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Formation of Employment Subcenters and Regional Industry Restructuring: Focusing Wholesale and Retail Sector in Incheon*

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Abstract

Purpose: This study examines the relationship between formation of employment subcenters and regional industrial structures in Incheon. **Research design, data, and methodology:** We used the five-year panel data from 2012 to 2016 in 146 basic municipal units of Incheon to analyze panel regression models. Gross employment density and employment to population ratio were used as indicators of employment subcenters formation. The entropy index and Hachman index were used for analyzing the diversity and heterogeneity of industrial structures. **Result:** The analyses of two panel regression models showed that for the formation of employment subcenters, both the Entropy and Hachman index were significantly negative in most models. But tertiary industry was shown to have a significant positive relationship in all models. In the wholesale and retail sector, it was found that the average number of employees in the employment subcenters is significantly higher than that in the non-employment subcenters. **Conclusions:** The specialization of the industrial structure rather than the diversification contributes to the formation of the employment subcenters in Incheon. In particular, it can be considered that the wholesale and retail sector plays a very important role in forming the employment subcenters in many areas of Incheon.

Keywords : Employment Subcenters, Entropy index, Hachman Index, Industrial Structure, Wholesale and Retail Sector.

JEL Classifications: C23, E24, L52, R58.

1. Introduction

The unemployment rate in Incheon has been the highest among the local governments, with an average of 4.5% over the last 16 years (2003 ~ 2018) (National Statistical Office, 2019). One of the reasons for this is the fact that the proportion of the manufacturing industry, which is the main industry in Incheon, is decreasing in all aspects of production and employment, while the growth of service industry is not progressing smoothly. In other words, the manufacturing industry is stagnant in terms of high value-added upgrading, and the service industry, which is increasing the share of employment in the region, is still in very weak situations in terms of competitiveness or regional bases. This aspect emphasizes the need for differentiated policy considerations for employment-induced industrial structures in Incheon. How can this employment-inducing industrial structure be identified? With the construction of new towns such as Songdo, Cheongra, Yeongjong, etc., Incheon is gradually progressing from a single employment subcenter city to a multi-core employment subcenter city. This suggests that we should look at Incheon's employment policy centered on employment subcenters where jobs are concentrated and thus cause various economic activities.

To this end, it is imperative to first examine which industries are leading the formation of the employment subcenters. In particular, we would like to focus on the role of wholesale and retail sector in service industry. In addition, for regional industrial policies, it is necessary to find out whether these employment-centered industries differ in each region. Incheon is divided into the urban area centered on service industry, the industrial park area which is centered on manufacturing industry, and the island area centered on agriculture and fishery industry. In other words,

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in order to derive appropriate regional industrial policies for each employment subcenters, it is necessary to examine whether the clusters or industrial structures of these industries differ depending on their respective employment subcenters.

Thus, the purpose of this study is to empirically investigate the relationship between employment subcenters and employment-inducing industrial structures in Incheon. In doing so, we would like to answer two questions: First, what features of industrial structure do employment subcenters in Incheon have? How diverse are the employment subcenters in Incheon in terms of industrial structures? Second, how is the wholesale and retail sector related to the formation of employment subcenters in Incheon. To this end, we use the five-year panel data from 2012 to 2016 in 146 basic units of Incheon to analyze panel regression models. Following the introduction, we review the theoretical background used in this study and previous domestic and international studies in part 2. We present data and variables for empirical analysis in part 3. After part 4 explains the model, part 5 shows the empirical results and part 6 explains conclusion.

2. Literature Review

2.1. Employment subcenters

In general, the urban spatial structure goes through a decentralization process that grows and spreads through the spatial centering of the population and employment. Employment subcenters created in this process can be said to have high employment concentrations compared to its neighboring areas. According to the theory of urban space structure, employment subcenters arise and grow in relation to economies of scale for agglomeration economies and productivity (Krehl & Siedentop, 2019). In other words, firms are trying to be located in employment subcenters to secure better labor, increase knowledge diffusion, and reduce production costs by sharing inputs. The indicators that can be used to identify employment subcenters include gross employment density, net employment density, employment to population ratio, gross population density and net population density. Among these indicators, McDonald (1987) suggested gross employment density and employment to population ratio were the best indicators of employment subcenters.

