an underdeveloped slum area is redeveloped and transformed into a middle-class house, office space, or condominium [23,24]. Second, the existing neighborhood stores were replaced by high-end retail ones; gentrification began in neighboring areas, called commercial gentrification [25–28]. Cafes, restaurants, and pubs with distinctive and unique atmospheres and boutique retail stores, such as beauty salons and clothing companies, trigger local gentrification [6,14,25]. Commercial gentrification is now easily observed worldwide, including in Asian countries [2,3,6,29], Europe, and other regions [28,30–32]. Third, tourism gentrification is its characteristic aspect in the modern era, where globalization and localization progressed simultaneously. The rise of the global economy and the increasing demand for localized and gentrified spaces promoted the influx of large-scale entertainment companies and tourism business capital into the neighboring spaces [14,33,34]. Fourth, eco-gentrification occurred as abandoned railways and covered rivers were regenerated into urban parks to meet residents' increased demands for parks and green spaces since the 21st century. Projects similar to the High Line Park in Manhattan, New York, as well as the urban revitalization project in Chelsea, were conducted in many countries globally [35–40].

2.2. Commercialization of the non-commercial area into the restaurant business cluster

In the past, restaurant businesses such as cafes, restaurants, and pubs have been considered for commercial uses for meals and spaces that perform social and cultural functions in the city. Oldenburg [41] emphasized the importance of "inclusively sociable places" as a third space for modern people's balanced lives, other than residential and professional ones. Some researchers argued that visiting a restaurant could be an action that forms a cultural capital that distinguishes them from others [7,42,43]. Restaurant businesses with distinctive interiors and exotic menu items have recently become young urbanites' dating and food tour destinations. Additionally, the emergence of smartphones and social networking services has contributed to the extent and popularity of culturally distinct consumption behaviors in new urban spaces. Regarding the commercial gentrification phenomenon in residential and industrial areas, the sentimental image, urban form and structure, and location characteristics of the gentrification areas have been actively studied.

Researchers who observed that clustering the city's commercial and cultural functions is important analyzed the proximity between commercial and cultural facilities, such as art galleries or large-scale parks. Zukin [44], Montgomery [45], Hae [46], and Gallan [47] examined the relationship between culture and art and business and commercial facilities. Further, they claimed that open galleries, designer boutiques, art-related educational facilities, and food boutiques result in mutual growth. The supply of urban parks plays a role in driving restaurant businesses' locations in neighboring areas [3,48].

However, the urban form and spatial structure have been analyzed by researchers focusing on the commercial gentrification phenomenon in residential and industrial areas. This demonstrates that the urban form, spatial structure, and landscape image of an old residential or industrial area could induce a demand for visits from outside users by combining the location with a unique store. Specifically, a gentrified residential or industrial area's spatial identity is an important mechanism for forming the commercial area's characteristics [7].

The appearance of restaurant business clusters is closely related to commercial gentrification. In the Korean context, after 2010, a process of industry change similar to commercial gentrification was observed [6]. As Zukin et al. [25] analyzed in the study of Harlem and Williamsburg, New York, industry modifications were observed, from a local store to a new entrepreneurial and enterprise one. This industry change process revealed a similar tendency in the empirical analysis studies conducted worldwide after 2010 [2,3,7,49, 50].

Regarding the cause of these non-commercial areas' commercialization, it was argued that the new commercial area was differentiated from the existing large one. Furthermore, it was because of the pursuit of the rent gap profit following the conversion of the building's commercial use by the landowner. First, it was hypothesized that the new commercial area would be differentiated because of excessive competition in large commercial areas and rising rents. Since 2010, the creation of commercial districts has mostly been small-scale, and these districts are located near existing mega commercial districts. Yoon [51] revealed that when the number of commercial facilities in the central commercial area increases, the number of commercial facilities in the residential area also increases; however, the reverse is invalid. Second, realizing the rent gap revenue generated by commercializing non-commercial use areas was predicted to promote the creation of new commercial spaces. Smith [21] theorized that financial capital investment to realize profits occurs when the rent gap caused by land use conversion is maximized. Heo [6] applied this to small- and medium-sized commercial capital and found that it was a significant transition mechanism for the existing commercial district with obsolete stores.

2.3. Survival characteristics of the restaurant business

"What factors lead to a business's success?" is a key question that never loses importance in the academic field and the realm of politics, economy, society, and culture. Furthermore, a company's stable market entry is a representative criterion for determining its success [52]. Owing to the recently increased interest in sustainability and urban resilience, there is a growing demand for measures to improve the sustainability of small- and medium-sized businesses that form the infrastructure of the industry and the local economy [53,54].

In the urban and regional economy fields, discussions on businesses' spatial characteristics have been continuously studied as factors influencing such sustainability. In particular, starting with Joseph Schumpeter, economists have argued that geographical proximity is a key factor in business success and economic growth. The positive effect of the agglomeration economy has been discussed in urban and regional economics. The Marshall-Arrow-Romer. Knowledge Spillover effect states that the proximity between businesses in the same industry contributes to knowledge diffusion and creates positive externalities. It is considered a main cause of the agglomeration economy. However, the Jacobs externality that the competitive effect is because of a local concentration and the Porter externality that causes a positive externality have been suggested as background theories [10,55]. In empirical research, assessing the magnitude of the agglomeration and competitive effects (positive and negative, respectively) is a common debate topic [56–58]. Online media marketing has been argued as an important business competitiveness factor [59–61].

