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Impacts of New Town Developments on Urban Shrinkage in Their Surrounding Areas*
: Focusing on Non-capital Region

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Abstract

New towns developed in suburban areas have played some positive roles, such as eliminating overcrowding in central cities and distributing population and housing to outer areas. However, in this era of low growth, there has been a critical view on new towns that new towns contribute to excessive expansion of urbanized areas and decline of central cities. Some studies identified that old towns and their adjacent areas experienced urban decline due to the new town development. However, most previous studies focused on single urban case without comprehensive discussions on the relationships between new towns and shrinking cities. In addition, little has been known about the impacts of new town developments at the regional scale, such as the urban region. Given this background, the purpose of this study is to analyze the effects of new town developments on urban shrinkage by taking into account the size and location of new town developments and their regional impacts using multinomial logistic regression. The analysis results reveal that development of new towns affects the shrinkage of adjacent cities. And the results imply that policy makers need to consider unintended consequences of the new town developments on surrounding shrinking cities and urban management policies at the regional scale.

Keywords New Town Development, Shrinking City, Urban Region Area, Urban Decline, Multinomial Logistic Regression Model
주제어 신시가지개발, 축소도시, 도시권, 도시쇠퇴, 다항로짓모형

Ⅰ. Introduction

Several attempts made in the form of large-scale new town development projects under the 「Housing Site Development Promotion Act」, 「Special Act on Public Housing」, etc., have thus far focused on tackling the issues of urban centralization and housing shortage. Yet, given the low population growth and over-100% of housing supply ratio, now is the time to more carefully consider other factors, including the location and position of a target city, when planning the large-scale housing development projects. However, in many cities across the country, new towns are being created in suburban areas, hoping for further growth (Kim, 2004), and various side effects have been raised as well, such as the

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decline of old towns due to the development of new towns (Eom and Woo, 2014; Kim and Lee, 2002). In particular, the closer it is to a new town and the larger the new town is, the greater the degree of decline observed in the existing old towns and the neighboring cities. These phenomena are observed both in capital and non-capital regions alike (Lim, 2008; You et al., 2012; Kim and Hur, 2017). In response to these trends, some have suggested the need for a broader, regional-scale approach that comprehensively considers the region where the old and new towns coexist to minimize the negative side effects of the urbanization caused by the development of new towns (You et al., 2012; Eom and Woo, 2014).

Meanwhile, in small and medium-sized cities in non-capital regions in Korea, urban decline is observed, in which the city loses its vitality in various aspects such as population, society and economy, etc.; in some cities, urban shrinkage is even being discussed, in which severe population decline occurs due to vicious structural cycles (Audirac et al., 2012; Lee et al., 2018; Ahn, 2020). With regard to this, a study was conducted to identify cities experiencing urban shrinkage based on the rate of population decrease (Lee and Han, 2014; Lee, 2016; Koo et al., 2016), and a growth strategy encompassing urban areas and their neighboring regions is proposed in an effort to secure the sustainability and competitiveness of small and medium-sized cities in non-capital regions (Lee, 2002; Im et al., 2018; Kim and Woo, 2018; Kim and Woo, 2019; Shin and Woo, 2020).

Taken together, it can be said that new towns are being developed all over the country despite the ever-declining growth and expansion rate of the domestic population and cities, and the urban decline of the old towns and neighboring cities due to the new town development is being discussed in academia. The situation signifies that the decline of small-and-medium-sized cities can be further accelerated if a new town is created adjacent to those cities already experiencing urban decline, which could potentially lead to urban shrinkage with severe reduction in population. The existing literature has mostly involved research conducted on single cities, in which a new town development is planned, with only few comprehensive discussions made on the implications of new town development and urban shrinkage. To take into account not only the city with new town development plan but also its neighboring cities and regions, a broader perspective at the level of the urban region area is required for valid analyses and discussion. Even though an approach covering urban region areas is called for to secure sustainability and competitiveness in small-and-medium-sized cities in non-capital regions, relevant research has been insufficient. Against this backdrop, this study aims to empirically analyze the impact of new town development on urban shrinkage in non-capital region where the urban shrinkage phenomenon is being observed, based on the perspective of the urban region areas.

Ⅱ. Literature Review

1. Studies on New Towns

1) Concept of a New Town

A new town is a concept that contrasts with the old town. In preceding studies, new cities and downtowns outside a city's central area were defined as new towns. Eom and Woo (2014), Hwang and Koo (2012) defined the housing site districts, as prescribed by the 「Housing Site Development Promotion Act」, as new towns. Similarly, in Kim and Hur (2017), the new town was defined as a planned city created artificially in the outskirts by the government in order to solve the problems of metropolitan cities after the mid-20th century. Yuh and Ahn (2006) defined a new town as a new region created in the suburbs of a city to alleviate the overcrowding in large cities and shortages in housing and housing sites. In Jin (1998), a new town was defined as an area having the characteristics of a large-scale housing complex in an outer area developed by the government based on its large-scale housing supply policy.

To sum up, new towns are not areas naturally formed over time, but areas that have been deliberately developed for the purpose of housing supply. Therefore, in this study, housing sites under the 「Housing Site Development Promotion Act」 as well as the public housing districts under the 「Special Act on Public Housing」 are defined as new towns. In addition, urban development zones under the 「Urban Development Act」 are also included in the definition of a new town, considering that the residential complexes are being created in non-capital regions based on the same act.

2) Impact of new towns on a city

New towns created in suburban areas in the past to resolve the overcrowding issues of metropolitan cities have led to positive results; however, there is a critical view against such towns, arguing that significant manpower and material resources are excessively funneled into new towns in the midst of the era of low growth (Kim, 2007).

There have been several studies conducted on the correlation between new town development and the decline of old towns, focusing on the capital region. The closer the new town is to an old town, the more severely the old town's industrial function declines, and the degree of decline is especially serious in urban-type industries, such as accommodation, food services, finance and insurance industry (Lim, 2008). It was found that the larger the size of the housing site district to be created, the greater the negative impact on the neighboring old towns (Kim and Hur, 2017). As the spatial expansion of residential and commercial areas adjacent to the new town has occurred, and with a new urban axis formed, the need for urban spatial restructuring is emerging (Kim and Lee, 2002).

In studies conducted in non-capital regions, the urban decline in neighboring areas due to the development of new town presented a similar aspect as well (Choi, 2005; Lee and Shin, 2007; You et al., 2012). In Choi (2005), which analyzed the impact of new towns in Gangneung-si, showed the population redistribution phenomenon leading to population growth in new towns through a population transfers analysis. It was also found that the population moving in from adjacent locations was greater than those moving in from remote areas. This means that the neighboring regions of the new town have suffered the urban decline due to the new town development. Similarly, Lee and Shin (2007) categorized the types of new towns in Jejudo Island to analyze the impact of new towns on population, suggesting that the new town development in small and medium sized cities have more negative impact such as excessive unsold housing and green belt destruction than positive ones like large-scale housing supply. In line with that, in non-capital regions, new towns were developed in suburban areas thanks to the advanced transportation and expanded infrastructure, and the new towns were found to absorb the population in the suburban areas, including that of the old towns. It was also found that the smaller the size of an old town, the more severe urban decline it may suffer due to the development of a new town (You et al., 2012).

