Master's Thesis of Engineering

The Impact of Urban Development on Housing Prices of Nearby Cities

도시개발사업이 주변지역의 부동산 가격에 미치는 영향에 관한 연구

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Abstract

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Real estate, a major concern in Korea, cannot be separated with urban development projects. Recently, the 3rd new town is being actively pursued, and the development plan aimed at housing supply can have various impacts. Among the impacts of large-scale housing supply, there is a change in the price of apartments located in the vicinity, and the location of the new development site determines the degree of this impact. Despite the importance of location in price determination, there are few studies that analyzed the influence of new apartments on existing apartments based on the actual distance between them, and studies using recent data are even scarcer. Therefore, the purpose of this study is to analyze whether the price of apartments located in the surrounding cities of the new town development target is affected and whether the influence varies according to the actual distance.

The development of a new town causes a competition effect at newly supplied housing, and depending on the development area, the degree of the oversupply of housing and the expansion of infrastructure will appear differently. Based on this premise, this study hypothesizes that the price of existing apartments located in the vicinity will decrease due to the new town development, and that the extent of the impact will be different depending on whether the existing apartment is located in a new town or not. To verify the hypothesis, the degree of influence of the distance from a new apartment in a new town development area to the actual transaction price of an existing apartment is analyzed using a general regression model, spatial lag model, and spatial error model based on the hedonic price model. It was found that apartment prices were generally negatively affected by the development of new towns, and in the case of new towns, overall negative influence was exerted, but when located outside of new towns, the development of new towns had a positive effect after a certain distance. This study is meaningful in that it empirically analyzed the influence of the actual distance, unlike previous studies that analyzed according to the distance sections. The result of this study suggests consideration in distance factors for future urban developments.

keywords : new town, urban development, spatial regression model, hedonic price model, distance influence

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Table of Contents

List of Tables

List of Figures

Chapter 1. Introduction

1.1. Research Background and Purpose

1.1.1. Research Background

Real estate prices have been one of the hot topics in South Korea. New town development, which is one of the massive urban developments, is planned mainly to manage housing prices of a certain region. This can be understood by how real estate policies works as a main factor in governmental party choices. In particular, recently, the level of interest has deepened. The headline of an article at the recent presidential election says that "the presidential election is a real estate fight after all," and interest even in the real estate-related industry is also increasing. It is not just the level of public interest at its peak. Looking at the development status in Korea, a total of 164,965 development activity permits were issued in 2021, and an area of 1,739,291,610㎡ was built(Statistics Korea, 2022). Currently ongoing redevelopment · reconstruction projects and industrial complex development projects are also distributed nationwide (Ministry of Land, Infrastructure and Transport, 2022). In particular, in the case of housing, according to KDI, as of the third quarter of 2022, the number of completed housing projects nationwide increased by 14.9% compared to the previous year (KDI, 2022). Nevertheless, the current housing supply and demand trend show that demand is insufficient compared to supply, and it is expected that there will be a continuous housing supply in the future. Large−scale housing supply has been achieved through new town development so far. As it provides large−scale housing at once, urban development projects such as new towns will have a significant impact on the surrounding area, especially on the price of residential space. At the time of the development of Pangyo New Town, the residents of Bundang New town opposed of the development of Pangyo for fear of diminishing apartment prices in the Bundang area, and the 3rd New town, currently under active development cannot avoid these concerns. Residents of Ilsan, Unjeong, and Geomdan held a rally against the 3rd New town, and in the case of Ilsan, in particular, just by the announcement of the additional 3rd New town resulted in the biggest drop in apartment sales prices after real estate measures.

Many development projects are currently underway in Korea, and the impacts of these development activities are diverse (Su et al. Choi, 2009; Liang. et al., 2020). These effects can be identified as a result of anything from simply real estate price fluctuations to speculative behavior. Prior to urban development projects, it is necessary to understand the impact of such development activities, and in particular, it is necessary to confirm whether the degree of influence changes according to the proximity between regions. This is crucial as it can aid in preparing countermeasures for the impact before development activities by predicting the results of these development activities.

Even in the third phase of new towns, which are currently under active development, there are many controversies for and against from the designation stage to the start of the current development. Now that the 3^{rd} New town is underway in progress following the 1^{st} and 2^{nd} New towns, we plan to conduct an empirical analysis on the impact of real estate prices on neighboring areas after development as people reacted before designation and development of the 3^{rd} New town.

Above all, when it comes to the surrounding area, since the concept of the surrounding area is abstract, its scope is important in identifying the effect or impact caused by development, and it is necessary to understand how the influence varies depending on distance.

1.1.2. Purpose of Research

As interest in real estate is high, many studies on the transaction price of apartments or officetels have been conducted. It is mainly about the price determination model and is an analysis using the hedonic price model. These studies are mainly composed of variables used in general hedonic price models, and as variables for surroundings, it can be said that microscopic studies are mainly composed of variables related to the accessibility of infrastructure such as schools and parks with accessibility-related variables. However, as many factors affect housing prices, it is also necessary to consider factors that influence cities and provinces, rather than merely adjacent micro units. This macroscopic study is meaningful in that it identifies price determinants in urban-scale development beyond building-scale development. Therefore, this study intends to analyze the determinants of apartment prices from a macroscopic point of view, focusing on the New town development project. Specifically, when a development project occurs and houses are supplied, this study analyzes how it actually affects real estate prices of the apartments in the surrounding area. This study aims to understand how the development of the 2nd New town has affected the real estate prices in the surrounding area, and above all, how and how much the degree of the influence varies depending on the distance. Adding up, this study also confirms through empirical analysis whether the degree of this influence varies depending on the characteristics of the affected area.

1.2. Research Range and Structure

1.2.1. Research Range

The scope of this study is divided into content, spatial, and temporal scope. The content scope is an analysis of the actual transaction price of apartments transacted in South Korea, and the actual transaction price of real estate provided by the Ministry of Land, Infrastructure and Transport is used. The spatial scope targets cities within the Gyeonggi-do region where new town development is designated, and is designated as cities around five new town regions. Specific areas are discussed later in Chapter 4. The time range is from 2006 to 2021 as the entire period provided on the website of the Ministry of Land, Infrastructure and Transport. The year 2022 is excluded because the time series has not been completed at the time being.

1.2.2. Research Structure

This study consists of total six chapters to analyze the influence of urban development on the surrounding area.

Chapter 1 describes the background and purpose of this study as an introduction, and the spatial, content, and temporal scope of the study, as well as the overall composition and flow.

Chapter 2 reviews theories and previous studies related to hypotheses, essential theories and related previous studies. The subjects of the major preceding studies reviewed are development projects and surrounding real estate prices, areas of influence of development projects, and real estate price analysis using spatial regression. After reviewing previous studies and theories in overall, the differences of this study are described.

Chapter 3 establishes research questions and hypotheses on the research topic before empirical analysis.

Chapter 4 is about the overall contents of the analysis before actual research, and sets the analysis target and scope, reviews the analysis data, and sets the flow and method of analysis.

Chapter 5 is about the results of the empirical analysis, and the hypotheses established in Chapter 3 are tested. The analysis results on the impact of development projects on real estate prices in the surrounding area and the impact of development projects on real estate prices according to the affected areas are described.