2.4. Novelty of this study

The existing literature about restaurants' survival characteristics in a gentrified commercial area could be summarized as having three implications. First, researchers have structuralized gentrification's causes and progress. The economic driving forces, such as the rent gap or the re-urbanization phenomenon, have been explained appropriately by gentrification's various types and phases. Second, the formerly non-commercial area's commercialization is well-established as a common type of commercial gentrification. Old, formerly non-commercial buildings are common destinations for young people. Especially in Seoul, multiple case studies have been

performed to determine commercial gentrification's aspects. Third, a retail business' survival characteristics were studied by various researchers worldwide. The Kaplan-Meier estimator and the Cox PH model are commonly used to analyze businesses' success. However, the survival characteristics of gentrified commercial areas have been insufficiently studied. More research is needed since commercial gentrification is well-recognized as a common phenomenon.

This study's novelty could be summarized as follows. First, it assessed gentrified commercial areas' survival characteristics. Gentrified areas are experiencing rapid change and intense competition such that their survival aspects are distinguishable from general cases. Second, "gentrification" connotes contextuality [62]. Thus, Seoul was selected as our case study area for its unique and regional characteristics within the global perspectives of gentrification. Gentrification in Seoul can be characterized by many of its commonalities. These include vibrancy gained through the spontaneous aesthetics of artists, artisans, small-scale producers, and entrepreneurs. Then, there is the risk of homogenization owing to capital entry. Additionally, with rising rents, many original inhabitants have been displaced and relocated. Furthermore, city centers have been transformed from places of livelihood into tourist destinations for locals and foreigners. However, it differs from gentrification in the United States and the United Kingdom owing to its relatively less segregated environment and its focus on commercial rather than residential areas [63]. Such contextuality can provide new insights into the field of gentrification studies. This study filtered Seoul's gentrified commercial areas to list the research area, and the survival characteristics were analyzed. Second, the study deliberately focused on urban spatial indicators representing the urban form, spatial structure, accessibility, and other aspects. Since most studies on business survival have focused on socioeconomic indicators, this study's findings could provide policy implications for urban designers and planners who can implement physical changes in the city.

3. Materials and methods

This study proposed a hypothesis about the density pattern of the food and beverage (F&B) businesses in a commercial area and assessed it. It was conducted in residential or industrial areas that were transformed into commercialized areas. This resulted in a high density of commercial areas specializing in the F&B industry.

The research questions were as follows:

Q1. How does the street's physical environment affect businesses' survival and closure?

Q2. How does the accessibility to cultural facilities and parks affect businesses' survival and closure?

Q3. How does the cluster aspect of F&B companies affect businesses' survival and closure?

In this section, to answer the aforementioned questions, the research data were gathered and used to select the case study area. In addition, the Cox PH model was explained. Fig. 1 provides a brief illustration of the research methodology.
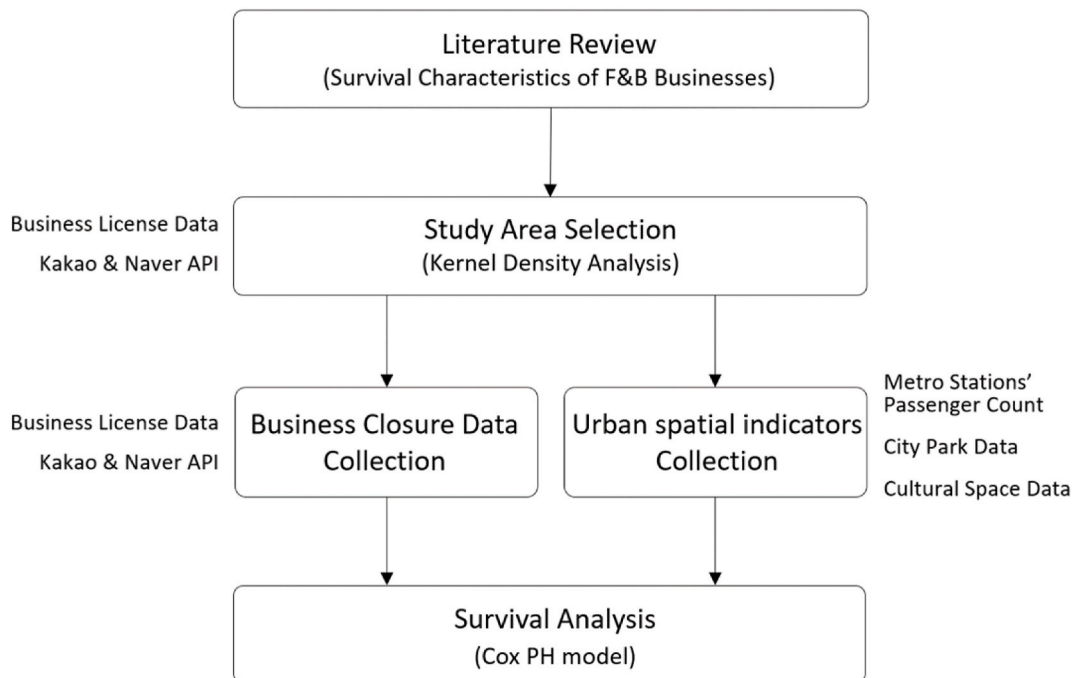

Fig. 1. Research flow.

3.1. Research site and data

In this section we explain how we derived and selected the areas where the urban spaces were not previously used commercially in Seoul. These became commercial sites of one or more areas because of a drastic increase in the restaurant industry's commercial density since 2010. In the past two decades, Seoul has experienced rapid economic growth and increased number of F&B businesses. Consequently, many residential and industrial areas have been commercially gentrified [2,37,64].

The Kernel Density Estimation (KDE) methodology of ArcGIS 10.8 was utilized to analyze the areas with an increasing commercial density in Seoul. Furthermore, restaurant commercial sites created after 2010 were selected. For the KDE analysis, the density estimation method was measured in raster space units. The amount of change in the commercial density between the start (January 1, 2010) and end time points (December 31, 2019) was measured using a 1m-by-1m square raster cell. Fig. 2 exhibits the KDE results.