In preceding studies, it was found to be common that new town development caused outmigration within the same region, potentially leading to decline in the old towns and neighboring cities. In this sense, the need for a regional-scale approach has emerged to more comprehensively considers the old towns and the new town development area before implementing reckless development of a new town (You et al., 2012; Eom and Woo, 2014).

2. Studies on Urban Region and Shrinking Cities

1) Studies on Delineation of Urban Region

Most previous studies regarding definition of the urban region areas have set final urban region areas by defining a certain scope around a central city first, and then identifying the relation between the central city and other cities within the scope (Kim and Kim, 2004; Shim and Yeon, 2011; Joo et al., 2014). Joo et al.(2014) pointed out the limitations lying in the existing metropolitan region definition method, which indiscriminately sees the area within a 50 km radius of a central city as a metropolitan region area. In this sense, this study defined the metropolitan region based on the connectivity index using freight traffic and public transportation of the regions within a 60-minute distance by car from the central city. Similarly, Shim and Yeon (2011) considered the metropolitan transportation network and defined the metropolitan region based on the connectivity index of the regions within a 60-minute distance by car from the central city and the urban characteristics index of its neighboring regions. Kim and Kim (2004) specified the metropolitan planning zones as the region within a 60 km distance (one-hour driving distance by car) from the central city, based on the connectivity, accessibility, and urbanity.

Meanwhile, some studies have focused on connectivity between central and surrounding areas rather than physical spatial range (Lee and Song, 1995; Kwon, 2001). In Kwon (2001), the metropolitan region within the capital area was established based on the connectivity index using commuter data and the urbanity index calculated from the farm household rate, population density, and urban land use rate. Lee and Song (1995) delineated the Seoul metropolitan zone

utilizing the connectivity and urbanization indicators which indexed the degree of functional interaction of the zone with the central city.

As such, while existing studies defined urban areas based on physical spatial scope and the connectivity index between the central city and its surrounding cities, the process of selecting cities for a certain urban region seemed to be lacking in objectivity. In order to establish an objective definition of urban region, a study was conducted in which urban regions were delineated using the minimum travel time based on the travel probability with the travel Origin-Destination (OD) data (Kim and Woo, 2018).

2) Studies on Identification of Shrinking City

Many small and medium-sized cities in Korea are experiencing population decline, and this trend is expected to continue. In particular, in some cities, the concept of a shrinking city has been proposed; it does not mean a temporary decline of city in terms of the urban life cycle, but a long-term and continued phenomenon of decline as a structural vicious cycle (Soja, 2003). This shrinking city is a concept that is clearly different from the urban decline phenomenon. Though there are no clear criteria for determining a shrinking city, some domestic studies have identified the shrinking cities using the population index as shown in Table 1 below (Lee and Han, 2014; Lee, 2016; Koo et al., 2016).

Lee and Han (2014) defined a city where population and financial independence declined on average over the past 10 years as a shrinking city. The shrinking cities were identified excluding the capital region, metropolitan cities, and cities with a population of 500,000 or more, and the results showed that the shrinking cities identified have a higher proportion of elderly population and weak industrial base. Lee (2016) identified a shrinking city based on the demographic structure, by calculating the local extinction risk index; this is the relative ratio of the female population of childbearing age to the elderly population. Koo et al (2016) argued the occurrence of urban shrinkage in which population declines and old houses are left neglected due to economic and demographic characteristics of small and medium-sized cities in non-capital regions, and identified the shrinking cities based on the analysis of long- and short-term patterns of population changes.

Table 1. Selection criteria for shrinking cities

Classification	Selection criteria for shrinking cities
Lee and Han (2014)	• Decreased annual average population change rate over the last 10 years • Deceased financial independence (except Seoul Metropolitan Area, metropolitan cities, and cities with populations over 500,000)
Lee (2016)	• Less than 0.5 of shrinking index ({ratio of population of female aged 20-39 (female of childbearing age)/ratio of the aged population over 65} over the last 10 years)
Koo et al. (2016)	• -0.5% or more of average annual population change rate over the last 20 years • Decreased annual average population change rate over the last 10 years (except metropolitan cities)

These shrinking cities appear mainly in non-capital regions and are recognized as serious urban problems (Lee et al., 2018). Against this backdrop, in small and medium-sized cities in Korea, urban region-based strategies have been proposed to promote a shared growth between a central city and its neighboring areas rather than to pursue competitiveness of a single city in response to the issue of shrinking city phenomenon(Jang and Moon, 2012; Im et al., 2018).

3) Need for Regional-scale Approach Considering Functional Connectivity of Shrinking Cities

Thanks to the advancement of public transport and the expansion of urban infrastructure, the activity radius of urban residents is going beyond the boundaries of existing administrative districts. This has caused the urban issues at the level of urban region level beyond the administrative districts, leading to discussions on the need for a regional scale approach. In particular, the small and medium-sized cities in non-capital regions continue to suffer from population decline, and this issue is expected to become more serious in the future. In this situation, a number of urban region-based policies have been introduced such as 5+2 Metropolitan Economic Zone, Regional Happy Settlement, Metropolitan Planning Zone, etc., along with rigorous research activities on the need for a regional scale approach.

Lim (2017) emphasized the need for a rather broader, urban region level approach, arguing that existing urban policy based on the premise of continued population growth is effective at the level of a single city but, at the national level, it could lead to a zero-sum game with limited

effectiveness. Likewise, Kim (2004) also highlighted the importance of an urban region level approach, suggesting a need for a regional development policy by functional zone formed based on the regional network, so as to more strongly build competitiveness of small and medium-sized cities. This regional approach is regarded as an effective policy that can lead to creating an economic zone encompassing the central city and its surrounding areas, while strengthening the functionality of the small and medium-sized cities in non-capital regions by sharing the urban services (So and Rhee, 2015). The urban region approach is included in the purpose of the metropolitan plans established by the 「National Land Planning and Utilization Act」, and the delineation of urban regions by functional connectivity seems to provide a foundation for establishing an effective spatial policy (Shim and Yeon, 2011). As such, the studies mentioned above proposed in common the urban region-based approach as a way to strengthen the competitiveness of the small and medium-sized cities in non-capital regions, and also pointed out the importance of delineating urban regions on the basis of the functional connectivity as well as the physical proximity between the areas.

3. Sub-conclusion

The literature review has showed that new town development advances by absorbing population and industries in the surrounding areas and old towns, throwing neighboring cities and old towns into population and industrial declines. In particular, such phenomenon of decline may get further accelerated in the small and medium-sized cities in non-capital regions already suffering the urban decline, which could also lead to the urban shrinkage—a long-term and continuous phenomenon of urban decline. Yet, the existing studies have focused on the impact of the new town development at the level of a single city, with only limited ones taking a more comprehensive approach to the urban shrinkage issues. Although some have chimed in for a need to take a look at the decline phenomenon in the surrounding areas from the perspective of urban regions, no studies have been conducted based on this perspective yet. Given this, this study aimed to conduct an empirical analysis of the impact of the new towns on the urban shrinkage in surrounding areas, with the urban region approaches in mind.