Chapter 6 reviews and summarizes the overall research as a conclusion, reviews the significance and policy implications of this study, and the limitations of the study, and suggests future research.

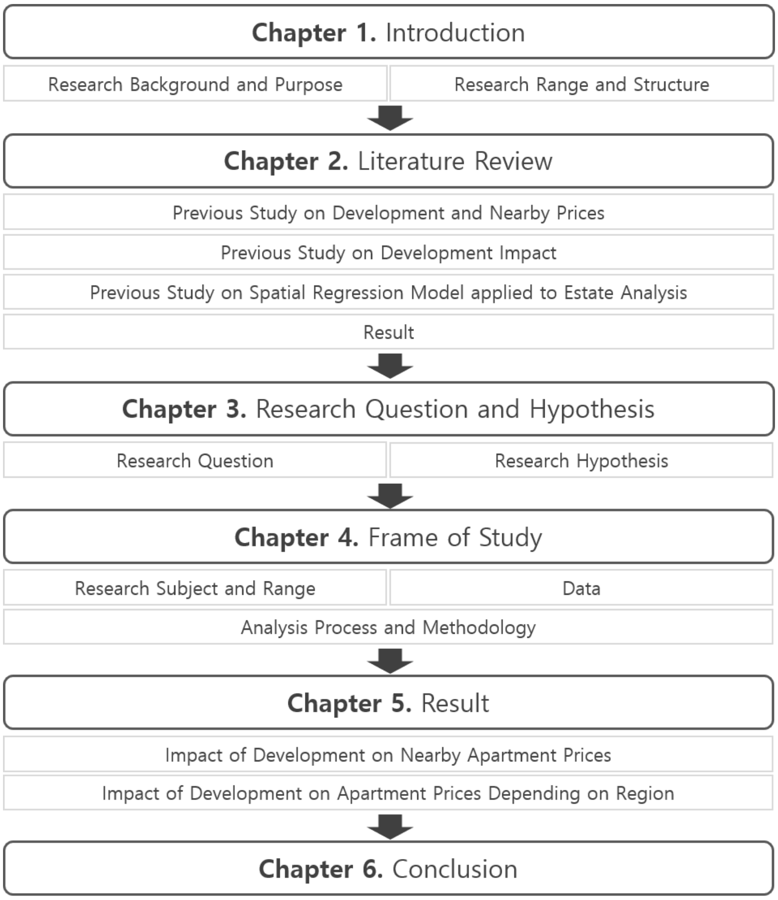

Figure 1. General structure and flow of study

Chapter 2. Literature Review

2.1. Literature Review on Development Projects and Surrounding Real Estate Prices

There is a long history of various urban development projects. Previous studies have analyzed the impact on real estate prices after development for various units, such as building-scale development, regional-scale development, and city-scale development. Previous studies have shown that real estate transaction data or housing sales price index are mainly used to carry out relevant research.

While using the actual transaction price data, there was a difference in analyzing the impact of the development project on the price using a difference-in-difference(DID) analysis model or quasi-log model. In a study by Ko Jin-soo and Lee Chang-moo (2017), difference-in-difference(DID) analysis model was built using actual real estate transaction price data to analyze the effect of public housing on nearby housing prices. As a result, the effect of price increase in the area near the public housing project appeared temporarily, and it was analyzed that it was due to the expectation of infrastructure supply in a relatively less developed area. In the study of Kim Won-jun and Seo Won-seok (2017), a semi-log hedonic price model was built using real estate transaction price data. As a result of the analysis, it was confirmed that the development of a new town has a negative external effect, and that the effect appeared even after the completion of the development of Sejong City. Additionally, educational facilities and parks were found to be important as in location decision characteristics. Cho Jeong-hee (2021)'s study analyzed the impact of expected price formation among consumer psychology on market stability by constructing an autoregressive distributed time lag model (ARDL) using actual transaction price data from 2014 to 2021. As a result of the analysis, it was found that people's expectations and behaviors are more affected by extreme market changes.

In the case of using the housing sales price index, it has the advantage that it is possible to build panel data because it is provided by region. In the study of Kwon Tae-in, Lee Sang-hyo, and Kim Jae-joon (2010), a vector error correction model was built using the housing sales price index, and the model was classified into new town, downtown, and residential-centered types according to the shape of the city. As a result, the influence according to the region was different for each type, and it was judged that the existing development level was the factor of the difference in the influence. In the study by Youngjun Kim, Joohan Sung, and Heungbae Kim (2017), a panel linear regression model was constructed using panel data, applying fixed effect and random effect models were applied depending on the region. As a result, since the increase in land price reflects the center of living area and the increase in land demand, it was derived that the demand for space such as residential and commercial is concentrated in a specific area. Moreover, depending on time variables, it analyzed that the increase in prices are due to the consumer's anticipation.

There have been overseas studies that have analyzed the fluctuations in housing prices due to development projects inside and outside the city. A study by Case, K.E., Mayer, and C.J. (1996) analyzed the housing price appraisal patterns in the Boston area from 1982 to 1994, and found that housing prices vary according to jobs, population, new development, accessibility, and school districts. In the study of Ding, C., Simons, R., and Baku, E. (2000), after constructing a hedonic price model using spatial disparity variables, an analysis was performed by investigating the impact of new and renewable development in Ohio on real estate in the surrounding area. It was concluded that the impact on real estate prices is regionally limited, and new development has a greater impact than redevelopment. In addition, all development has a greater impact on low-wage areas, and small-scale development has little impact on surrounding real estate. The study by Liang, C.M., Lee, C.C., and Yong, L.R. (2019) mixed the difference in difference method and space measurement method to identify the impact of urban regeneration on the price of surrounding residential facilities. For the study, the project divided the development project process into two stages and compared the difference in effect. Finally, it suggested that the impact of the development project had already occurred before the implementation of the development process.

These preceding studies used a framework for comparing and analyzing prices between regions by classifying regions, or after selecting regions around a specific development project, analyzed price fluctuations through comparing the stages before and after development, and performed analysis targeting actual transaction prices and land prices. To add up, identifying the influencing factors through classification between regions and projects were major approaches. Similar to this study, a study by Kim Won-jun and Seo Won-seok (2017), which analyzed the influence of new towns on real estate prices in the surrounding area, revealed the negative external effects of new town development, but analyzed only for Sejong City. It therefore has a limitation that it is difficult to generalize, and as a study that focused on analyzing spatial changes after development, the effect of distance from nearby development sites was not revealed.