The following criteria were prepared to ensure the site selection's objectivity. First, the average commercial density of the developed commercial area was set as the criterion for the increase in the commercial density of commercialization for this study's endpoint. Second, when the commercial density increase area of the first criterion was 100 m by 100 m, that is, 10,000 m^2 or more, it was set as the minimum requirement for the commercial land's formation. Third, the planned commercial land creation by development projects and a simple density increase in the existing commercial land were excluded as commercial land creation areas. Fig. 3 shows the final case study areas.

Subsequently, the data for the analysis were constructed to verify the research hypothesis in the survival analysis. The company's survival period and business closure were measured as the dependent variables. Regarding the independent variables, overall, 27 variables were constructed as the survival analysis data by measuring the urban form, spatial structure, accessibility, agglomeration economy, and miscellaneous factors.

First, using the local administrative license data, the business license data of the general and remaining restaurants were employed to establish the restaurant business survival period, business survival, the specifics of the restaurant business industry, and other factors. The accumulated licensing data until September 30, 2020, were utilized as this research's data. The restaurant business' location was corrected through the Kakao Application Programming Interface (API) map/local and the Naver API search service to improve the location accuracy. Second, the data on the urban form and spatial structure factors were constructed using the electronic address map of the Ministry of Public Administration and Security. In this study, the data as of August 2020 were used. Third, using the database of the number of passengers by the train/subway station provided by the Korea Railroad Corporation and the Seoul Transportation Corporation, the accessibility factors' subway access data were constructed. The number of people embarking and disembarking from 2010 to 2019 formed the data on the number of people arriving at the subway station accessibility variable. Fourth, using the road name address background map of the Ministry of Public Administration and Security, the city park's location, area, and the subway station's entrance were constructed in the accessibility factor. This research was performed using the data from August 2020. Fifth, using the cultural space information of the Seoul Open Data Plaza, the location data of the art-related facilities in Seoul were constructed. The cultural space information provides the names and locations of cultural spaces of various types, such as museums/memorials, performance halls, art galleries, culture and art centers, and cultural centers; this study utilized the data uploaded in December 2020. Sixth, using the information on the city's official land price in the Seoul Open Data Plaza, the data regarding the area's official price, where the businesses of other elements were located in the year of opening and the average rate of change in the official price during the business period, were constructed. Furthermore, the individual official land price data from 2010 to 2020 were constructed and utilized throughout Seoul. Table 1 summarizes the data utilized in the analysis.
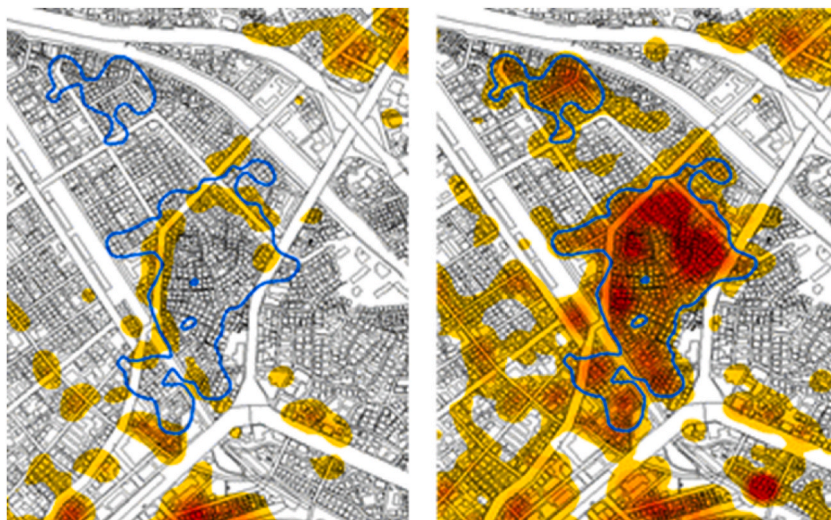

Fig. 2. Comparison of the Kernel density in Yeonnam-dong in early 2010 (left) and late 2019 (right).
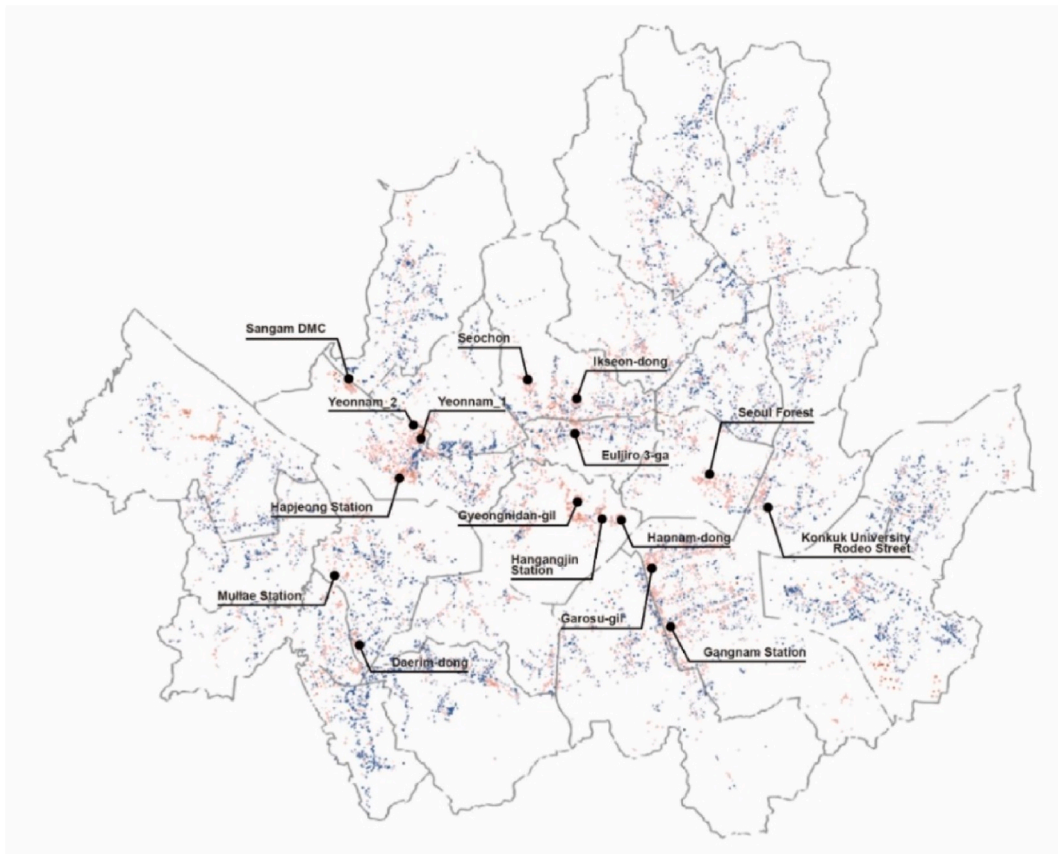
Fig. 3. Case study areas (black dot) and food and beverage commercial facility location in Seoul (red dot: food and beverage commercial facility increase, blue dot: food and beverage commercial facility decrease)