Studies that identified employment centers through the statistical model analysis included Gordon, Richardson, and Wong (1986), who viewed the regions with high t-values in the employment density model, as well as McDonald and Prather (1994), who identified the regions with high residuals as employment subcenters in the Chicago suburbs. Studies using variables other than gross employment densities include Shukla and Waddell (1991), who identified the location of businesses, and Heikkila, Johnson, Gordon, Kim, Peiser, and Richardson (1989), who identified employment subcenters through land price models.

As mentioned above, previous studies related to employment subcenters have mainly focused on identifying employment subcenters and examined changes in the employment subcenters. However, there are relatively few studies that strive to empirically analyze and understand the characteristics of the industrial structure that influence the formation and growth of employment subcenters. Thus, this study attempts to estimate an empirical model that captures these characteristics using gross employment density and employment to population ratio as the dependent variables according to the recommendations of McDonald (1987).

2.2. Diversity of the industrial structure

The theoretical argument that employment distribution by the industry or the industrial structure can affect employment is based on the theory of economic geography. According to this theory, in the presence of various externalities that cause economies of scale, firms can be concentrated in specific regions, resulting in different industrial structures and growth paths, even in regions with similar resources and characteristics. This externality can be seen through the industrial specialization (Marshall, 1975; Romer, 1986) or through the diversity in industrial structures (Jacobs, 1969; Song, 2019; Wang et al., 2017; Kim, 2018; Mengmeng, 2018).

If the theory of industrial specialization is valid, regional industrial policies should be prepared in the direction of fostering only a few industries with comparative advantages in each region (Diamond & Simon, 1990; Shao, 2018). Since 1999, local governments in Korea have implemented regional strategic industry promotion policies to select and foster local strategic industries. In order to find out how the diversity or specialization of industrial structure in each region affects the formation of employment subcenters, it is necessary to first consider the indicators that measure the diversity of the industrial structure itself.

As for the methodology for measuring the diversity of industrial structures, it can be divided into the approach based industrial organization theory and the approach based economic base theory. In the first approach, indicators for measuring the diversity of regional industrial structures include the Ogive Index (Rodgers, 1957; Mack et al., 2007), the Herfindal Index (Simon, 1988; Simon & Nardinelli, 1992), and the Entropy Index (Hackbart &

Anderson, 1975; Trendle & Shomey, 2003; Ryu & Lee, 2012).

The different indicators are used to measure the degree of diversity of industrial structures because there is no consensus on which economic conditions are considered to be fully diversified (Gnidchenko, 2011). In other words, various diversity indices have been developed because they have each chosen a different reference economy that can become the standard of diversity indices. However, all of these indices are generally similar in that they use the number of employees in each industry as basic statistics.

In this study, empirical analysis will be performed using the entropy index. The entropy maximization approach proposed by Hackbart and Anderson (1975) and applied to empirical analysis by Kort (1981) and Trendle and Shorney (2003) is the application of the entropy law of physics. Following Smith and Gibson (1988), the entropy index of economic diversity can be defined as follows:

$$\text{Entropy index } = \sum_{i=1}^{N} S_i \ \ln(\frac{1}{S_i}) = -\sum_{i=1}^{n} S_i \ln(S_i),$$

where N is the number of sectors, S_i is share of economic activity in ith industry and ln is the natural logarithm. The entropy measure compares the existing employment or income distributions among industries in a region to an equiproportional distribution. Higher entropy index values indicate greater relative diversification, while lower values indicate relatively more specialization. The maximum value of the measure would result with the equal distribution of employment among all industries. The minimum value of zero (maximum specialization) would occur if employment were concentrated on one industry. On the other hand, if employment were distributed equally among the N sectors, the entropy index would reach its maximum value, indicating perfect diversity. Although both indexes yield similar diversity rankings to regions, the entropy index is the more popular measure of sectoral concentration among the regional scientists.