Ⅲ. Methodology

1. Scope and Process

The spatial scope of this study covers the entire set of non-capital regions, excluding the Seoul Metropolitan area, Sejong-si, Jeju-si, and Ulleung-gun. The spatial unit for this study was set to Si and Gun (cities and counties), and the temporal range was set from 2008 to 2018 so as to focus on the impact of the recently established new towns. As specified in Section 2.1 above, this study defined the housing sites under the 「Housing Site Development Promotion Act」, the public housing districts under the 「Special Act on Public Housing」, and the urban development zones under the 「Urban Development Act」as new towns using the spatial information data in the housing site information system (www.jigu.go.kr), and, considering the results of the preceding studies (Eom and Woo, 2014; Park and Kim, 2018) suggesting that it takes some time for residents to move in after completion of the new town development, 153 new towns completed from 2006 to 2016 were selected as the subjects of the study.

The analysis can be categorized into two segments: First, basic information of the new towns and shrinking cities in non-capital regions were compiled. To this end, a total of 49 shrinking cities in 2018 that satisfy at least two of the delineation criteria for shrinking cities presented in Table 1 were selected (See Table 2). Second, a multinomial logistic

Table 2. Shrinking cites in 2018

Classification	Si·Gun Cities
Gangwon-do	Taebaek-si, Samcheok-si, Yeongwol-gun, Jeongseon-gun, Goseong-gun
Chung cheong-do	Okcheon-gun, Goesan-gun, Danyang-gun, Gongju-si, Seocheon-gun, Cheongyang-gun
Jeonla-do	Gimje-si, Jinan-gun, Muju-gun, Jangsu-gun, Imsil-gun, Sunchang-gun, Gochang-gun, Buan-gun, Damyang-gun, Gokseong-gun, Goheung-gun, Boseong-gun, Jangheung-gun, Gangjin-gun, Haenam-gun, Hampyeong-gun, Yeonggung-gun, Jangseong-gun, Wando-gun, Jindo-gun, Shinan-gun
Gyeongsang-do	Sangju-si, Mungyeong-si, Uiseong-gun, Yeongyang-gun, Cheongdo-gun, Seongju-gun, Yecheon-gun, Bonghwa-gun, Uiryeong-gun, Changnyeong-gun, Goseong-gun, Namhae-gun, Hadong-gun, Sancheong-gun, Hamyang-gun, Geochang-gun, Hapcheon-gun

regression model is used to verify the impact of a new town on the urban shrinkage in neighboring cities within the same urban region. To this end, the urban regions set by Kim and Woo (2018) was used, as described in Figure 1. To define the urban regions objectively, Kim and Woo (2018) set the scope of influence of the functional network as an urban region by using the Markov Chain model based on the regional hubs derived from the total linked trips. As a result, a total of 25 urban regions including all Sis and Guns were established, excluding the Seoul metropolitan area, Sejong-si, Jeju-si, and Ulleung-gun. Table 3 below shows the urban regions that this study intended to use for its analysis.

2. Model and Variables

1) Multinomial Logistic Regression Model

A Multinomial Logistic Regression Model (MLR) was used to analyze the impact of new towns on the surround-

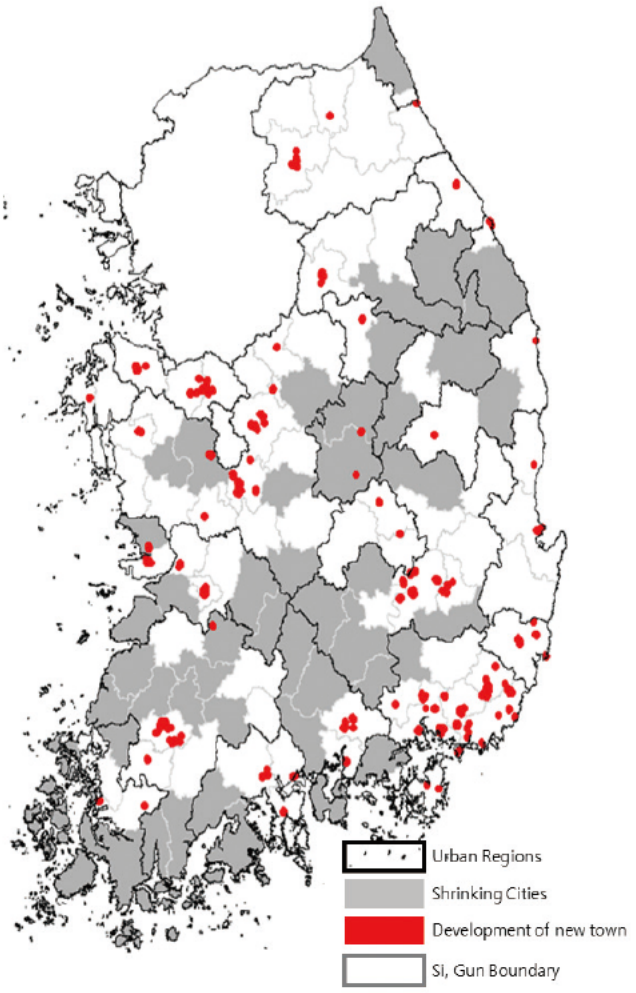

Figure 1. Urban regions(Kim·Woo, 2018) & shrinking cites, New town

Table 3. Urban regions except the Seoul region and Sejong-si (Kim·Woo, 2018)

Regions	Si and Gun
Gwangu region	Gwangju-si, Gangjin-gun, Gochang-gun, Gokseong-gun, Gurye-gun, Naju-si, Namwon-si, Damyang-gun, Sunchang-gun, Yeonggwang-gun, Wando-gun, Imsil-gun, Jangseong-gun, Jangheung-gun, Jeongeup-si, Hwasun-gun
Seocheon-Gunsan region	Gunsan-si, Seocheon-gun
Mokpo region	Mokpo-si, Muan-gun, Sinan-gun, Yeongam-gun, Jindo-gun, Hampyeong-gun, Haenam-gun
Yeosu region	Yeosu-si, Goheung-gun, Gwangyang-si, Boseong-gun, Suncheon-si
Jeonju region	Jeonju-si, Gimje-si, Buan-gun, Wanju-gun, Iksan-si, Jangsu-gun, Jinan-gun
Daejeon region	Daejeon-si, Gyeryong-si, Gongju-si, Goesan-gun, Geumsan-gun, Nonsan-si, Muju-gun, Boryeong-si, Boeun-gun, Buyeo-gun, Yeongdong-gun, Budget-gun, Okcheon-gun, Eumseong-gun, Jeungpyeong-gun, Jincheon-gun, Cheongyang-gun, Cheongju-si, Chungju-si, Hongseong-gun
Seosan-Taean region	Seosan-si, Taean-gun
Jecheon region	Jecheon-si, Danyang-gun
Cheonan-Asan region	Cheonan-si, Asan-si, Dangjin-si
Gangneung region	Gangneung-si
Donghae-Samcheok region	Donghae-si, Samcheok-si
Sokcho region	Sokcho-si, Goseong-gun
Wonju region	Wonju-si, Yeongwol-gun, Pyeongchang-gun, Hoengseong-gun
Taebaek-Jeongseon region	Taebaek-si, Jeongseon-gun
Chuncheon region	Chuncheon-si, Yanggu-gun, Yangyang-gun, Inje-gun, Hongcheon-gun, Hwacheon-gun
Pohang region	Pohang-si, Gyeongju-si, Yeongdeok-gun
Gimcheon-Gumi region	Gimcheon-si, Gumi-si, Chilgok-gun
Daegu region	Daegu-si, Geochang-gun, Gyeongsan-si, Goryeong-gun, Gunwi-gun, Seongju-gun, Yeongcheon-si, Uiryeong-gun, Uiseong-gun, Cheongdo-gun, Cheongsong-gun, Hapcheon-gun
Busan region	Busan-si, Gimhae-si, Miryang-si, Yangsan-si, Changnyeong-gun, Changwon-si, Haman-gun
Sangju-Mungyeong region	Sangju-si, Mungyeong-si
Andong region	Andong-si, Yeongyang-gun, Uljin-si