2.2. Literature Review on Area of Influence of Development Project (distance)

Among the studies that analyzed the influence of development projects, studies that analyzed distance as a main impact factor were also conducted. A study by Riyoung Kim and Kwangsik Yang (2014) analyzed the impact of large-scale development on the real estate market through Granger causal analysis and VAR model. This suggests impact varies by region and factors such as population fluctuations and housing price have a greater impact than economic factors. A study by Kyung-Min Koo, Daun-Jung, and Heung-Soon

Kim (2009) analyzed the external effects of wealth due to the deteriorating residential environment in the vicinity of New Town by utilizing the panel least squares method and the panel generalized moment method. As a result, it concluded that the negative impact of apartments within 500m of the New town district has decreased since the announcement of New town, and it is difficult to generalize the perception that these projects raise asset values by bringing about positive external effects. In the study of Jooyoung Kim and Donggun Yoon (2015), the difference in difference method and hedonic price function were used to analyze the impact of innovation city development on land prices in surrounding areas according to region and time classification. As a result of the analysis, it was found that distance is a major factor in determining the land price of the surrounding area, and that the influence increases over time, and that there is no significant difference in the rate of increase in land price between areas. In the study of Soo Choi, Suntak Seo, and Jiyoung Park (2009), a hedonic price model was established and analyzed in order to set the range of influence on the surroundings after the development project. As a result, the variables that affect the land price influence distance were derived from the form of the land price function, the land price difference rate between the relevant area and the surrounding area, and the size of the development project district.

Previous studies on the influence of distance on real estate mainly divided the surrounding area into distance ranges or analyzed the difference in impact depending on the area in consideration of the direction, and analyzed the impact of the development project from the perspective of external effects.

2.3. Literature Review on Real Estate Analysis Using Spatial Regression Model

When performing real estate−related analysis, there are several studies that have performed analysis using a spatial metric model. The study by Seongwoo Kim and Gunseop Jeong (2010) compared the hedonic model and the spatial accounting model to perform an analysis to check the model fit using the actual transaction price of an apartment. There is a similar study by Seongwoo Kim and Gunseop Jeong (2010) that performed a comparative analysis between spatial metric models based on setting the actual distance. Jang Mong−hyeon and Kim Han−soo (2020) conducted a study to analyze the factors influencing apartment price using a spatial metric model, and compared the difference in the level of influence for each factor. A study by Kim Eun−hyang and Park Se−woon (2020) analyzed determinants of land price using spatial regression, and identified the price determinants of traders by considering accessibility and spatial influence.

2.4. Sub-conclusion

In most previous studies, after setting the range for the surrounding area, analysis was performed by comparing before and after within the range or comparison between zones. This method does not show the degree of effect that occurs as the distance changes, making it difficult to examine the effect. Although there have been studies that have considered the influence of distance using a spatial metric model, these studies have been conducted with polygon data and have limitations in that they are not based on individual transaction cases. Therefore, in this study, rather than to compare the influence by dividing the region by range, it aims to use the distance variable to analyze how the influence changes as the distance increases. In addition, the affected regions are not classified by simply location, but by the characteristics of the region to analyze differences other than geographical differences.

Chapter 3. Research Question and Hypothesis

3.1. Research Question

Real estate prices are determined by the interaction of several factors, which has been proven by numerous previous studies. However, as the analysis based on apartment buildings was conducted as discussed in Chapter 2, microscopic factors were mainly considered. Among the macro factors that can affect the transaction price of housing, the impact on real estate prices in surrounding areas after urban development will be analyzed, focusing on the development of new towns according to housing supply policies. Therefore, the research questions to be discussed in this study are as follows.

1. When a development project occurs and housing is supplied, how does it affect the price of apartments in the surrounding area depending on the distance?

According to the results of land price analysis of the surrounding area after the development project, the halo effect occurs even to the surrounding area due to the expectation of favorable development. However, if you look at the actual development project designation stage or development case, it can be seen that the price of the surrounding area has fallen. If so, does this difference in impact arise from the difference in degree of proximity to the development project?

2. If a development project affects apartment prices in the surrounding area, how does the degree of influence differ according to the characteristics of the area?

Currently, the majority of areas showing opposition due to the designation and development of the 3rd new town are the existing 1st and 2nd new towns. It is confirmed that the opposition is not large in cities that are not adjacent to new towns, although they are opposed due to concerns about the decline in house prices and population outflow in the existing 1st and 2nd new towns. Does the degree of impact on real estate actually differ depending on the characteristics of the neighborhood?

3.2. Research Hypothesis

Regarding the research question discussed above, the hypotheses set up to be verified in this study are as follows.

1. Development projects such as the 2nd new town will have a negative impact on apartment prices in the surrounding area.

The goal of new town development is to supply housing, and as housing supply expands, residents living in existing cities have a wider range of housing choices. In the meantime, new town development has been designated as a neighborhood area of Seoul for the purpose of managing the housing price of Seoul, and as a result, competition appears as a residential area within a new town development that complements the existing new town problem. Price competition for housing in the new town development area will occur, and the real estate price of the existing residential area will naturally fall.

2. The impact of development projects will appear differently between areas where the affected area is a new town and areas where it is not.

The first phase of the new town was started in 1989 and has already deteriorated significantly. In this state, if a new town is developed nearby and real estate prices drop, it is difficult to expect improvement in the residential environment because business feasibility is not guaranteed when redeveloped. In the case of areas other than new towns, especially underdeveloped areas, the halo effect will be seen due to the development of transportation infrastructure or convenience facilities due to the development of new towns. Therefore, the degree of impact on real estate prices due to the development of new towns in the surrounding areas will be different between the two regions.

Chapter 4. Frame of Research

4.1. Research Subject and Scope

4.1.1. Spatial Scope of Analysis

Among the 2nd new town projects, it is a transaction case site located in the surrounding areas of Dongtan New Town, Pangyo New Town, Wirye New Town, Gimpo Han River New Town, and Unjeong New Town. The areas analyzed and included as surrounding areas for each case are as follows. The surrounding areas of Dongtan New Town are districts in Yeongtong-gu, Suwon-si, Gyeonggi-do, and Hwaseong-si, Gyeonggi-do. The surrounding areas of Pangyo New Town are districts of Bundang-gu, Seongnam-si, Gyeonggi-do. The surrounding area of Wirye New Town corresponds to districts in Sujeong-gu, Seongnam-si, Gyeonggi-do. The surrounding area of Gimpo Hangang New Town includes districts within Gimpo-si, Gyeonggi-do. Lastly, the surrounding areas of Unjin Town are located in Ilsandong-gu and Ilsanseo-gu, Goyang-si, Gyeonggi-do. In addition, in spatial regression analysis, the analysis includes transaction cases in Seoul, which is the middle area of the cases, so that they can be measured with an appropriate value when calculating the weight for distance.

4.1.2. Contextual Scope of Analysis

This study aims to analyze the influence of urban development projects on real estate prices in the surrounding area, focusing on the 2nd new towns. Here, the surrounding area is based on the case of the Bundang−Pangyo new town, which showed a representative intention to oppose the new town development, and constituted transaction cases centering on areas located at similar distances. Using the case, it is confirmed whether the housing supplied by the development project of the 2nd new town has an impact on the apartment price in the surrounding area. For the entire sample, the distance between the newly supplied apartment and the existing apartment in the neighboring area is used as a variable to analyze the effect. More specifically when the variable of the nearby development was considered, it was specified into the distance of the closest and the second closest city. This is because apartment prices cannot be impacted by just one city but a compound of impact of many cities. Therefore, the distance of the closest apartment of each five cases were all calculated and the top two closest distances were chosen. In addition to the analysis, the affected area is classified into a first−phase new town and a city that is not, and the distance influence of each model is compared. Above all, since distance is the most crucial variable, it is analyzed using a spatial regression model.