Second, the indicators of industrial diversity based on the economic base theory include the location quotient (LQ) and the Hachman Index (Hoover & Giarratani, 1984). LQ is one of the most widely used measures of specialization in a given sector and industrial concentration of a regional economy. The summation of sectoral LQs, also referred to as the coefficient of specialization, is used as a measure of regional specialization. Similarly, the reciprocal of the sum of location quotients weighted by industry shares gives the Hachman index of economic diversity as follows:

$$\text{Hachman Index} = \frac{1}{\sum_{i=1}^{N}[(\frac{S_i^{Reg}}{S_i^{Inc}})\times S_i^{Reg}]} = \frac{1}{\sum_{i=1}^{N}[LQ_i \times S_i^{Reg}]},$$

where S_i^{Reg} is a region's share of employment in the ith industry, S_i^{Inc} is the Incheon share of employment in the i th industry, and N is the number of industry. The Hachman index is an indicator that measures how closely the region's industry employment distribution compares to that of Incheon. This measure is bounded between 0 and 1, where 1 means the region has exactly the same industrial structures as Incheon, and 0 means it has a completely different industrial structure. In this study, we used both the entropy index and the Hachman index, which have different theoretical foundations, as indicators of regional diversity.

3. Variables

In this study, a panel data analysis is conducted to analyze the impact of regional industrial structures on employment subcenters formation using five-year data from 2012 to 2016 in 146 basic municipal units of Incheon (1 town(eup), 19 township(myeon)s, 126 neighborhood (dong)s).

Table 1: Descriptive Statistics

Variable	Variable description	Mean	Standard Deviation	Median	Min	Max
Dens	Gross employment density (employment/area)	3 7.3	35.0	30.4	0.06	191.6
Emp	Employment-population ratio (employment/population)	34.8	35.2	23.4	3.1	246.4
Ent	Entropy index	2.1	0.3	2.2	0.8	2.6
Hac	Hachman index	0.5	0.2	0.6	0.01	0.9
Prim	Number of primary industry employees (1 industry)	1.2	5.1	0.0	0.0	55.0
Seco	Number of secondary industry Employees (5 industries)	1,965.	5,602.4	452	0.0	58,434
Tert	Number of tertiary industry employees (13 industries)	4,446	4,428.1	3,626	77	33,928

The employment by industry, area, and population of basic municipal units in Incheon used statistical data provided by the National Statistical Office. The dependent variables are the gross employment density and the employment to population ratio, and the independent variables are the indexes representing the diversity and heterogeneity of the industrial structure and the employment by industry. The entropy index and the

Hachman index are used as industry diversity and heterogeneity indexes. The employment of each industry is examined by the employment of 21 industries by the main category of Korean Standard Industrial Classification (KSIC). The classification of primary, secondary and tertiary industries used Clark's (1940) method. The basic statistics of the variables used to estimate the panel regression model are as follows.

The table below shows the correlation coefficients of the independent variables and the VIFs (Variance Inflation Factors) for multicollinearity diagnosis.

Table 2: Correlation and VIF

	Ent	Hac	Prim	Seco	Tert
Ent	1	0.32***	-0.07	-0.54***	0.1***
Hac		1	-0.2***	0	0.02
Prim			1	-0.02	-0.06
Seco				1	0.3***
Tert					1
VIF	1.30	1.28	1.18	1.34	1.33

Notes:*** indicate that the estimated correlation coefficients are statistically significant at 1%.