3.2. Cox PH model

This study used the Cox PH model to verify the factors affecting F&B businesses' survival and closure. Cox PH model is a commonly used model for the occurrence of certain events, such as business closures [65,66], disease outbreaks [67], or product failure [68].

The formula used for this study was as follows:

$$h(t, X) = h_0(t) exp \left(\sum_{i=1}^{n} \beta_i \overrightarrow{X_i} \right)$$

$$\overrightarrow{X} = (X_1, X_2, \cdots, X_n)$$

$h_0(t)$ is the hazard function $h(t)$ without considering the covariate $\overrightarrow{X}$ (when the vector is zero). Although h_0 did not assume a specific parametric model, it has produced reasonable regression coefficients, hazard ratios, and survival curve estimation results [69].

This study's dependent variable was measured as the period between an event's occurrence and termination points. Therefore, the problem of "right censored data" arose for incomplete events. The survival regression and the Tobit model could be considered for cross-sectional data analysis. As the latter assumes a parametric model unlike the former, the assumptions for the linear effects and the Gaussian error must be satisfied [70,71]. The Tobit model is convenient for estimating the mean survival time because of the linear model's characteristics. However, in the Cox PH model, the mean survival time is difficult to estimate because there is no assumption of the parametric model [72]. Nevertheless, this study employed the Cox PH model because its main concern was the increase or decrease in the business closure risk rather than its magnitude.

This study addressed the survival characteristics of commercial area businesses that have been rapidly formed owing to gentrification. Therefore, the proportional risk assumption was challenging to satisfy because the area's site, the number of visitors, and the rent changed gradually. In this study, the Cox PH assumption was examined by performing the Schoenfeld residual test that analyzes the residual and provides an interpretation of the variables based on the result. The Schoenfeld test result is shown in Fig. 4.

In the Cox PH analysis, the 26 variables prepared in Section 2.2.1 were employed as covariates. The business entity's size and total integration were excluded from the variables because the variance inflation factor index was close to 5. Consequently, the final model

Table 1
Data utilized in the analysis.

Category		Variable	Unit	Description	Data source
Dependent variable		Business operation period	day	Business operation period	Local Administrative Authorization data
		Business survival dummy	0 or 1	Business survival (closure = 1)	
Independent variables	Urban form	Width of the adjacent road	m	Width of the road adjacent to the business	Ministry of Public Administration and Security
		D:H ratio	–	Ratio of the width (D) and the height (H) of the building	
		SBL_average	m	Mean of the building width within the street	
		SBL_variance	–	Variance of the building width within the street	
	Urban spatial structure	Local integration (500 m)	–	Space syntax indicator	
		Global integration (500 m)			
		Local choice (500 m)			
		Global choice			
		Connectivity			
	Accessibility	Accessibility to the subway station	unit A*	Urban Network Analysis (UNA) gravity index weighted with the number of people arriving at the station	Korea Railroad Corporation, Seoul Transportation Corporation
		Accessibility to small and mid-scale parks		UNA gravity index of parks smaller than 10,000m²	Ministry of Public Administration and Security
		Accessibility to large-scale parks		UNA gravity index of parks larger than 10,000m²	
		Accessibility to art museums		UNA gravity index of art museums	Seoul Open Data Plaza
		Number of homogenous businesses (100 m)	ea	Number of homogenous businesses within the 100 m radius (narrow category)	Ministry of Public Administration and Security, Kakao API, Naver API
		Number of heterogeneous businesses (100 m)	ea	Number of heterogeneous businesses within the 100 m radius (broad category)	
	Agglomeration Economy	Number of all business (100 m)	ea	Number of all businesses within a 100 m radius	
		Business diversity (narrow category, 100 m)	–	Business diversity within a 100 m radius (narrow category)	
		Business diversity (broad category, 100 m)	–	Business diversity within the 100 m radius (broad category)	
		Number of homogenous businesses (total area)	ea	Number of homogenous businesses within the total area	
		Number of all businesses (total area)	ea	Number of heterogeneous businesses within the total area	
		Business diversity (total area)	–	Business diversity within the total area	
	Miscellaneous	Ground floor dummy	0 or 1	Businesses located on the ground floor	Ministry of Public Administration and Security
		Business size (area)	m²	Business floor area	
		Official land price at the time of the business opening	won	Official land price at the time of the business opening	Seoul Open Data Plaza
		Average change rate of the official land price	unit B*	Average change rate of the official land price between the opening and closure of the business	

* Unit A is 'people/exp(β*m), where ' and β are 0.002 (subway station) and 0.004 (others), respectively.
* Unit B is (land price during the last year of the business operation - land price at the time of the business opening)/the years of business duration.

comprised 24 variables: three city types, four spatial structures, five accessibility, eight integrated economies, and four other factors.