4.2. Analysis Data

In this study, among the apartment actual transaction price data provided by the Ministry of Land, Infrastructure and Transport, available data from 2006 to 2021 are used. The region is limited to the regions covered in the spatial scope, and only data up to 2021 is used to complete the one-year time series. Variables are largely composed of a dependent variable and independent variables, and the dependent variable is the actual transaction price of an apartment in each case (10,000 won). The control variable is divided into control and explanatory variables. The control variable is composed of variables in the general hedonic price model, and the explanatory variable includes the distance to the development area and the size of the development area, which are the main variables of this study. Using GIS, variables of accessibility to surrounding facilities and variables of distance to development sites were calculated.

The method for calculating the distance to the development area of the explanatory variable is as follows. The distance to the development area is not simply the distance to the midpoint of the new town or the center of the city center of the new town. Assuming competition between apartments due to those who have a choice in price determination, the distance to the center of the nearest apartment complex in a newly developed new town is used as a distance variable to the development site. Accordingly, the size of the development area becomes the total number of households in the nearest apartment complex in the surrounding new town area.

Table 1. Variables used in analysis

Category		Variable	Remarks
Dependent Variable		Actual sales transaction price (apt)	Unit : 10,000 won
Independent Variable	Control Variable	Net releasable area	–
		Transaction year	–
		Floor	–
		Construction year	–
		Total household	–
		Parking space per household	–
		Construction age	= transaction year – construction year
		Floor area ratio	–
		Building coverage ratio	–
		Highest floor	–
		Year of transaction	Dummy Variable (2006~2021)
		Floor heat type	Dummy Variable (central, district, individual, city gas, cogeneration)
		Apartment type	Dummy Variable (stair, hallway, combined)
		Distance with school	Distance of closest school by each case
		Distance with bus stop	Distance of closest bus stop by each case
		Distance with park	Distance of closest park by each case

		Distance with GTX station	Distance of closest GTX station by each case
		Distance with department store	Distance of closest department store by each case
		Distance with hospital	Distance of closest hospital by each case
		Adjacent to subway	Dummy variable (within 500m : 1, else : 0)
	Explanatory Variable	Distance with development	Closest distance with an apartment within developed city/town-squared (1st, 2nd closest)
		Size of development	Total households of the closest apartment
		Interaction variable	= distance*size

Table 2. Descriptive statistics of hypothesis 1 model

Variable		N	min	max	avg	std. dev
Actual sales transaction price		22,035	5800	420,000	44,125.49	26,989.78
Net releasable area		22,035	14.201	244.75	80.83	29.98
Floor		22,035	1	59	9.57	6.21
Total household		22,035	6	4,089	995.67	662.89
Parking space per household		22,035	0.14	12	1.13	0.42
Construction age		22,035	0	38	17.91	7.19
Floor area ratio		22,035	73	1079	211.04	80.74
Building coverage ratio		22,035	7	93	18.39	9.13
Highest floor		22,035	4	59	21.15	6.50
Transaction Year	2006	22,035	0	1	0.02	0.13
	2007	22,035	0	1	0.02	0.13
	2008	22,035	0	1	0.04	0.19
	2009	22,035	0	1	0.06	0.24
	2010	22,035	0	1	0.04	0.19
	2011	22,035	0	1	0.05	0.22

	2012	22,035	0	1	0.03	0.18
	2013	22,035	0	1	0.05	0.22
	2014	22,035	0	1	0.08	0.27
	2015	22,035	0	1	0.10	0.29
	2016	22,035	0	1	0.10	0.30
	2017	22,035	0	1	0.09	0.28
	2018	22,035	0	1	0.07	0.26
	2019	22,035	0	1	0.08	0.27
	2020	22,035	0	1	0.12	0.33
	2021	22,035	0	1	0.06	0.23
Heat type (central heating)		22,035	0	1	0.00	0.05
Heat type (district heating)		22,035	0	1	0.85	0.35
Heat type (individual heating)		22,035	0	1	0.14	0.34
Heat type (city gas)		22,035	0	1	0.14	0.35
Heat type (cogeneration)		22,035	0	1	0.85	0.36
Apartment design type (stair)		22,035	0	1	0.81	0.39
Apartment design type (hallway)		22,035	0	1	0.18	0.38
Apartment design type (combined)		22,035	0	1	0.01	0.11
Distance with school		22,035	44.56	3,671.58	227.06	118.06
Distance with bus stop		22,035	2.73	3,132.14	135.66	61.73
Distance with park		22,035	11.14	2,995.53	218.18	148.56
Distance with GTX station		22,035	185.22	8,034.22	3,856.68	1,642.26
Distance with department store		22,035	107.45	11,460.97	2,159.93	1,664.96
Distance with hospital		22,035	40.65	5,577.81	1,882.07	1,026.34
Adjacent to subway		22,035	0	1	0.25	0.44
Closest distance with development-sq		22,035	0.00	1,213.62	28.18	46.67
2nd closest distance with development-sq		22,035	1.56	2,524.56	446.72	602.96
Size of development (closest)		22,035	196.00	3,481.00	700.65	397.05

Size of development (2nd closest)	22,035	196.00	3,481.00	723.92	532.77
Interaction variable (closest)	22,035	0.00	49,216.44	3,241.30	3,105.70
Interaction variable (2nd closest)	22,035	821.61	97,491.01	14,023.48	20,748.68

Table 3. Descriptive statistics of hypothesis 2 model (new town)

Variable		N	min	max	avg	std. dev
Actual sales transaction price (apt)		12,569	5,800	420,000	50,587.28	29,242.52
Net releasable area		12,569	21.12	244.75	84.66	33.74
Floor		12,569	1	59	9.36	6.30
Total household		12,569	6	2,700	855.33	477.50
Parking space per household		12,569	0.39	4.03	1.17	0.44
Construction age		12,569	0	31	19.39	5.98
Floor area ratio		12,569	79	770	203.07	87.88
Building coverage ratio		12,569	7	93	18.36	10.09
Highest floor		12,569	4	59	22.04	6.51
Transaction Year	2006	12,569	0	1	0.03	0.17
	2007	12,569	0	1	0.01	0.10
	2008	12,569	0	1	0.04	0.19
	2009	12,569	0	1	0.07	0.26
	2010	12,569	0	1	0.04	0.20
	2011	12,569	0	1	0.05	0.21
	2012	12,569	0	1	0.04	0.19
	2013	12,569	0	1	0.05	0.21
	2014	12,569	0	1	0.08	0.27
	2015	12,569	0	1	0.10	0.30
	2016	12,569	0	1	0.11	0.31
	2017	12,569	0	1	0.10	0.29
	2018	12,569	0	1	0.07	0.25
	2019	12,569	0	1	0.06	0.24
	2020	12,569	0	1	0.11	0.31
	2021	12,569	0	1	0.05	0.21