4. Model

The panel regression analysis can be used to estimate the dynamic relations of individuals and to consider the unobserved heterogeneity factors in the model, rather than using pooled OLS (Ordinary Least Squares) using cross-sectional analysis. The panel model also has the advantage of providing more information and variability to obtain an efficient estimator and to mitigate multicollinearity problems (Baltagi, 2005; Hsiao, 2014). Recently, statistical analysis using panel data has been performed in many applications(Tahir & Mushtaq, 2016; Lee, 2019; Sheikh et al., 2019; Bong & Premaratne, 2019; He & Wang, 2019; Agustina & Pramana, 2019; Yim, 2019; Kim & Kim, 2019).

In this study, two panel regression models with different dependent variables are estimated to secure the robustness of the estimation results. In other words, the dependent variables are divided into two variables: gross employment density and employment to population ratio. Therefore, two panel regression models to be estimated in this study can be expressed as follows.

$$(1)\ Dens_{it} = \beta_1 Ent_{it} + \beta_2 Hac_{it} + \beta_3 Prim_{\mathrm{it}} + \beta_4 Seco_{it} + \beta_5 Tert_{it} + u_{it},$$
$$u_{it} = v_i + \epsilon_{it}$$

$$(2)\ Emp_{it} = \beta_1 Ent_{it} + \beta_2 Hac_{it} + \beta_3 Prim_{\mathrm{it}} + \beta_4 Seco_{it} + \beta_5 Tert_{it} + u_{it},$$
$$u_{it} = v_i + \epsilon_{it}$$

The two dependent variables, $Dens_{it}$ and Emp_{it} represent Gross employment density and employment to population ratio in region i of year t, respectively. The independent variable Ent_{it} represents entropy index and Hac_{it} represents Hachman index, and im_{it} , $Seco_{it}$, and $Tert_{it}$ represent the employment of the primary, secondary, and tertiary industry, respectively Among the elements constituting the error term u_{it}, v_i is time-invariant and it accounts for any individual-specific effect that is not included in the regression (Baltagi, 2005, p.15). In this case we could think of it as the region's unobserved characteristics. The error ϵ_{it} is often called the idiosyncratic error or time-varying error, because it represents unobserved factors that change over time. These are very much like the errors in a straight time series regression equation.

If $v_i = 0$, there is no regional heterogeneity that is not observed in this model, so we can ignore the characteristics of panel data and estimate it as a pooled OLS. A test for this is the F test for individual effects, the results of which are shown in Table 3 below. The first row of Table 3 shows that the null hypothesis that there is no observed regional heterogeneity is strongly rejected in all four models. In other words, the above four models are appropriate to be estimated by fixed effects models or random effects models rather than simple pooled OLS models.

Table 2: Model Validity Test

	Model (1)	Model (2)
F test for individual effects	F = 202.31, df1 = 145, df2 = 579, p-value<0.000	F = 26.507 df1 = 145 df2 = 579 p-value<0.000
Hausman test	χ^2 = 8.645, df = 5 p-value=0.124	χ^2 = 13.6, df = 5 p-value=0.018
Breusch-Pagan test	χ^2 = 5930.7, df = 150 p-value<0.000	χ^2 = 8184.5, df = 150 p-value<0.000

If v_i is a fixed variable that is estimated to be different for each region, the above equation can be estimated by applying fixed effects model. However, if v_i is determined randomly, the above equation is estimated by applying the random effects model. This estimator considers the individual effects as random draws from a specific distribution and seeks to estimate the parameters of this distribution in order to obtain efficient estimators of the

slopes (Croissant & Millo, 2019). It is not easy to determine in advance whether the above panel regression model is to be understood and estimated as a fixed effects model or a random effects model. Therefore, this study tests the null hypothesis that the random effects model is valid using the Hausman test, and estimates one of the fixed effects model and the random effects model based on the results. In the second row of Table 3, the p value of the Hausman test is the value for the null hypothesis that the random effects model is valid. At the significance level of 5%, the null hypothesis that the random effects model is valid for the first model was adopted, and the null hypothesis was rejected for the second models.