The model's suitability was judged using the log-likelihood ratio test and the concordance index. The former's value was 1278.6 for 24 degrees of freedom and satisfied a significance probability of 0.01 or less; thus, the model fit was significantly better than that of the covariate-free model. Although the concordance value is generally suitable between 0.6 and 0.7540, this model yielded a value of 0.737, thus confirming the model fit.

We examined whether the Cox PH assumption was violated for all independent variables. Five variables violated it, namely, partial selection, access to small- and medium-sized parks, the density of all industries (the total commercial land), business size, and land price increase.

4. Results

The Cox PH survival analysis results are presented in Table 2.

In the urban form factor, the D:H ratio's average and variance and the building elevation width were analyzed for each street in the commercial area. The results of the average D:H ratio and the distribution of the building elevation width (horizontal) were significant. The D:H ratio's risk ratio was 0.898 (Z = −2.330), and the significance was 0.020; the higher the D/H ratio, the lower the risk of closing
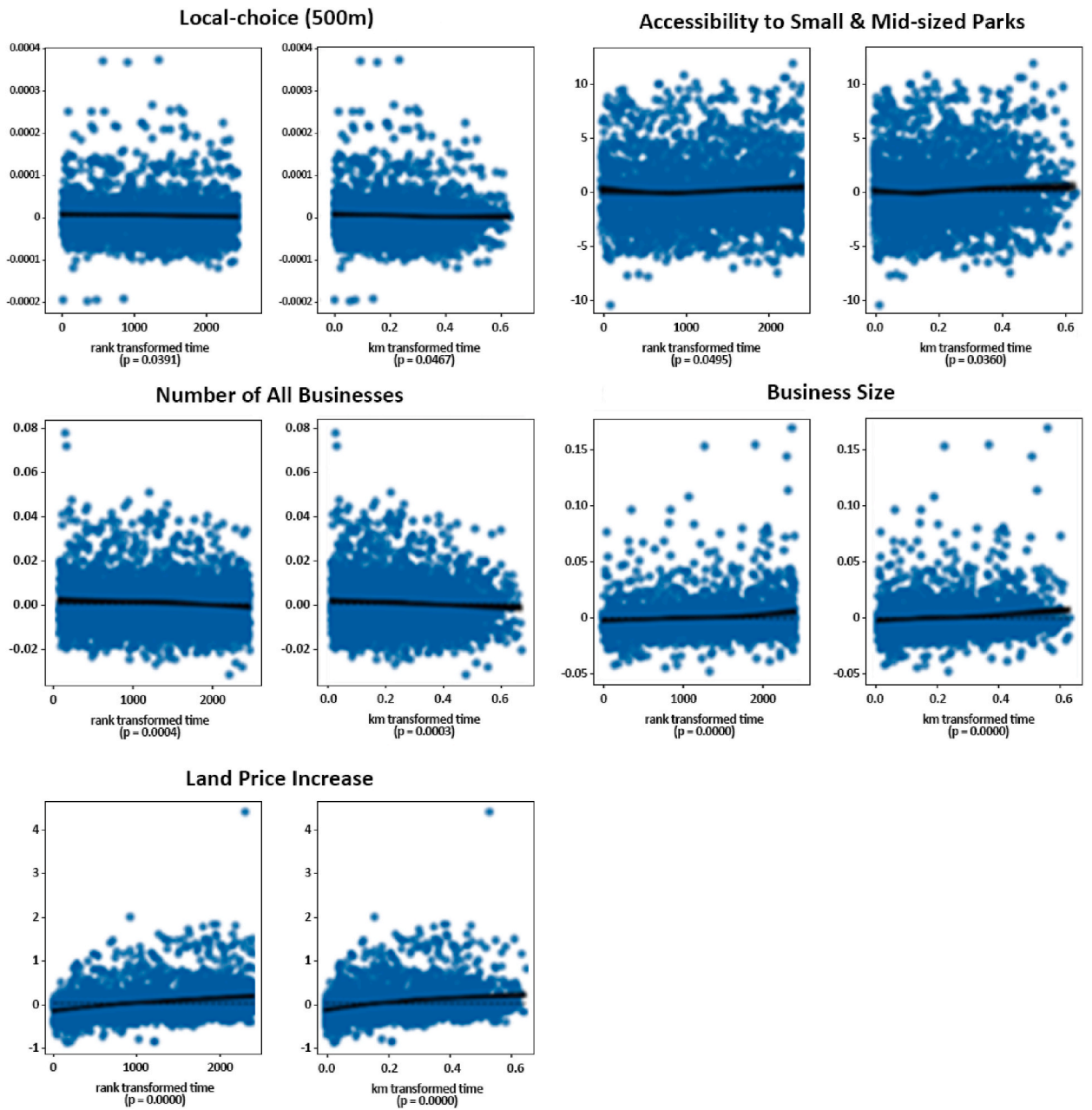
Fig. 4. Schoenfeld residuals test and distribution of variables violating the Cox PH assumption.

the street's business. Moreover, the risk ratio of the dispersion of the building elevation width was 1.000 (Z = −5.643) and the significance was less than 0.01. Furthermore, the greater the dispersion of the building elevation width, the smaller the business closure risk. In particular, the higher the variance of the width of the building's elevation in the street landscape, the lower the business closure risk owing to the commercial districts lacking standardized building sizes because of the presence of various sizes.