(Continue on next page)

Regions	Si and Gun
Yeongju region	Yeongju-si, Bonghwa-gun, Yecheon-gun
Ulsan region	Ulsan-si
Jinju region	Namhae-gun, Sacheon-si, Sancheong-gun, Jinju-si, Hadong-gun, Hamyang-gun
Tongyeong region	Tongyeong-si, Geoje-si, Goseong-gun

ing areas' urban shrinkage. The MLR model is used when the estimated values of a regression model present biases as the homoscedasticity of errors and normal distribution (the assumptions of a general regression model) are violated if the dependent variable is a nominal scale rather than a quantitative scale. Also, the MLR model is based on the probabilistic choice model, capable of predicting the probability of occurrence of an event. It is a nonlinear model, and the one used in this study is described in the following:

$$U_{ij} = V_{ij}^{E} + V_{ij}^{S} + V_{ij}^{P} + V_{ij}^{D} + e_{ij} \quad (1)$$

U_{ij}: Probability of Si/Gun (j) to choose city cluster type(i)

V_{ij}^{E}: Economic characteristics

V_{ij}^{S}: Social characteristics

V_{ij}^{P}: Physical characteristics

V_{ij}^{D}: New town development

i: City clustertype j: Si, Gun

Since this polynomial logistic model is nonlinear, the general least-squares method cannot be used. Therefore, the maximum likelihood estimation method was used after taking the logarithm in Formula 1.

Based on the results of the basic status analysis in Chapter 4, all Sis and Guns were classified into three clusters: Cluster 1 was Shrinking cities, Cluster 2 was Non shrinking small cities, and Cluster 3 was Non shrinking big and middle cities. In the analysis model, Cluster 3 was set as the reference group, and the probability of each Si or Gun to match any of the three Clusters was shown in the following:

$$P(y=i) = \frac{1}{1 + e^{U_1} + e^{U_2}} \quad (2)$$

i: City type (*cluster* 1, 2)

$P(y=i)$: Probability to choose I (city type)

Provided, $e^{U_3} = 1$

2) Dependent and Independent Variables

For the dependent variables used in the multinomial logistic regression analysis, three city clusters classified based on the results of the basic status analysis in Chapter 4 were used (Table 4). Explanatory variables set based on spatial data provided by Statistics Korea (KOSTAT), the housing site information system, and open data portal were classified into physical variables, socio-economic variables, and new town variables (Table 4). For the physical variables, the KTX stations (dummy), the number of universities, and the ratio of buildings older than 30 years were included. The number of the KTX stations (dummy) and that of the universities are variables that signify good transportation and education infrastructure. Those two were set as variables for the analysis of this study assuming that the increase in such variables affect the growth of a city while reducing the probability of urban shrinkage. The ratio of the dilapidated buildings has been used in previous studies as the physical characteristics variable of a shrinking city. The higher the ratio, the more likely the respective Si or Gun may experience the urban shrinkage phenomenon.

As for the socio-economic variables, the ratio of the number of employees in the accommodation and food service activities, and wholesale and retail trades, which are urban-type industries, and that of the financial, insurance and real estate (including renting and leasing) businesses, the so-called "FIRE" industries represented by producer service businesses, were set in the previous study. The higher the ratio of such industries, the more positive impact is made on urban growth, which can serve as a negative factor in the process urban shrinkage. Other than that, the ratio of the employees in manufacturing business was set as a socio-economic variable, and per capital GRDP as an explanatory variable as well.

In this study, it was assumed that in an urban region functionally connected with a new town to be developed, the population migrates from the surrounding areas to the new town,possibly leading to urban decline in the neighboring cities and population growth in the new town region. Thus, considering the scales of each Si/Gun, "the area of new town per person in the city"and "the area of new town per person in the urban region" were set as the new town variables in the independent variables. In addition, the ratio of the new town area of the physically adjacent administrative districts

Table 4. Variables used in the model and calculation formula

Classification		Variables	Calculation formula
Dependent variable		Classification of Si · Gun	Cluster 1: Shrinking Cities Cluster 2: Non shrinking small cities (Cities with population of less than 100,000) Cluster 3: Non shrinking big · middle cities (Cities with population of more than 100,000)
Indepen-dent variables	Physical variables	KTX station	Cities with KTX station: 1, Other cities: 0
		University	Count of universities
		Ratio of dilapidated buildings in 2018	Buildings over 30 years in 2018 / Total buildings in 2018
	Socio-economic variables	Per capita GRDP	GRDP per person
		Ratio of manufacturing employees in 2018	Manufacturing employees / Total employees in 2018
		Ratio of accommodation and food service activities employees in 2018	Accommodation and food service activities employees in 2018 / Total employees in 2018
		Ratio of wholesale and retail trade employees in 2018	Wholesale and retail trade employees in 2018 / Total employees in 2018
		Ratio of financial, insurance, real estate, renting, leasing activities employees in 2018	Financial, insurance, real estate, renting, leasing activities employees in 2018/Total employees in 2018
	New town variables	The area of new town per person in the city	New town area in city / Population of city
		The ratio of new town area at adjacent Si Gun within the same urban region	New town area at adjacent Si Gun within the same urban region / Total new town area within the same urban region except oneself
		The area of new town per person in the urban region	Total new town area in the urban region / Population of the urban region
	Dummy variables	Big metropolitan Si Gun	Big metropolitan area cities: 1, Other cities: 0

(Si/Gun) to the total new town areas within the same urban region, excluding the applicable administrative district, was set as an explanatory variable as well. Finally, dummy variables are for the large urban region in which the metropolitan cities are included among the urban regions. These were included in the model, given that the Si/Gun areas within the large urban region have lower probability of becoming a shrinking city, thanks to the trickle-down effect from the large city belong to the same urban region.

Ⅳ. Result

1. Basic Status of New Towns and Shrinking Cities

Before examining the impact of new towns on cities in non-capital regions, the status of new towns and shrinking cities created from 2006 to 2016 in non-capital regions were analyzed.