Finally, there is the Breusch-Pagan Test for heteroskedasticity. Independent and identically distributed errors can seldom be taken for granted in the mostly non-experimental contexts. In particular, variance estimates derived under the random sampling assumption are typically biased inference (Croissant & Millo, 2019; Githaiga, 2020; Bitok et al., 2020). If heteroskedasticity is detected we can use robust covariance matrix to account for it (Kim & Go, 2017). As shown in the third row of Table 3, the null hypothesis for homoscedasticity was rejected in both models. Therefore, in this study, a robust general covariance matrix with a fully general structure with respect to heteroskedasticity and serial (cross-sectional) correlation is obtained according to the method proposed by Thompson (2011) to achieve unbiased inferences for estimates.

5. Results

5.1. Estimation results

Table 4 shows the results of the two panel regression models that estimate the effects of diversity and heterogeneity of regional industrial structures on employment subcenters formation, measured by the entropy index and the Hachman index. Among the estimation models, RE is the results obtained by using the random effects model, and FE is the results obtained by the fixed effects model. The parentheses are the standard errors obtained using the robust general covariance matrix. The estimation results show that the signs of the significant estimates all agree with expectation.

First, the estimates of the entropy index are shown as significant negative signs in both models. This shows that the specialization of the industrial structure rather than the diversification of the industrial structure in the Incheon area contributes to the formation of employment subcenters. Second, the estimates of the Hachman index also show significant negative signs in both models. Since the Hachman index shows how heterogeneous the industrial structure of each region is from the overall industrial structure of Incheon, this estimation result shows that the more heterogeneous the industrial structure of each region is from the average industrial structure of Incheon, the more likely it is to be formed as employment subcenters. This fact confirms that the industrial geographic characteristics of Incheon are very diverse. Third, in the relationship between the formation of employment subcenters and the amount of employment by industry, the tertiary industry showed a positive relationship in both models. This fact indicates that Incheon is rapidly moving from a manufacturing-oriented industrial structure to a service-oriented one.

Table 3: Results

Independent variables	Dependent variable	
	Gross employment density	Employment to population ratio
	Random Effect (RE)	Fixed Effect (FE)
Entropy index	−879.990** (428.990)	−10.547*** (2.337)
Hachman index	−1702.1*** (615.370)	−23.178*** (6.161)
Primary	−5.092 (7.333)	0.123 (0.069)
Secondary	−0.079 (0.058)	0.001 (0.001)
Tertiary	0.346*** (0.015)	0.003*** (0.0002)
Constant	5141.7*** (944.91)	
R^2	0.5088	0.2360
N	730	730

Notes: Robust standard errors in parentheses, *, **, *** indicate that the estimated coefficients are statistically significant at 1%, 5%, 10% levels, respectively.

5.2. The Formation of employment subcenters and the wholesale and retail employment

In the previous section, it was found that the tertiary industry had a positive relationship with the formation of employment subcenters. Here, we would like to find out more about the role of the wholesale and retail sector in the tertiary industry in comparison with the manufacturing sector. As shown in Table 5, Incheon's total employment has been growing at an average annual rate of 3.4% from 2012 to 2016. The wholesale and retail sector, which accounts for 14% of Incheon's total employment, has been growing at an average annual rate of 3.6%. In contrast,

during the same period, the manufacturing sector, which was the representative industry in Incheon in the past, grew by only 2.0% per year, and its share of total employment also decreased from 26% in 2012 to 25% in 2016.