In the urban spatial structure factor, the total integration, local integration (500 m), global selectivity, local selectivity (500 m), and connectivity were analyzed for a street network with a radius of 1000 m in a commercial area through a space syntax analysis. The local integration (500 m), total selectivity, and local selectivity (500 m) were significant; the overall integration was excluded from the analysis because of a multicollinearity problem. The local integration degree's risk ratio (500 m) was 0.999 (Z = −4.659), and the significance was less than 0.01; moreover, as the former's value increased, the probability of the business closure decreased. Specifically, when the location requirement where the business is located increases, the centrality of the street phase in the space at a distance of 500 m, the probability of the business closure decreases. In addition, in the local (500 m) and the total selectivity, the risk ratios were 1.000 (Z = 5.166) and 1.000 (Z = 4.175), respectively; additionally, the significance was also 0.01 or less, and the higher

Table 2

Results of the Cox proportional-survival analysis.

Factors	Variables	Unit	Exp(β)	Z (β/se)	P-value	VIF
Urban form	D:H ratio	–	0.898**	−2.33	0.020	1.506
	SBL_average	m	1.001	0.381	0.703	3.097
	SBL_variance	–	1.000***	−5.643	<0.01	3.397
Urban spatial structure	Local integration (500 m)	–	0.999***	−4.659	<0.01	2.595
	Local choice (500 m)		1.000***	5.166	<0.01	2.007
	Global choice		1.000***	4.175	<0.01	1.891
	Connectivity		1.005	0.309	0.758	1.251
Accessibility	Accessibility to the subway station	unit	1.000***	−9.425	<0.01	2.172
	Accessibility to small and mid-scale parks		0.830***	−2.862	<0.01	1.444
	Accessibility to large-scale parks		1.266**	2.208	0.027	1.518
	Accessibility to art museums		0.763***	−8.894	<0.01	1.295
Agglomeration economy	Number of homogenous businesses (100 m)	ea	0.972***	−3.946	<0.01	2.297
	Number of heterogeneous businesses (100 m)	ea	0.985***	−2.853	<0.01	1.651
	Number of all businesses (100 m)	ea	1.004	1.246	0.213	3.171
	Business diversity (narrow category, 100 m)	–	1.335	1.097	0.273	3.406
	Business diversity (broad category, 100 m)	–	0.568**	−2.082	0.037	2.883
	Number of homogenous businesses (total area)	ea	1.001*	1.834	0.067	1.990
	Number of all businesses (total area)	ea	1.000	1.509	0.131	2.658
	Business diversity (total area)	–	0.822	−0.371	0.710	1.842
Miscellaneous	Ground floor dummy (first floor: 1, other: 0)	–	0.870***	−3.186	<0.01	1.098
	Business size (area)	m²	0.999***	−3.612	<0.01	1.098
	Official land price at the time of business opening	won	1.000	0.439	0.661	1.860
	Average change rate of the official land price	unit	0.862***	−27.333	<0.01	1.358

No. of observations: 6,138	No. of events observed: 2,403
Concordance: 0.737	Partial Akaike information criterion: 37739.890
Partial log-likelihood: −18846.945	Log-likelihood ratio test: 1278.588 on 23df

* p-value less than 0.1; **p-value less than 0.05; *** p-value less than 0.01.

the selectivity value, the greater the closure risk. This indicated that the probability of business closure increases as the business is located on the shortest path in an urban passage.

Regarding the accessibility factor, the accessibility from subway stations, parks smaller than 10,000 m², parks larger than 10,000 m², and public facilities (art galleries and atria) was analyzed; significant estimation results were derived for all variables. The risk ratio of the subway station accessibility was 1.00 (Z = −9.425), and the significance was less than 0.01; the better the accessibility, the lower the business closure risk. Here, the accessibility was weighted by the number of passengers arriving at the subway station, thus indicating that the closer the distance from the subway station with high usage, the lower the closure risk. Regarding accessibility to park facilities, the risk ratio of parks larger and smaller than 10,000 m² was 1.266 (Z = 2.208) and 0.830 (Z = −2.862), with a significance of 0.027 and 0.01 or less, respectively. Conflicting results were found according to the different scales of parks, implying that the closure risk increases and decreases when a business is located around a park with relatively large and small usage, respectively. This includes the amount, class, and area. However, the risk ratio of cultural facilities (art) was 0.763 (Z = −8.894), and the significance was less than 0.01; the better the accessibility, the lower the business closure risk. In particular, the closure risk of businesses with excellent access to art museums and art-related facilities was lowered.

The business aggregation and industry diversity were analyzed in a microscopic space unit of 100 m, and the entire commercial area's size in the agglomeration economy factor. The variables were the same type of business density (100 m), alternative type of business density (100 m), total business density (100 m), business diversity (narrow category, 100 m), business diversity (broad category, 100 m), same type of business density (total commercial area), total business density (total commercial area), and business diversity based on the same type of business (total commercial area). Within the range of 100 m, the risk ratios were 0.972 (Z = −3.946) and 0.985 (Z = −2.853) for alternative businesses and aggregation of the same type of businesses, respectively, with a significance of 0.01 or less. Thus, the more spatially concentrated the same type of businesses, the less the probability of closure. Specifically, the closure risk decreases because the menu items, such as Korean, Japanese, and Chinese foods, are the same, or the restaurant businesses with alternative goods, such as cafes, restaurants, fast food, and bars, are situated closely. In the commercial areas' overall spatial range, the risk ratio was 1.001 (Z = 1.834), and the significance was 0.067; the more the businesses had identical menu items within the commercial area's entire space, the higher the business closure risk. Nevertheless, the business diversity (broad category) was significant (0.037) only in the micro-space range of 100 m, and the risk ratio was 0.578 with a standardization coefficient of −2.082; the higher the business diversity in the alternative goods set classification, the lower the closure risk. This indicated that the probability of business closure increases when the consumption-linked companies, where each business's services can be consumed continuously over time, are spatially concentrated.