Heat type (central heating)	12,569	0	0	0.00	0.00
Heat type (district heating)	12,569	0	1	0.97	0.18
Heat type (individual heating)	12,569	0	1	0.04	0.18
Heat type (city gas)	12,569	0	1	0.04	0.20
Heat type (cogeneration)	12,569	0	1	0.96	0.20
Apartment design type (stair)	12,569	0	1	0.81	0.39
Apartment design type (hallway)	12,569	0	1	0.19	0.39
Apartment design type (combined)	12,569	0	1	0.01	0.10
Distance with school	12,569	54.60	3,671.58	214.18	111.09
Distance with bus stop	12,569	7.31	3,132.14	127.05	56.65
Distance with park	12,569	11.14	2,995.53	213.23	126.67
Distance with GTX station	12,569	185.22	8,034.22	3,219.50	1,719.06
Distance with department store	12,569	133.41	8,932.10	1,452.50	788.71
Distance with hospital	12,569	59.70	5,577.81	1,396.23	671.12
Adjacent to subway	12,569	0	1	0.32	0.47
Closest distance with development-sq	12,569	0.07	1,213.62	20.73	52.86
2nd closest distance with development-sq	12,569	1.56	2,465.40	539.42	655.97
Size of development (closest)	12,569	222.00	3,481.00	752.34	347.42
Size of development (2nd closest)	12,569	222.00	3,481.00	826.07	578.27
Interaction variable (closest)	12,569	219.11	49,216.44	2,964.16	3,208.06
Interaction variable (2nd closest)	12,569	821.61	97,491.01	18,346.69	24,971.30

Table 4. Descriptive statistics of other cities

Variable	N	min	max	avg	std. dev
Actual sales transaction price (apt)	9,763	5,800	420,000	36,252.07	21,774.05
Net releasable area	9,763	14.201	244.75	76.15	23.66

Floor		9,763	1	45	9.86	6.11
Total household		9,763	6	4,089	1,166.78	813.73
Parking space per household		9,763	0.14	12	1.09	0.39
Construction age		9,763	0	38	15.60	8.24
Floor area ratio		9,763	73	1079	222.91	68.81
Building coverage ratio		9,763	9	81	19.01	8.68
Highest floor		9,763	4	49	19.77	6.40
Transaction Year	2006	9,763	0	1	0.00	0.06
	2007	9,763	0	1	0.03	0.16
	2008	9,763	0	1	0.04	0.19
	2009	9,763	0	1	0.05	0.22
	2010	9,763	0	1	0.03	0.18
	2011	9,763	0	1	0.05	0.22
	2012	9,763	0	1	0.03	0.17
	2013	9,763	0	1	0.06	0.24
	2014	9,763	0	1	0.08	0.27
	2015	9,763	0	1	0.09	0.29
	2016	9,763	0	1	0.08	0.28
	2017	9,763	0	1	0.08	0.27
	2018	9,763	0	1	0.08	0.27
	2019	9,763	0	1	0.09	0.29
	2020	9,763	0	1	0.13	0.34
	2021	9,763	0	1	0.07	0.26
Heat type (central heating)		9,763	0	1	0.01	0.08
Heat type (district heating)		9,763	0	1	0.69	0.46
Heat type (individual heating)		9,763	0	1	0.29	0.46
Heat type (city gas)		9,763	0	1	0.30	0.46
Heat type (cogeneration)		9,763	0	1	0.69	0.46
Apartment design type (stair)		9,763	0	1	0.83	0.38
Apartment design type (hallway)		9,763	0	1	0.16	0.37
Apartment design		9,763	0	1	0.01	0.12

type (combined)					
Distance with school	9,763	44.56	3,671.58	246.72	130.61
Distance with bus stop	9,763	2.73	3,132.14	147.93	74.03
Distance with park	9,763	16.75	2,995.53	225.63	174.53
Distance with GTX station	9,763	237.11	8,034.22	4,655.62	1,099.03
Distance with department store	9,763	107.45	11,460.97	3,075.63	2,009.61
Distance with hospital	9,763	40.65	5,577.81	2,493.15	1,069.49
Adjacent to subway	9,763	0	1	0.16	0.37
Closest distance with development-sq	9,763	0.00	1,213.62	44.26	64.45
2nd closest distance with development-sq	9,763	7.23	2,524.56	330.85	497.40
Size of development (closest)	9,763	196.00	3,481.00	639.40	455.07
Size of development (2nd closest)	9,763	196.00	3,481.00	597.34	438.26
Interaction variable (closest)	9,763	0.00	49,216.44	3,861.21	3,818.46
Interaction variable (2nd closest)	9,763	1,096.31	97,193.88	8,607.32	11,015.01

4.3. Analysis Process and Methodology

4.3.1. Flow of analysis

The analysis flow for conducting empirical analysis according to the research hypotheses set in Chapter 3 is as follows. First of all, the actual transaction price data obtained from the Ministry of Land, Infrastructure and Transport is pre-processed. At this time, GIS is used to obtain distances to neighboring facilities and development areas. As a result, the hedonic price model is analyzed, and the analysis model is applied to general linear regression model, spatial lag model, and spatial error model to compare the analysis results. Through the analysis process, it is intended to identify the influence of the 2nd new town development on the surrounding area according to the distance targeting all cases. Afterwards, the same process is performed for the second hypothesis. The sample is classified into groups depending on the characteristic of the affected area, which is by dividing the affected area into areas that were previously new towns and areas that are not. For each group divided by its locational characteristics, general linear regression, spatial lag model, and spatial error model are constructed as well as the process done with the first hypothesis. In addition, through the influence graph according to the distance, it is confirmed whether the aspect or degree of influence between the two categories is different. After empirical analysis through the above analysis process, implications for the results are derived.

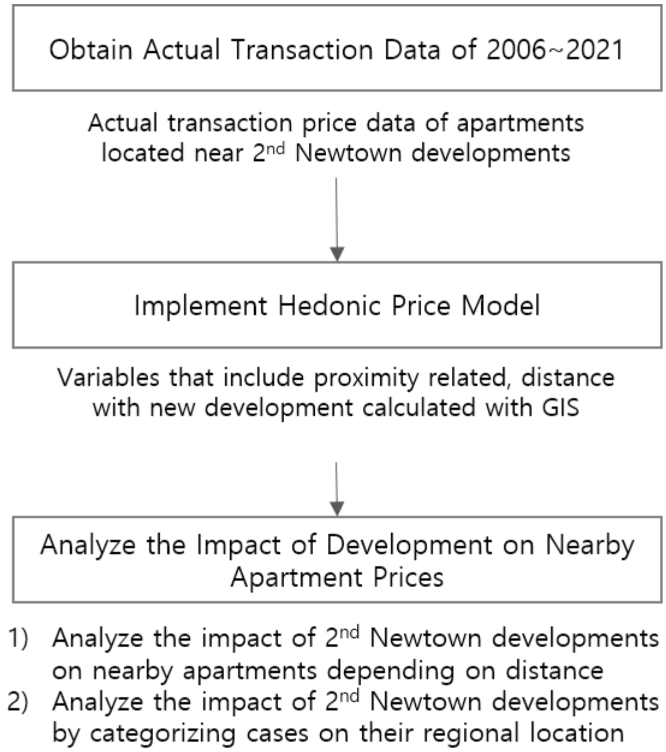

Figure 2. Empirical Analysis Flow

4.3.2. Methodology

1) Hedonic Price Model

It is known that the hedonic price model was developed by Rosen (1974) based on the approach of Lancaster (1966) among consumer theories. He saw land as a complex commodity, consisting of clusters from which consumers sought utility. Therefore, the price can be decomposed into the implied price of various characteristics through regression analysis. However, since the hedonic price model in the form of general linear regression does not consider location, a spatial regression model that considers spatial dependence should be used. Although spatial regression models are applied, the form will be based on the hedonic price model.

$$y = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta_i x_i$$

2) Spatial Lag Model

The spatial lag model is one of the most frequently used spatial regression models, which assumes that prices are interdependent in space. This means that the price does not exist independently, but depends in part on the characteristics of nearby objects. The spatial parallax model is as follows.

$$p = \rho W_p + a + \beta_x + \varepsilon$$

In the spatial disparity model, p is a column vector and x is an m*n matrix of independent variables. W is a standardized spatially weighted m*n matrix representing the spatial correlation. Wp is the spatial disparity dependent variable, and p is the spatial autocorrelation parameter.