First, based on city types by population size specified in the 「Regulations on Fire Fighting Service Standards」, cities with a population of less than 100,000 were defined as small cities, cities with a population of less than 100,000 to 500,000 as middle cities, and cities with a population of 500,000 or more as big cities. The basic status of the new towns in those three types of cities was analyzed, as shown in Table 5. It was found that about 79 (51.6%) of all new towns were developed in big cities, followed by 59 (38.6%) in middle cities and 15 (9.8%) in small cities. In addition, the total area of the new town created in big cities was 44.73 km^2, about 57.5% of the area of the new town area nationwide during the same period. The average size of new towns created in big cities was 0.57 km^2. The total area of the new towns created in middle cities was

30.14 km^2, accounting for about 38.8% of the total new town areas. The average size of new towns created in middle cities was 0.51 km^2. The total area of the new town in small cities was 2.09 km^2, with an average size of 0.19 km^2, accounting for 3.7% of the total new town area. These results imply that new towns were created mostly in big and middle cities, and the new towns in big and middle cities were built on a larger scale than in small cities.

After classifying cities in non-capital regions into shrinking and non-shrinking cities, the number of small cities and the basic status of new towns were analyzed, and the results are shown in Table 6. Of the 49 shrinking cities in non-capital regions, 48 were found to be small cities with a population of less than 100,000. In addition, it was found that the scale of new towns was smaller in shrinking cities than in non-shrinking ones, and most of the new towns were built mostly in non-shrinking cities (147, 96.1%) compared to shrinking cities (6, 3.9%). As seen in these results and the data in Table 5, in small and shrinking cities, the number of new towns was small and relatively smaller scale of new towns were created, suggesting that the characteristics of new towns may be similar in small cities and shrinking cities.

When examining the results of the new town analysis by city size and the shrinking cities identified comprehensively, it was found that the urban shrinkage can be influenced by the size of the city. Therefore, considering the city sizes and shrinking cities status, the Si/Gun in non-capital regions were classified into shrinking cities (Cluster 1), small cities not shrinking (Cluster 2), and big and middle cities not shrinking (Cluster 3). Meanwhile, among the Si/Gun in non-capital region falling into Cluster 1, the new towns were formed in Gongju-si (middle city), Sangju-si, Mungyeong-si, Imsil-gun, and Seocheon-gun (small cities).

Finally, the new town status was analyzed by cluster, and the results are presented in Table 7 below. The analysis showed that a total of 6 (3.9%) new towns were created in the shrinking cities (Cluster 1), which was the smallest number of new towns created among the three Clusters of cities. The total area of the new town zone was 2.07 km^2 (2.7%), and the average size of a new town area created was 0.34 km^2. A total of 11 (7.2%) new towns were created in non-shrinking small cities (Cluster 2), and the total area of new towns was 1.56 km^2 (2.0%) and the average area of the new towns was 0.14 km^2. In non-shrinking big and middle cities (Cluster 3), a total of 136 (88.9%) new towns were created, and the total area of new towns was 74.15 km^2 (95.3%) and the average size of the new towns was 0.55 km^2. Finally, the proportion of new town areas in adjacent Si/Gun areas

Table 5. New town status by cities scale

Classification	New town development count	Sum of new town development area (km^2)	Average of new town development area (km^2)
Small cities	15 (9.8%)	2.90 (3.7%)	0.19
Middle cites	59 (38.6%)	30.14 (38.8%)	0.51
Big cites	79 (51.6%)	44.73 (57.5%)	0.57

Table 6. New town developments in small cities by shrinking status

Classification	Small cities	Sum of new town development area (km^2)	Average of new town development area (km^2)	New town development count
Shrinking cities	48	2.90 (2.7%)	0.34	6 (3.9%)
Non-Shrinking cities	31	74.87 (97.3%)	0.52	147 (96.1%)

Table 7. New town status by Cluster

Classification	New town development count	Sum of new town development area (km^2)	Average of new town development area (km^2)	The ratio of new town area at adjacent Si Gun within the same urban region
Cluster 1	6 (3.9%)	2.07 (2.7%)	0.34	17.9%
Cluster 2	11 (7.2%)	1.56 (2.0%)	0.14	14.0%
Cluster 3	136 (88.9%)	74.15 (95.3%)	0.55	13.1%

among the total new town areas in the same urban region was examined, and it was found that 17.9% of the new towns were created near the shrinking cities, followed by 14.0% (on average) of those created near the non-shrinking small cities, and 13.1% (on average) adjacent to the non-shrinking big and middle cities.

The results of the analysis of the basic status of new towns and shrinking cities showed that more new towns were created in big and middle cities than in small cities, and the scale of new towns was also larger in big and middle cities. The analysis of the status of new towns by Cluster showed that the smallest number of new towns were created in shrinking cities, and the ratio of the new towns area developed in Si/Gun near the shrinking cities was found to be the highest. Considering these results and that of the previous studies suggesting that the new towns cause decline in the adjacent cities, the development of new towns can absorb the population from the nearby cities, possibly affecting the urban shrinkage. Thus, based on the three types of cities, a multinomial logistic regression model was used to verify the effect of the new town on urban shrinkage.

2. Basis Statistics

Table 8 shows the basic statistics of the major variables analyzed for 124 Sis/Guns in non-capital regions, excluding the capital region, Jeju-si, and Ulleung-gun. Among the physical variables, the average number of universities in Si/Gun was 1.96, and Busan was found to have 24 universities, the largest number of universities in non-capital regions. The ratio of dilapidated buildings over 30 years old was 32.2% on average, and the region with the highest ratio was Sinan-gun, Jeollanam-do, with 70.2%.

As for the socio-economic variables, the average per capital GRDP was found to be KRW 30.83 million, and the ratio of the manufacturing employees industry stood at 20.1%. The ratios of the workers in the accommodation & food service industry and the wholesale & retail trade industry, classified as urban-type industries in the preceding studies, were presented as an average of 12.25% and 12.78%, respectively, which were at the similar level as the previous studies. The ratio of financial, insurance, real estate, renting, leasing activities was found to be at 3.70% on average.

Among the new town variables, which are the main variables of this study, the area of new town per person in the city was 1.80 m^2/person on average, and Yangsan-si was found to have the highest number with 31.40 m^2/person, thanks to the Yangsan new town development. The ratio of new town area at adjacent Si/Gun within the same urban region was found to be on the average of 50%. The area of new town per person in the urban region was 2.56 km^2/person.

Table 8. Descriptive analysis of variables

Variables		Obs	Mean	Std. Dev.	Min	Max
Physical variables	KTX station	124	0.25	0.43	0.00	1.00
	University	124	1.96	3.81	0.00	24.00
	Ratio of dilapidated buildings in 2018	124	32.23	13.20	4.59	70.21
Social · Economical variables	per capita GRDP	124	30.83	14.42	14.58	101.68
	Ratio of manufacturing employees in 2018	124	20.01	12.73	4.29	57.03
	Ratio of accommodation and food service activities employees in 2018	124	12.25	4.23	5.16	30.55
	Ratio of wholesale and retail trade employees in 2018	124	12.78	2.64	6.65	20.48
	Ratio of financial, insurance, real estate, renting, leasing activities employees in 2018	124	3.70	1.35	1.65	8.29
New town variables	Area of new town per person in the city	124	1.80	4.00	0.00	31.40
	Ratio of new town area at adjacent Si Gun within the same urban region	124	50.00	5.00	0.00	100.00
	Area of new town per person in the urban region	124	2.56	1.68	0.00	6.58
Dummy variables	Large metropolitan Si Gun	124	0.50	0.50	0.00	1.00

3. Model Analysis Result

A multinomial logistic model was used to analyze the effect of the development of new towns on urban shrinkage, and the results are as follows. First, the model used in this study was found to be suitable with the significance level of less than 0.01 in the likelihood ratio test, as shown in Table 9.