For the miscellaneous factor, whether the business is located on the ground floor, the store size, the official land price when the business opened, and the land price's average change rate were analyzed. Significant results were derived from the land price's average change rate, whether the business is located on the ground floor, and the store size. Whether the business is located on the ground floor was estimated as a dummy variable; furthermore, the risk ratio was analyzed to be 0.870 (Z = −3.186), and the significance was less than 0.01. The closure risk was also lowered when the business was located on the first floor, providing good accessibility for

pedestrian users. The business size (area) had a risk ratio of 0.999 (Z = −3.612). The significance was less than 0.01, indicating that the closure probability decreases when the business size increases. However, the official land price's average change rate during the business duration was 0.862 (Z = −27.333); moreover, the significance was less than 0.01, indicating that the greater the change rate, the lower the closure risk.

5. Discussion

The analysis results may be interpreted as follows:

First, in the urban form factor, this study speculated that the street landscape's physical environmental characteristics in the gentrified commercial areas would significantly affect the business operating environment of each store on the street. It was considered that the gentrified commercial area's spatial attractiveness, distinguished from the high occlusive street environment observed in the existing uniform central and station commercial areas, would affect the store's survival characteristics. This is because these existing areas have strong geographical advantages, while the gentrified commercial ones often lack such characteristics. Thus, it was assumed that a unique external environment harmonizing with the external environment would strongly impact the business operating environment. The D:H ratio and the average and variance of the buildings' elevations were measured as the basic physical environmental features. It was demonstrated that the smaller the D:H ratio observed in the established commercial areas, the higher the sense of the street view's closure because of buildings, the smaller the building entrance's size, and the higher the street business closure risk (hypotheses 1-1 and 1–2). The results are meaningful in that the landscape image of a commercial street formed by the physical environmental characteristics of the D:H ratio and the architectural scale affects the place's satisfaction and attractiveness for the pedestrians using it [73–75] and the probability of business closure in the gentrification commercial sites.

Second, in the urban spatial structure factor, the local integration degree (500 m) affected the lowering of the closure risk of a street business with a central status in the pedestrian area, that is, businesses that could be destinations for urban residents. The business closure probability decreases as the frequency of contact with the walking visitors targeting the street space increases. As initially demonstrated by Hillier et al. [76] and according to Choi and Koo [77], commercial facilities demonstrate a cluster phenomenon in spaces with high integration, even in Korea. This study provided further insight into and knowledge about the quantitative changes because of commercial stores' creation and extinction, shown in previous studies, by demonstrating that the closure risk of restaurant businesses decreases on streets with high integration. However, the degree of choice, which indicates walking and vehicle traffic mobility, showed a positive relationship in the 500 m and the entire space range (1000 m radius of the commercial area). Specifically, the closure probability increased in a street space with a high passing flow. According to Hwang et al. [78], the retail business is located on a busy street, while the restaurant business is located where the demand for the rent burden and closure to outsiders is secured. In particular, the traffic in the street space could act as a factor that hinders the restaurant business' closed environment. Therefore, the higher the degree of the street space selection, the greater the closure probability, as the minimum closure required by the restaurant store is not secured.

Third, in the accessibility factor regarding high-use subway stations, the better their accessibility, the greater the absolute frequency of contact between the floating population and businesses from the station. This is advantageous to the business environment, thus reducing the closure probability. Previous studies also found a positive relationship between proximity to subway stations and the business closure probability [9]. In this study, the inflow population from subway stations was added to control the accessibility factor and induce coherent results. Regarding the accessibility to art galleries, it could be interpreted that they help to form cultural images of various exhibitions and surrounding areas; furthermore, restaurants share a pool of consumers in common, thus reducing the business closure probability (hypothesis 2-1). Regarding the accessibility to parks, the better the accessibility to large-scale urban parks, the higher the closure probability (hypothesis 2-2). However, physical accessibility to small- and medium-sized parks demonstrated the opposite results. The location of restaurant businesses around the park generally increased their attractiveness, positively affecting the business environment. For large parks, however, negative effects resulted because the commercial supply exceeded the commercial demand; the increase in operating costs was greater than the effect of improving the business environment owing to the location attractiveness. Moreover, the better the accessibility, the higher the business closure probability.

Fourth, regarding the agglomeration economy factor and the number of businesses of the same type (narrow category) within the total commercial areas, the red ocean market was formed because of the quantitative increase in businesses selling similar products. Additionally, the rent increase owing to local commercialization negatively affected the business environment (hypothesis 3-1). Nevertheless, a contrary result was obtained within the 100 m microscopic space range. Regarding the number of businesses of the same type and the number of alternative businesses, both within 100 m, the probability of business closure decreased as the number of stores selling similar or alternative products increased (hypothesis 3-2). It could be understood that the gentrified commercial area has the characteristics of an alley commercial area where navigating is difficult because of the building's small size compared to the general commercial area. Thus, users prefer spaces with a concentration of similar businesses where the search and travel costs are minimized in selecting a destination. Regarding the business diversity of the broader category within 100 m, it was interpreted that if restaurant businesses in the common consumption group are located in the nearby areas, the consumer pool is shared, and consumption occurs simultaneously, thus lowering the business closure probability (hypothesis 3-3). This phenomenon occurs because visitors prefer a location that minimizes travel and search costs, as various types of restaurant businesses can be accessed simultaneously, such as eating in restaurants, resting in cafes, and drinking in pubs.

Fifth, in the miscellaneous factor, a business entry on the first floor lowered the probability of closure because it could secure visibility to the internal commercial space and increase street access. This result contradicted that of a previous study [9] that a surge in the land price because of a low-rise entry in developing commercial areas increases the business closure probability. Thus, in the

gentrified commercial areas, the store's interior becomes an important decision-making factor for consumer use; the more it enters the low-rise space, the more this promotion effect is maximized. Regarding the business size, there were various factors; however, it was interpreted that the smaller the size, the greater the disadvantage and the capital turnover rate. This result strengthened the validity of previous studies' findings [66]. Nevertheless, regarding the official land price's average change rate, the closure probability decreased as the value increased, which should be interpreted considering the current regulations. A rise in land prices does not immediately lead to a surge in rent prices because the Commercial Building Lease Protection Act regulates the rent increase's upper limit. In areas where the land prices continue to rise as the business environment for commercial purposes improves, the greater the increase in profits owing to improving the business environment, the lower the closure risk.