3) Spatial error model

The spatial error model is a model that expresses spatial dependence through an error term and has the following form.

$$p = a + \beta_x + u \qquad u = \lambda W_u + \varepsilon$$

Here, W means the spatial weight matrix and X means the matrix of independent variables. This model considers spatial autocorrelation as a nuisance by including it into the error term (Stakhovych, & Bijmolt, 2009).

Chapter 5. Result

5.1. Impact of Development on Apartment Prices in Nearby Cities

5.1.1. Spatial Autocorrelation Analysis

Prior to spatial regression analysis, spatial autocorrelation analysis is performed to test whether the samples are spatially dependent. At this time, it is necessary to set the weight, but the analysis unit of this study is point data, so the condition of adjacency cannot be applied like a general spatial weight setting. Therefore, by setting the bandwidth, it is set to assume that points within the range are adjacent. At this time, it is important to set an appropriate bandwidth, which sets the distance sequentially so that the distance with the highest r-squared is applied. As a result of the application, the best analysis results were obtained when the bandwidth was set to 5km. The analysis result of spatial autocorrelation is expressed as a Moran's I scatter plot, and the Moran index is also derived. The closer the exponent is to 1, the stronger the positive (+) spatial autocorrelation is, and the closer to −1, the stronger the negative (−) spatial autocorrelation is. As a result of the analysis of the entire sample, the Moran index was 0.641, showing high autocorrelation.

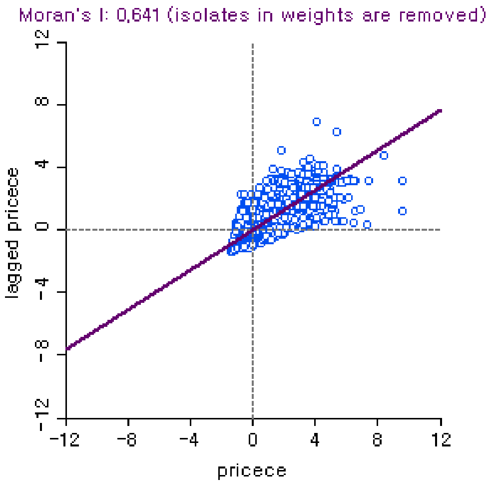

Figure 3. Moran's I for hypothesis 1 model

5.1.2. Analysis Model

The total sample is a total of 22,035 apartment transaction cases, and a general linear regression model, spatial lag model, and spatial error model were constructed with the dependent variable, the apartment transaction price. As a result of general linear regression analysis, a total of 34 significant independent variables were derived with a modified coefficient of determination of 0.74, AIC(Akaike info criterion) was derived as 482,789, and SC (Schwarz criterion) was derived as 483,069. As a result of the spatial disparity model analysis, 34 significant independent variables were found, with a coefficient of determination of 0.82, AIC of 475,390, and SC of 475,678. Dependent variables with provisional spatial weights were found to be significant. As a result of the analysis of the spatial error model, 31 significant independent variables were derived, and the coefficient of determination was

0.86, AIC was 470,889, and SC was 471,169.

As a result of comparison between the models, it can be confirmed that the r−squared of the spatial lag model increased compared to the OLS model, and the r−squared of the spatial error model is better than that of the spatial lag model. The coefficient of determination increased, and the cases of AIC and SC also decreased. Therefore, based on the analysis result of the spatial error model that showed the best model fitness, the influence graph according to its coefficients of distance was confirmed.

Table 5. Result of analysis for hypothesis 1 model

Variable	OLS	SLM	SEM
Intercept	9,880.00***	7,117.69***	460.84***
Area	477.40***	366.41***	178.03***
Floor	144.00***	178.09***	0.43
Total household	−0.72***	0.38***	572.40
Parking space per household	993.20***	−5,308.91*	310.63***
BCR	202.20***	75.70***	950.17***
Highest floor	929.70***	189.10***	1,943.89*
District heating	5,287.00***	2,625.20***	2,093.38**
Stair type	2,712.00***	−677.32***	−8,295.54***
2006	−17,560.00***	−10,081.90***	−2,854.91***
2007	−2,465.00**	−2,882.84***	−12,864.80***
2008	−15,750.00***	−12,772.90***	−12,311.60***
2009	−12,500.00***	−11,587.20***	−13,841.50***
2010	−14,510.00***	−13,271.80***	−13,895.70***
2011	−16,410.00***	−13,888.40***	−14,690.70***
2012	−15,330.00***	−14,230.10***	−15,595.20***
2013	−15,340.00***	−14,919.60***	−13,622.40***
2014	−14,480.00***	−13,450.60***	−13,223.50***
2015	−16,030.00***	−13,470.40***	−11,538.40***
2016	−11,950.00***	−11,309.50***	−8,713.71***
2017	−8,236.00***	−8,116.45***	−3,700.88***

2018	−4,241.00***	−3,675.09***	7,507.30***
2020	5,662.00***	6,649.80***	24,450.70***
2021	25,520.00***	24,064.50***	−1.55***
Distance to GTX station	−1.62***	−0.88***	3,835.24***
Adjacent with subway(500m)	4,064.00***	1,908.43***	3.96
Distance to bus station	−7.99***	−6.47***	−4.78**
Distance to school	−3.99***	−2.06***	−2.47***
Distance to hospital	−5.26***	−2.26***	−8.27**
Closest distance−sq	28.36***	13.27***	−6.70***
Total household of closest apt	−9.25***	−5.71***	−6.70***
Second closest distance−sq	−11.27***	−7.10***	−3.66***
Total household of 2nd closest apt	−3.91***	−3.18***	0.61***
Closest distance*size	0.04	0.18***	0.14***
2nd closest distance*size	0.10***	0.11***	460.84***
Adj. R−sq	0.74	0.82	0.86
AIC	482,789	475,390	470,889
SC	483,069	475,678	471,169

p−value '***' less than 0.01, '**' less than 0.05, '*' less than 0.1

5.1.3. Empirical Analysis Result

When comparing the general linear model and the spatial regression model (lag, error), it was confirmed that the r−squared increased in the order of spatial lag in the general linear model, spatial error model, and spatial lag model. The coefficients of the distance and scale variables derived from each model are graphically expressed and compared. The graph patterns between the models were similar, in the sense that the influence of the closest city exceed of those in 2nd closest distance. However, the spatial error model's distance figure showed that the influence of nearby development has a generally negative influence. When the spatial error model was used as the standard for the influence according to the distance, the development project was derived to have a negative influence in general, where its degree diminishes until approximately 14km.