In order to analyze the impact of new towns in non-capital regions on urban shrinkage, Cluster 3 (Non shrinking big and middle cities) was analyzed as a reference group, among Cluster 1 (Shrinking cities), Cluster 2 (Non shrinking small cities), and Cluster 3 (Non shrinking big and middle cities), and results are shown in Table 10.

The analysis of Cluster 2 showed that most of the physical and socio-economic variables were not significant, suggesting that Cluster 2 and Cluster 3 had no distinctive differences in physical and socio-economic aspects. The indicators found to be significant were the number of universities (physical variable), and the area of new town per person in the city (new town variable). According to the analysis, the region with fewer new towns was highly likely to be included in Cluster 2, if the Si/Gun areas had fewer universities. These results can be attributable to the relative shortage of universities (usually packed with younger population) in small yet not shrinking cities compared to big and middle cities, and also to the relatively smaller number of new town development projects in the small cities, as shown in the new town status by cities scale (Table 5).

The results of analysis of Cluster 1 showed that a number of variables were found to bear significance, and this indicates that the physical, socio-economic, and new town characteristics of the Cluster 1 cities largely differ from those of Cluster 3 cities. As for the physical characteristics, the fewer the number of universities and the higher the ratio of the aging buildings, the higher the probability of a city to be selected as a shrinking city region, compared to Cluster 3. This means that a city with a relatively weak educational and residential environment is more likely to be a shrinking city. In socio-economic indicators, the odds ratios of the manufacturing, wholesale and retail, and FIRE industries ratio variables were found to be less than 1 (meaning a negative coefficient value), and this means that the ratios of such

Table 9. Model suitability

Model	-2log likelihoood	Log likelihood ratio test	
		chi-squared	p-value
Unrestricted	268.12	-	-
Restricted	76.87	191.24	0.00

Table 10. Results of multinomial logistic regression

Type	Variable	Cluster 1		Cluster 2	
		Exp (B)	z-value	Exp (B)	z-value
Physical variables	KTX station	0.46	0.70	0.23	0.45
	University	0.13*	0.09	0.09**	0.05
	Ratio of dilapidated buildings in 2018	1.41***	0.05	1.16	0.38
Social·Economical variables	per capita GRDP	0.87	0.18	0.93	0.48
	Ratio of Manufacturing employees in 2018	0.75*	0.10	0.79	0.16
	Ratio of Accommodation and food service activities employees in 2018	1.22	0.62	1.31	0.48
	Ratio of Wholesale and retail trade employees in 2018	0.28*	0.09	0.34	0.16
	Ratio of Financial, insurance, real estate, renting, leasing activities employees in 2018	0.05*	0.09	0.07	0.12
New town variables	Area of new town per person in the city	0.61**	0.03	0.60**	0.03
	Ratio of new town area at adjacent Si Gun within the same urban region	2.01**	0.04	1.44	0.31
	Area of new town per person in the urban region	0.83	0.39	0.76	0.20
Dummy variables	Large metropolitan Si Gun	2.42	0.77	33.98	0.22

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$, Pseudo-R-Squared=0.69

industries are lower in Cluster 1 cities than in Cluster 3 cities. To examine in more detail, the manufacturing industry, which had driven the growth of cities in the past, is more likely to cluster and prevail in big and middle cities than in small cities, therefore the ratio of manufacturing business was smaller in shrinking cities. It also means that the wholesale and retail businesses that have a tendency to concentrate in downtown areas would also situate in big and middle cities instead of shrinking cities. The preceding studies showed a similar trend as well. The FIRE industry, a producer service business and a high value-added industry, showed a similar trend as the industries mentioned above, presenting that the lower the ratio of employees in such industries, the higher the probability of becoming a shrinking city (Cluster 1).These results imply that the shrinking cities had relatively weaker industrial foundation to drive economic growth in the area.

Meanwhile, when looking at the new town variables—the major variables of this study—the "area of new town per person in the city" and the "ratio of new town area at adjacent Si/Gun within the same urban region" were found to show statistically meaningful values First, the odds ratio of the "area of new town per person" was less than 1, meaning that the probability of not becoming a Cluster 1 cities increased by 1.64 times (1/0.61) as the area of the new town increased by $1m^2$/person. These results chime in with that of the basis status of new town and shrinking cities (see Table 7) and the new town status by city type (see Table 8), owing to the fact that the new towns tend to be developed in non-shrinking cities. Although "Area of new town per person in the urban region" variable was found to be insignificant, taken together with the "Ratio of new town area at adjacent Si/Gun within the same urban region", it can be interpreted that creating a new town in a physically adjacent and functionally linked city affect the urban shrinkage in Si/Gun areas in non-capital regions. The odds ratio of the "Ratio of new town area at adjacent Si Gun within the same urban region" to verify the effect of creating a new town on the urban shrinkage was found to be greater than 1. It means that as the "Ratio of new town area at adjacent Si/Gun within the same urban region" increases by 1%, the probability of the applicable city becoming a Cluster 1 cities increases by about 2.01 times. In other words, even if the new town development does not occur in a shrinking city, the large-scale housing site development in the adjacent Si/Gun areas in the same urban region can affect the urban shrinkage in the neighboring cities. These results coincide with that of Table 8 showing that there is relatively large areas of new town near the shrinking cities, suggesting that the development of new town areas in non-capital regions absorbs the population of neighboring cities and, therefore, can affect the shrinkage of cities beyond urban decline.

Ⅴ. Conclusion

Despite the continued trend of low growth, new towns are being developed continuously in the suburban areas, and the preceding studies have stated their opinions that the new town development may lead to urban decline in the old towns and the neighboring cities. Meanwhile, along with the population decline in small and medium-sized cities in Korea, urban shrinkage—a long-term decline phenomenon—is being observed in non-capital regions. Taken together, it means that the development of a new town in a neighborhood of a small and medium-sized city in a non-capital region, which is already experiencing urban decline, can further accelerate the urban decline, leading to urban shrinkage down the road. Against this backdrop, this study aimed to empirically analyze the impact of new town development on the urban shrinkage in the neighboring region from the broader perspective at the regional scale. To that end, we analyzed the scale of cities in non-capital regions, the urban shrinkage situation, and basis status of new towns by city type first, and then verified the impact of the new town development on the urban shrinkage by city type using the multinomial logistic model.

In the results of the status analysis of new towns and shrinking cities, the project frequency and development area of new towns were greater in big and middle cities than in small cities. Most of the shrinking cities were found to appear in small cities with a population of less than 100,000, and it was also found that a large-scale new town was created in the surrounding area rather than the shrinking city itself.