6. Conclusions

6.1. Significance of this study

The significance of this study can be summarized as follows: (1) verification of physical environment factors affecting business continuity, (2) effect of art museums and galleries on business continuity, (3) difference of effect on business continuity by park size, (4) effect of clustering aspect of gentrified residential and industrial areas' restaurant business on business continuity. In summary, this study discovered the effects of multiple parameters, including physical aspects and leisure facilities, on the business continuity of gentrified commercial areas.

First, this study verified that the physical environment affects businesses' continuity in the residential and industrial areas gentrified as the restaurant business. This study's physical environment variables, including D:H ratio, SBL_variance, spatial integration, and spatial choice, were significant factors for the Cox PH model. Although the existing literature indicated that the physical environmental characteristics affect the location identity and satisfaction [75], whether the actual business environment, such as sales and survival characteristics, is affected remained unclear. Therefore, although the case study was limited to gentrified commercial areas, it was meaningful as it proved that the commercial street's physical construction environment significantly affects the business environment.

Second, this study confirmed that art museums and galleries, which had been assumed to be restaurant businesses' anchor facilities, affect business continuity. Using the Urban Network Analysis Gravity index as a variable, it was found that the greater the accessibility to art museums and galleries, the lower the business closure risk, at a significance less than 0.01. According to existing studies on the cluster characteristics of art museums, galleries, and restaurants, cultural amenities provide a consumer pool to restaurants [45,79]. This study is significant as it confirmed that art museums and galleries as cultural facilities influence nearby restaurants' business continuity; additionally, it validated the explanation presented in a previous study from the survival analysis perspective.

Third, this research demonstrated that each type of park, according to the size standard, had a different effect on the business environment related to business continuity. The analysis showed that the better the accessibility to large-scale parks, the higher the business closure risk (significance <0.05). Contrarily, the better the accessibility to small- and medium-sized parks, the lower the business closure risk (significance <0.01). Park facilities had a positive effect on business continuity. However, for an urban park that attracts many visitors because of the large park size, eco-gentrification occurs, thus causing an increase in the land price of the surrounding area; this adversely affects the business environment. This study is meaningful as it shows how the existence of a large-scale park affects restaurant businesses' survival characteristics.

Fourth, this study investigated how the clustering of the gentrified residential and industrial areas' restaurant business specifically affects business continuity. The density of the homogenous and heterogeneous restaurant business was analyzed in the entire commercial area and the microscopic spatial range of the network distance of 100 m. Through this, it was found that the closure risk increases as more restaurants of the same type are in the entire commercial area. However, the former decreases as the latter in the microscopic space increases or the types of restaurant businesses in the common consumption group diversify. To explain this, this research applied the Huff [80] model to the (intra-) microscopic space unit (radius of 100 m) inside the commercial area. Furthermore, as many businesses have similar menus and common consumption groups, the greater the possibility of choosing an alternative commercial space, the higher the likelihood that the consumers will visit the area. Although limited to the gentrified urban space, this explanation is significant because it supports the agglomeration effect of the same industry that was previously positively divided.

6.2. Limitations

This study's limitations have been summarized as follows:

First, the variables related to the street space's landscape image were insufficiently considered. Thus, various street environment variables should be considered, such as the pavement, presence of street trees, street facilities, building facades, floating population, and the opening and closing of stores [81,82]. After incorporating these additional variables, structural equations must be constructed to proactively validate whether they exert any temporal or perceptual effects on pedestrians utilizing the horizontal space. However, in this study, in addition to analyzing the streetscape, the accessibility to other facilities and the agglomeration economy were considered. Thus, the analysis was conducted at the level of the street's physical shape characteristics. Recently, a street landscape evaluation method with artificial intelligence has been introduced to obtain a street's photographic image. In addition to the differentiation of variables, that of the measurement methods could be expected.

Second, the variables that violate the PH assumption were included in the analysis. It is controversial whether the Cox PH model includes those variables that do not satisfy the PH assumption. However, in biology and medicine, where the survival analysis models

are actively employed, even those variables that violate the assumptions are comprised in the model to increase the explanatory power rather than satisfy the assumptions. The derived results have been widely interpreted by the time-averaged hazard ratio during survival [[83],84]. Therefore, in this study, the variables that violate the PH assumption were included in the analysis to avoid difficulty in interpretation caused by converting the model into a multi-layered and time series one. This was done to satisfy the PH assumption and to secure the model's explanatory power. However, in subsequent studies, attempting a triangulation of the model's validity by conducting a survival analysis with a multi-layered and a time series model is necessary.

Third, this study did not consider the rental fees expected to have the most significant impact on the survival period of retail businesses. Unlike residential properties, obtaining rental fee information for commercial establishments often requires direct investigation because of the limited public disclosure of such data. Owing to the nature of the individual research, constructing a dataset for over 6,000 samples was not feasible. Thus, rental fee data could not be included in the analysis. Additionally, it was concluded that analyzing the partially disclosed data alone would deviate from the study's original purpose. If subsequent research incorporating rental fees is pursued, a detailed analysis of the survival and closure characteristics of food service establishments is anticipated.

Data availability statement

The data cannot be published because of the copyright policy of original data. The prepared data will be made available on request.

CRediT authorship contribution statement

Wonjun Cho: Conceptualization, Data curation, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **Youngsang Kwon:** Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Kwang Sik Jeong:** Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. **Jeyun Yang:** Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

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