Table 5: Average Annual Growth Rate of Wholesale and Retail

Industry	2012	2013	2014	2015	2016	Average annual growth rate
Total employment	871,532	899,057	931,879	982,068	997,049	3.4
Wholesale and retail	121,125 (0.14)	126,375 (0.14)	129,776 (0.14)	135,409 (0.14)	139,503 (0.14)	3.6
Manufacturing	228,556 (0.26)	229,736 (0.26)	235,134 (0.25)	242,106 (0.25)	247,340 (0.25)	2.0

How is this steady growth in the wholesale and retail sector related to the formation of employment subcenters? In the following, we will examine the differences in the employment of the wholesale and retail sector between the regions identified as employment subcenters (employment subcenters) and the rest of regions in Incheon (non-employment subcenters), comparing with the manufacturing sector. There are many ways to identify employment subcenters, including absolute standards and relative standards using statistical techniques (McMillan, 2001). In this study, we use the two methods that are frequently used as absolute standards. In other words, we use Green (1980)'s method of identifying areas where employment density is more than twice the average as employment subcenters, and the method of Giuliano and Small (1991), which judges the employment subcenters as areas with more than 2,500 employment densities and more than 10,000 total employment densities. In Green (1980), only employment density is used as a key indicator in determining employment subcenters. In this case, the population-intensive urban service sectors are likely to emerge as the major industry sectors of employment subcenters. Giuliano and Small (1991), on the other hand, consider the total number of employees in addition to the employment density, increasing the possibility of identifying suburban areas such as industrial areas as employment subcenters.

Table 6 shows the number of basic municipal units identified as employment subcenters by the above two methods and the average number of employees in the wholesale and retail sector and manufacturing sector in the employment subcenters by year 2012 through 2016. The numbers in parentheses indicate the number of basic municipal units, the average number of employees in the wholesale and retail sector and the manufacturing sector in the non-employment subcenters. In 2016, for example, in Green (1980),16 of the 146 basic municipal units were identified as employment subcenters in Incheon. The average employment of the wholesale and retail sector and the manufacturing sector in these employment subcenters was 1,790 and 2,176, respectively.

On the other hand, there are 130 non-employment subcenters, in which the average number of employees in the wholesale and retail sector and the manufacturing sector is 852 and 1,634, respectively. Parametric Welch t-test and nonparametric Wilcox test were conducted to verify whether the average number of employees in the wholesale and retail sector differed between the employment subcenters and the non-employment subcenters(. According to the classification of Green (1980), all five years showed a significant difference. In other words, the average number of the wholesale and retail workers in the employment subcenters is significantly higher than that in the non-employment subcenters. In contrast, in the manufacturing sector, the differences between the two subcenters are not significant.

According to Giuliano and Small's (1991) classification, the wholesale and retail sector showed a significant difference with the same result as Green's classification, but the manufacturing sector shows a significant difference between the employment subcenters and the non-employment subcenters, unlike the result of applying Green's (1980) classification. This is because Giuliano and Small (1991) consider the total number of employees, and many industrial areas scattered in Incheon were identified as the employment subcenters.

In the above, in the wholesale and retail sector, it was found that the average number of employees in the employment subcenters is significantly higher than the average number of employees in the non-employment subcenters on both classification criteria for identifying the employment subcenters. In other words, the employment level of the wholesale and retail sector is high in both the existing urban areas and the industrial areas, and it can be seen that the wholesale and retail sector plays a very important role in forming the employment subcenters in many areas of Incheon.

Table 6: Relationship between Employment Centers and Wholesale and Retail Employment

Definition	Industry	2012	2013	2014	2015	2016
Green (1980)	Employment Subcenters	17 (129)	16 (130)	17 (129)	18 (128)	16 (130)
	Wholesale and retail (Welch t-test) (Wilcox test)	1.645 (722) * ***	1,862 (742) ** ***	1675 (785) * ***	1,701 (818) ** ***	1,790 (852) ** ***
	Manufacturing (Welch t-test) (Wilcox test)	2,204 (1,481)	2,028 (1,517)	2,105 (1,545)	2,456 (1,546)	2,176 (1,634)
Giuliano & Small (1991)	Employment Subcenter	14 (132)	15 (131)	16 (130)	18 (128)	17 (129)
	Wholesale and retail (Welch t-test) (Wilcox test)	2,298 (673) *** ***	2,280 (703) *** ***	2,246 (721) *** ***	2,277 (737) *** ***	2,266 (782) *** ***
	Manufacturing (Welch t-test) (Wilcox test)	8,896 (787) ***	8,714 (755) * ***	8,344 (781) * ***	7,400 (850) ***	7947 (870) ***

Notes: *, **, *** indicate that the estimated coefficients are statistically significant at 1%, 5%, 10% levels, respectively.