The results of analysis using a multinomial logistic regression model showed that the physical and socio-economic characteristics were in good conditions in Sis and Guns that were not shrinking and, as for those in non-capital regions,

the weaker the physical environment and industrial base, the more likely it can become a shrinking city. It was also found that the more recently the new towns are created in the physically adjacent Si/Gun areas in the same urban region, the more likely the cities experience the urban shrinkage in non-capital regions, signifying that the new towns created in non-capital regions may cause the urban shrinkage in the neighboring cities.

Based on the results of this study, the following implications can be drawn: First, it was found that the scale of a city can be a major factor of a shrinking city, along with the population trend and residential environment suggested in other previous studies. The results showed that most of the regions experiencing the urban shrinkage was small cities with a population of less than 100,000, implying that the scale of a city can affect the urban shrinkage. This could also signify that going forward, studies on urban shrinkage should take into account the economy of a city's scale, in addition to its population trend and residential environment.

Second, the results showed that Cluster 2 (Non shrinking small cities) and Cluster 3 (Non shrinking big and middle cities) do not have significant differences in terms of urban-type industry and producer service industry. This means that a small city may not show the urban shrinkage if its economic foundation is healthy and, therefore, the economic factors as well as the population structure and residential environment should be considered when identifying the shrinking cities.

Third, it is necessary to formulate urban management policies at the level of urban regions in response to the emergence of a low growth era. The results showed that the development of the new town can affect the urban shrinkage in its physically adjacent and functionally linked cities. In other words, the development policies can absorb the human and material resources from the physically adjacent and functionally connected cities within the same urban region, accelerating the urban decline phenomenon and even the urban shrinkage in the adjacent cities. Therefore, when planning large-scale housing site development projects in non-capital regions, not only the status of the applicable Si/Gun but also other potential side effects to be posed on the neighboring small-scale Si/Gun with a functional connection within the same urban region should also be considered, such as the issue of outmigration of population, etc. Yet, the current Sl/Gun unit planning system is not favorable to consider such factors, so a more deliberate planning at the level of urban region is required.

Finally, as for the urban regions not showing the growth trends yet, urban management policies for improving residential environment and a spatial structuring strategy to connect the old towns and its neighboring cities in a more compressive manner should be considered, instead of focusing on the external expansion with the new town development projects.

References

1. Ahn, J.G., Kim, D.S., and Park, C.H., 2020. "A Study on the Characteristics of One-Person Household in Local Small and Medium Cities", *Journal of the Korean Regional Science Association*, 36(2): 13-24.
안정근·김동성·박철흥, 2020. "지방 중소도시 유형별 1인 가구 특성연구", 「지역연구」, 36(2): 13-24.

2. Audirac, I., Cunningham-Sabot, E., Fol, S., and Moraes, S.T., 2012. "Declining Suburbs in Europe and Latin America", *International Journal of Urban and Regional Research*, 36(2): 226-244.

3. Choi, C.E., 2005. "A Study on Effects of Population by Large Scale Residential Development Project –The Case of Kyodong Residential Development Project in Gangnung City–", *Journal of The Korean Regional Development Association*, 17(1): 143-162.
최창의, 2005. "신시가지 조성이 도시인구에 미친 영향에 관한 연구 –강릉시 교동 11 지구 택지개발사업을 사례로–", 「한국지역개발학회지」, 17(1): 143-162.

4. Eom, H.T. and Woo, M.J., 2014. "The Impacts of Suburban New Town Development on the Decline of Inner Cities", *Journal of Korea Planning Association*, 49(5): 51-66.
엄현태·우명제, 2014. "교외지역 신시가지 개발이 중심도시의 구시가지 쇠퇴에 미치는 영향 분석", 「국토계획」, 49(5): 51-66.

5. Hwang, K.H. and Koo, S.H., 2012. *Use Patterns of Public and Community Facilities and Policy Directions in New Town Areas*, Gyeonggi Research Institute.
황금회·구성환, 2012. 「경기도 신시가지 공공 및 편익시설의 이용실태와 개선방향 연구」, 경기연구원.

6. Im, B.Y., Lee, K.S., and Ma, K.R., 2018. "Future Prospects and Strategies for National Territorial Development in an Era of New Normal: Implications of Japan's Compact and Network Strategies", *Space & Environment*, 64: 45-70.
임보영·이경수·마강래, 2018. "지방소멸과 저성장 시대의 국토공간전략: 일본의 사례를 중심으로", 「공간과 사회」, 64: 45-70.

7. Jang, H.Y. and Moon, T.H., 2012. "Establishing City-Region Based on Connectivity and Their Development Directions",

Journal of Korea Planning Association, 47(1): 5-18.
장환영·문태헌, 2012. "연계성에 따른 지방 광역도시권의 설정과 발전 방향", 「국토계획」, 47(1): 5-18.

8. Jin, W.H., 1998. "The Alternative Policies for the Sustainable Development of New Town in Metropolitan Area, Korea –The case of Jisan Bummul, Taegu–", *Journal of The Korean Association of Regional Geographers*, 4(1): 135-155.
진원형, 1998. "대도시 신시가지의 지속가능한 개발 대안 모색 –대구시 지산 범물지구를 사례로–", 「한국지역지리학회지」, 4(1): 135-155.

9. Joo, S.M., Choi, J.H., and Kim, B.J., 2014. "A Study on Boundary Set-up of Metropolitan Areas in Dae-gu using Network Analysis in GIS", *Journal of the Korean Society of Cadastre*, 30(3): 85-95.
주승민·최진호·김봉준, 2014. "GIS 네트워크 분석을 활용한 대구광역시 광역도시권역 경계설정에 관한 연구", 「한국지적학회지」, 30(3): 85-95.

10. Kim, D.H. and Lee, J.H., 2002. "A Study on the Characteristics of Change in Urban Space Structure due to Large Residential Development Project", *Journal of Korea Planning Association*, 37(5): 87-99.
김두현·이주형, 2002. "대규모 택지개발사업에 따른 도시공간구조 변화특성에 관한 연구", 「국토계획」, 37(5): 87-99.

11. Kim, D.H. and Woo, M.J., 2018. "A Study on the Identification of Hub Cities and Delineation of Their Catchment Areas Based on Regional Interactions", *Journal of Korea Planning Association*, 53(7): 5-22.
김도형·우명제, 2018. "지역 거점도시 식별 및 상호작용에 따른 영향권역 설정에 관한 연구", 「국토계획」, 53(7): 5-22.

12. Kim, D.H. and Woo, M.J., 2019. "Study on the Delineation of City-Regions Based on Functional Interdependence and Its Relationships with Urban Growth", *Journal of Korea Planning Association*, 54(7): 5-23.
김도형·우명제, 2019. "기능적 상호작용에 따른 도시권 설정과 성장관계에 대한 연구", 「국토계획」, 54(7): 5-23.

13. Kim, G.A. and Hur, J.W., 2017. "A study on the Influence of the New Town Development on the Change of the Old Town: Focused on the Capital Region", *Journal of the Korean Regional Economics*, 36: 53-74.
김경아·허재완, 2017. "신시가지 개발에 따른 구시가지 변화에 관한 연구: 수도권 지역을 중심으로", 「한국지역경제연구」, 36: 53-74.