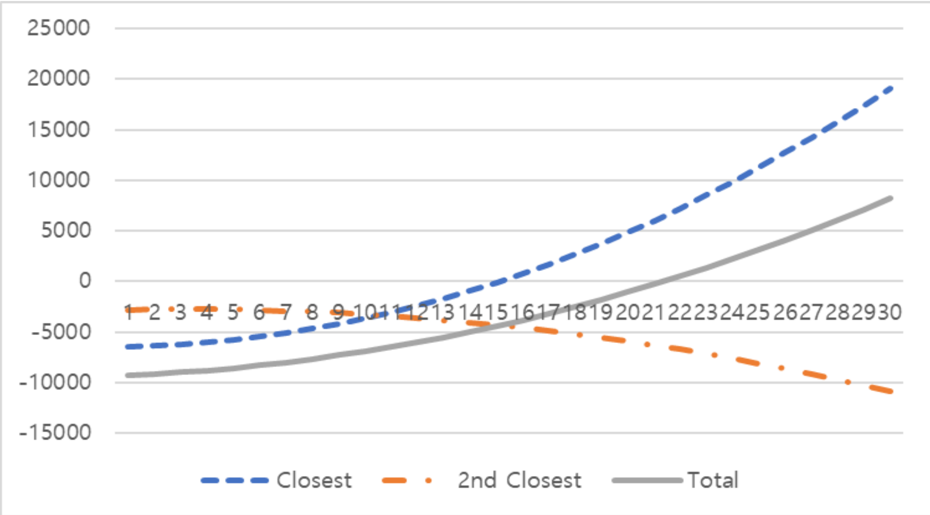

Figure 4. Ordinary Linear Model of hypothesis 1 model

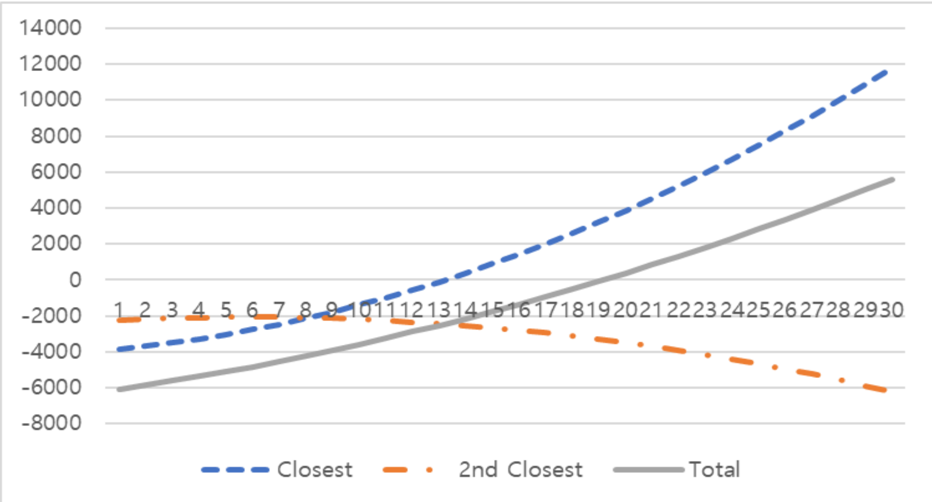

Figure 5. Spatial Lag Model of hypothesis 1 model

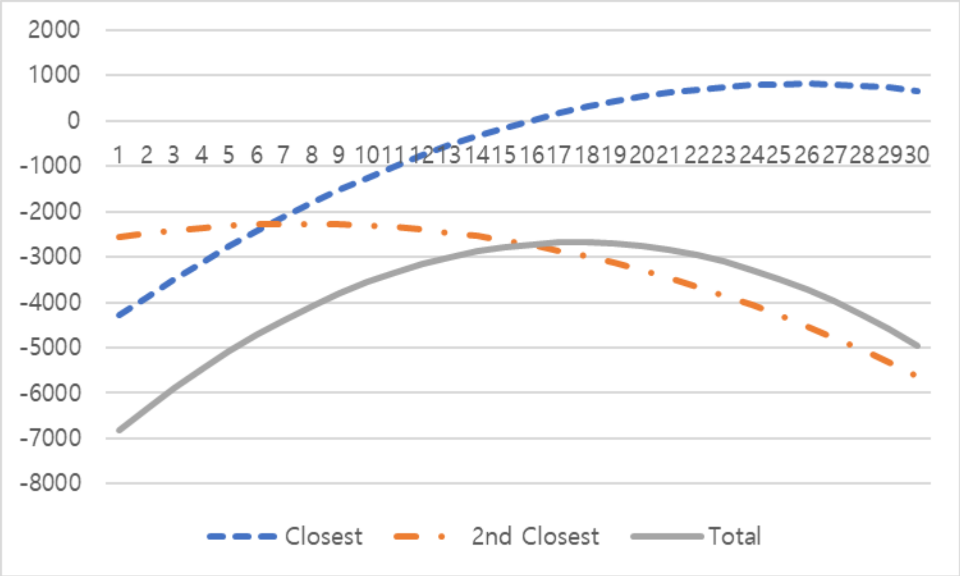

Figure 6. Spatial Error Model of hypothesis 1 model

5.2. Impact of Development on Apartment Prices Depending on Region

5.2.1. Spatial Autocorrelation Analysis

Each of the two models is also subjected to spatial autocorrelation analysis to test whether the sample is spatially dependent prior to spatial regression analysis. At this time, it is necessary to set the weight, and apply the bandwidth that derives the highest r-squared result for each model in the same way as for the entire sample. As a result, in the case for both the new town and the cases other than new town model, 5km was set for the most adequate bandwidth. The result of the analysis of the new town model showed a high positive autocorrelation of 0.555 about Moran index, and a high positive spatial dependence of 0.759 for the model outside the new town.

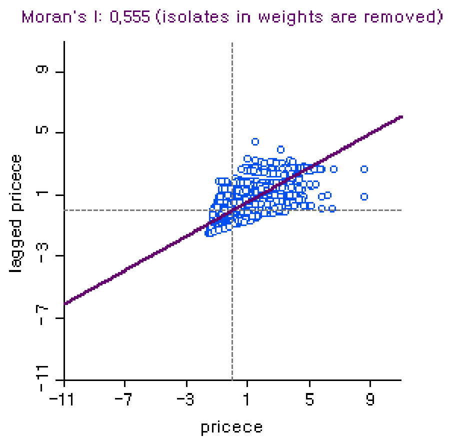

Figure 7. Moran’s I for hypothesis 2 model (new town)

Figure 8. Moran's I for hypothesis 2 model (other cities)

5.2.2. Analysis Model

1) New town area

A total of 12,569 apartment transaction cases were sampled by new town area, and a general linear regression model, spatial lag model, and spatial error model were constructed with the dependent variable, the apartment transaction price. As a result of the general linear regression analysis, a total of 34 significant independent variables were derived with a modified coefficient of determination of 0.79, AIC(Akaike info criterion) was derived as 274,760, and SC (Schwarz criterion) was derived as 275,020. As a result of spatial disparity model analysis, 31 significant independent variables were found, the coefficient of determination was 0.82, AIC was 272,874, and SC was 273,142. Dependent variables with provisional spatial weights were found to be significant. As a result of the analysis of the spatial error model, 31 significant independent variables were derived, and the coefficient of determination was 0.85, AIC was 270,980, and SC was 271,240.