6. Conclusions

6.1. Discussions and implications

In Incheon, employment subcenters with various industrial structures are increasing in line with the expansion of multi-nuclearization of urban spaces. The purpose of this study was to examine the relationship between the formation of employment subcenters and regional industrial structures. In other words, it was to find out how the diversification or the specialization of the industrial structure is related to the formation of employment subcenters, and in particular, which industries cause the formation of employment subcenters. In this study, panel regression models were estimated using regional statistics from 146 basic units of Incheon. The implications of the main results obtained from the empirical analysis of this study are as follows.

First, as seen from the relationship between the employment subcenters and the entropy index, the Incheon area shows that the specialization of the industrial structure rather than the diversification of the industrial structure contributes to the formation of the employment subcenters. Thus, it suggests that the employment centers in Incheon are formed with specialized industrial structures. In fact, Incheon's main districts can be divided as followers: the old town area centered on the traditional urban service industry (Dong-gu and Nam-gu) , the new city area centered on the business service industry (Seo-gu and Yeonsu-gu), the industrial area of the manufacturing industry (Namdong-gu), the airport-seaport area centered on the transportation service industry (Jung-gu), and the island area centered on the agricultural and fishery industry (Ganghwa-gun, Ongjin-gun).

Second, most local governments, such as Incheon, have their own regional industrial policies and develop policies to discover and foster unique and promising industries suitable for their regional characteristics. However, the fact that the relationship between the employment subcenters and the Hachman index is negative in this empirical analysis suggests that the industrial structure of individual regions is more employment-oriented than the overall industrial structure of Incheon. This implicates that promising industries in Incheon should be selected at a more detailed regional level than the overall city level.

Third, the high correlation between the employment center and the service industry in Incheon shows once again that the industrial structure of the Incheon area has changed from manufacturing to service. In particular, we tried to find out how the employment in the wholesale and retail sector is related to the formation of employment subcenters. By testing for differences between means, it was found that the average number of employees in the employment subcenters is significantly higher than the average number of employees in the non-employment subcenters on both classification criteria for identifying the employment subcenters. According to these results, it can be considered that the wholesale and retail sector play a

very important role in forming the employment subcenters in many areas of Incheon.

6.2. Limitations and future directions for research

This study aimed to investigate the regional industrial structures that can contribute to the formation and development of employment subcenters by paying attention to various employment subcenters in Incheon as a way to solve the employment problem in Incheon. The limitations of this study and additional research directions are as follows.

First, in this study, the employment-oriented industrial structure can be easily achieved as the differentiated industrial structure are suitable for regional characteristics. However, in most regions, employment-based promising industries are often determined in larger regions. In smaller areas, it is more common to engage in competition to attract promising outsiders rather than discovering their own specialized industries. In other words, even if the proposition is sound that regionally differentiated promising industries are desirable, the problem of how to discover promising industries and grow them into employment centers still remains a local problem.

Second, empirical analysis using the regression model is limited in that it is based on historical data. In other words, it is important to point out that the regression model is difficult to reflect upon for the important fact that a new industry is emerging. In most local economies, industrial structures need to be diversified. This suggests that it is more desirable to discover and foster new industries than to establish policies by focusing on many of the existing industries in the region when implementing regional strategic industry promotion policies. Thus, if a long-term policy and strategy is properly implemented from a dynamic point of view, it is possible to diversify the regional industrial structure by fostering new industries, thereby promoting regional economic growth.

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