14. Kim, H.C. and Kim, C.S., 2004. "A Study on the Indicator for Delimitation of Metropolitan Planning Area", *Journal of Korea Planning Association*, 39(4): 7-18.
김호철·김철수, 2004. "광역계획권 설정지표에 관한 연구", 「국토계획」, 39(4): 7-18.

15. Kim, H.S., 2007. "Evaluation on the Second Phase New Town Development in SMA", *Journal of The Korean Regional Development Association*, 19(4): 249-270.
김현수, 2007. "2기 신도시의 평가에 관한 연구", 「한국지역개발학회지」, 19(4): 249-270.

16. Kim, S.B., 2004. "Urban Development and Regional Innovation System: The Theory and Cases of Functional Territory Development", *Journal of the Economic Geographical Society of Korea*, 7(3): 345-357.
김선배, 2004. "도시발전과 지역혁신체제: 기능적 관점의 지역발전 이론과 사례", 「한국경제지리학회지」, 7(3): 345-357.

17. Koo, H.S, Kim, T.H., Lee, S.W., and Min, B.S., 2016. *Urban Shrinkage in Korea: Current Status and Policy Implications*, Korea Research Institute for Human Settlements.
구형수·김태환·이승욱·민범식, 2016. 「저성장 시대의 축소도시 실태와 정책방안」, 국토연구원.

18. Kwon, Y.W., 2001. "The Delineation of the Seoul Metropolitan Region in Korea", *Journal of Korea Planning Association*, 36(7): 197-219.
권용우, 2001. "수도권 광역도시권의 설정", 「국토계획」, 36(7): 197-219.

19. Lim, D.I., 2008. "Analysis on the Changes of Urban Structure by New Town Development –Case Study of Go-Yang City by GIS–", *Journal of the Korea Contents Association*, 8(10): 317-327.
임동일, 2008. "신도시 개발에 따른 도시구조 변화의 분석 –GIS를 이용한 고양시 구도심지역 변화 분석–", 「한국콘텐츠학회논문지」, 8(10): 317-327.

20. Lim, H.B., 2017. "Urban Planning Using Shrinking City in Population Declining Age", *Journal of the Korean Urban Management Association*, 30(2): 87-114.
임형백, 2017. "인구감소시대에 축소도시를 활용한 도시계획", 「도시행정학보」, 30(2): 87-114.

21. Lee, H.Y. and Han, S.K., 2014. *Where to Go in the Lost Town of the Small Town?*, Anyang: Korea Research Institute for Human Settlements.
이희연·한수경, 2014. 「길 잃은 축소도시 어디로 가야 하나」, 안양: 국토연구원.

22. Lee, H.Y. and Song, J.H., 1995. "A Study on the Establishment and Regional Structure of Seoul Metropolitan", *Journal of the Korean Geographical Society*, 30(1): 35-56.
이희연·송종홍, 1995. "서울 대도시권역의 설정과 지역구조에 관한 연구", 「대한지리학회지」, 30(1): 35-56.

23. Lee, S.H., 2016. "7 Things about 'Shrinkage of Local Cities' in Korea", *Korea Employment Information Service Employment Trend Brief*, Spring issue: 3-17.
이상호, 2016. "한국의 '지방소멸'에 관한 7가지 분석", 「한국고용정보원 지역 고용동향 브리프」, 봄호: 3-17.

24. Lee, S.H. and Shin, J.J., 2007. "A Study On the Improvement of Urban Development Projects in Small and Medium Cities; Focused on Jeju City", *Journal of Korea Planning Association*, 42(6): 161-179.
이성호·신중진, 2007. "중·소도시 택지공급사업 개선방안에 관한 연구", 「국토계획」, 42(6): 161-179.

25 Lee, S.K., 2002. "A Study on Establishing Regional Technopoles and Networking Regional Innovation Projects –A Case Study of the Daegu, Kyongbuk Region–", *Journal of The Korean Regional Development Association*, 14(1): 41-68.
이성근, 2002. "지역기술거점의 형성과 지역혁신네트워크 구축에 관한 연구 –대구, 경북지역을 사례로–", 「한국지역개발학회

지」, 14(1): 41-68.

26. Lee, S.S., Jeon, H.J., and Lee, J.S., 2018. "An Investigation into the Evaluation Criteria, Cases and Causes of Urban Shrinkage", *SH Urban Research & Insight*, 8(3): 83-100.
이삼수·전혜진·이재수, 2018. "축소도시의 진단 기준과 사례 분석 및 발생 요인 연구", 「주택도시연구」, 8(3): 83-100.

27. Park, J.I. and Kim, J.H., 2018. "A Study on the Change of Population Distribution in Metropolitan Area by the Development of the New Town-type Innovation City: A Case Study of the Daegu Innovation City in South Korea", *Journal of the Korean Regional Science Association*, 34(3): 55-68.
박정일·김지혜, 2018. "신시가지형 혁신도시 개발에 따른 대도시 인구분포 변화에 관한 연구: 대구혁신도시 사례를 중심으로", 「지역연구」, 34(3): 55-68.

28. Shin, H.C. and Woo, M.J., 2020. Study on the Reverse Commuting Phenomena Considering Spatial Mismatch: In the Non-Seoul Metropolitan Area", *Journal of the Korean Regional Science Association*, 36(2): 3-12.
신학철·우명제, 2020. 공간 미스매치를 고려한 역통근 현상에 관한 연구 -비수도권 광역대도시권을 대상으로-", 「지역연구」, 36(2): 3-12.

29. Shim, J.H. and Cho, Y.H., 2011. "The Boundary Delimitation of Busan Metropolitan Area Using Network Analysis", *Spatial Information Research*, 19(6): 75-86.
심재헌·조연호, 2011. "네트워크 분석기법을 이용한 광역도시권 설정방안 -부산광역권 설정사례를 중심으로", 「대한공간정보학회지」, 19(6): 75-86.

30. So, S.C. and Rhee, J.B., 2015. "A Study on Regional Development Policy between S. Korea and Japan", *Journal of Local Government Studies (JLGS)*, 27(4): 209-242.
소순창·이진복, 2015. "지역활성화 정책에 관한 한·일 비교연구", 「한국지방자치학회보」, 27(4): 209-242.

31. Soja, E.W., 2003. "Writing the City Spatially", *City*, 7(3): 269-280.

32. You, S.M., Byun, B.S., and Kim, S.Y., 2012. "An Analysis of the Characteristics of Changes in Population and Industrial Structure due to Residential Development -A Case of Cheonan-Si and Asan-Si-", *The Geographical Journal of Korea*, 46(4): 415-427.
유상민·변병설·김수영, 2012. "택지개발사업에 따른 인구와 산업구조의 변화 특성 분석 -천안시, 아산시를 대상으로-", 「국토지리학회지」, 46(4): 415-427.

33. Yuh, O.K. and Ahn, K.H., 2006. "A Study on the Development and Growth of YoungDong New Town", *Journal of the Korean Regional Development Association*, 18(4): 161-182.
여옥경·안건혁, 2006. "영동신시가지의 개발과 성장에 관한 연구", 「한국지역개발학회지」, 18(4): 161-182.

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