As a result of comparison between the models, it can be confirmed that the r−squared of the spatial disparity model has increased compared to the general linear model, and the r−squared of the spatial disparity model has improved compared to the spatial disparity model in the new town area, same as the results of the overall sample analysis. The coefficient of determination increased, and the cases of AIC and SC also decreased. Therefore, based on the analysis result of the spatial error model that showed the best explanation, the influence graph according to the distance was confirmed.

Table 6. Result of analysis for hypothesis 2 model (new town)

Variable	OLS	SLM	SEM
Intercept	38,070.00***	31,262.90***	13,058.50***
Area	513.90***	440.38***	496.12***
Floor	236.00***	253.06***	227.34***
Total household	4.34***	2.77***	4.97***
Parking space per household	893.30**	−5,179.93***	3,250.77***
BCR	316.40***	121.35***	268.59***
Highest floor	241.10***	19.94	653.56***
Cogeneration type	−5,836.00***	−8,113.24***	−8,378.77***
Stair type	2,143.00***	−827.03***	2,542.68**
2006	−24,450.00***	−19,293.70***	−15,678.80***
2007	−11,770.00***	−9,011.17***	−7,937.90***

2008	−25,630.00***	−22,154.80***	−20,763.00***
2009	−19,230.00***	−18,427.00***	−18,022.90***
2010	−22,250.00***	−20,999.30***	−20,869.80***
2011	−24,160.00***	−22,555.00***	−21,724.40***
2012	−22,210.00***	−21,649.20***	−21,535.90***
2013	−22,240.00***	−22,818.80***	−23,355.70***
2014	−20,350.00***	−20,056.50***	−19,911.10***
2015	−23,910.00***	−21,884.40***	−20,747.80***
2016	−18,900.00***	−18,562.40***	−17,941.10***
2017	−12,880.00***	−12,764.80***	−12,933.60***
2018	−6,894.00***	−6,295.28***	−6,045.29***
2020	4,358.00***	5,350.83***	6,473.76***
2021	24,000.00***	25,177.50***	25,628.80***
Distance to GTX station	−0.42***	−0.27***	−0.81***
Adjacent to subway station	3,823.00***	2,017.62***	3,389.59***
Distance to bus stop	−6.71***	−4.28**	−2.78
Distance to school	−3.83***	−1.54	−3.19
Distance to hospital	−3.38***	−1.90***	0.07
Closest distance−sq	−10.66**	−8.26**	−11.39***
Total household of closest apt	−19.00***	−11.47***	−10.09***
2nd closest distance−sq	−16.11***	−12.26***	−10.42***
Total household of 2nd closest apt	−11.68***	−8.86***	−7.63***
Closest distance*size	0.45***	0.41***	0.62***
2nd closest distance*size	0.34***	0.28***	0.26***
Adj. R−sq	0.79	0.82	0.85
AIC	274,760	272,874	270,980
SC	275,020	273,142	271,240

p−value '***' less than 0.01, '**' less than 0.05, '*' less than 0.1

2) Areas other than New towns (other cities)

A total of 9,763 apartment transaction cases were sampled in areas where the affected area was not a new town, and a general linear regression model, spatial lag model, and spatial error model were constructed with the apartment transaction price as a dependent variable. As a result of the general linear regression analysis, a total of 31 significant independent variables were derived with a modified coefficient of determination of 0.71, AIC (Akaike info criterion) was derived as 210,749, and SC (Schwarz criterion) was derived as 210,979. As a result of the spatial disparity model analysis, 31 significant independent variables were found, and the coefficient of determination was 0.82, AIC was 206,057, and SC was 206,294. Dependent variables with provisional spatial weights were found to be significant. As a result of the analysis of the spatial error model, 31 significant independent variables were derived, and the coefficient of determination was 0.87, AIC was 203,360, and SC was 203,590.

As a result of the comparison between the models, the R-squared of the spatial lag model was increased compared to the general linear model, and the error of the spatial lag model was less than that of the spatial lag model. The coefficient of determination increased, and the cases of AIC and SC also decreased. Therefore, based on the analysis result of the spatial error model that showed the highest accuracy, the influence graph according to the distance was confirmed.

Table 7. Result of analysis for hypothesis 2 model (other cities)

Variable	OLS	SLM	SEM
Intercept	39,870.00***	93,115.20***	21,219.60***

Area	370.00***	679.09***	261.67***
Floor	163.80***	330.44***	105.44***
Total household	−0.72***	−4.20***	0.50***
Parking space per household	2,366.00***	14,781.10***	−1,983.75***
Construction age	−604.60***	−1,860.75***	−164.48***
BCR	30.41*	−106.31**	78.31***
Highest floor	689.30***	2,469.62***	65.55**
Central heating	10,200.00***	30,147.70***	3,211.95**
City gas type	−5,799.00***	−13,873.30***	−2,970.08***
2006	−49,390.00***	−70,674.30***	−41,938.60***
2007	−25,500.00***	−37,699.20***	−21,224.90***
2008	−37,480.00***	−63,668.90***	−28,298.50***
2009	−36,980.00***	−61,652.30***	−28,338.50***
2010	−37,110.00***	−61,055.00***	−28,724.30***
2011	−36,600.00***	−60,007.40***	−28,397.10***
2012	−35,480.00***	−56,054.60***	−28,266.30***
2013	−35,940.00***	−54,759.10***	−29,348.10***
2014	−34,420.00***	−52,566.70***	−28,064.60***
2015	−30,860.00***	−42,746.50***	−26,696.90***
2016	−28,480.00***	−37,871.80***	−25,185.90***
2017	−26,360.00***	−31,388.50***	−24,597.00***
2018	−25,410.00***	−32,013.80***	−23,095.70***
2019	−23,380.00***	−29,046.20***	−21,388.30***
2020	−15,880.00***	−21,527.40***	−13,898.60***
Adjacent to subway	2,389.00***	6,436.98***	971.47***
Distance to hospital	−3.95***	−11.39***	−1.34***
Closest distance−sq	35.68***	69.35***	23.89***
Total household of closest apt	−6.25***	−14.34***	−3.41***
2nd closest distance−sq	−8.74***	−18.56***	−5.29***
Closest distance*size	0.76***	1.76***	0.41***
2nd closest distance*size	0.02*	−0.08**	0.06***
Adj. R−sq	0.71	0.82	0.87
AIC	210,749	206,057	203,360
SC	210,979	206,294	203,590

p−value '***' less than 0.01, '**' less than 0.05, '*' less than 0.1

5.2.3. Empirical Analysis Result

As for the new town models, it shows a similarity between the three models. The influence of the closest city is bigger than that of the second closest, and it changes as the distance increases. In general, all models show a negative influence occurring due to development nearby. In terms of oversupply effect and infrastructure expansion effect, the 1st new town cities show less of the latter, because there are already provided as they are a new town themselves. In this case, the oversupply effect puts a bigger impact, resulting as giving a negative influence on housing prices to those apartments nearby.

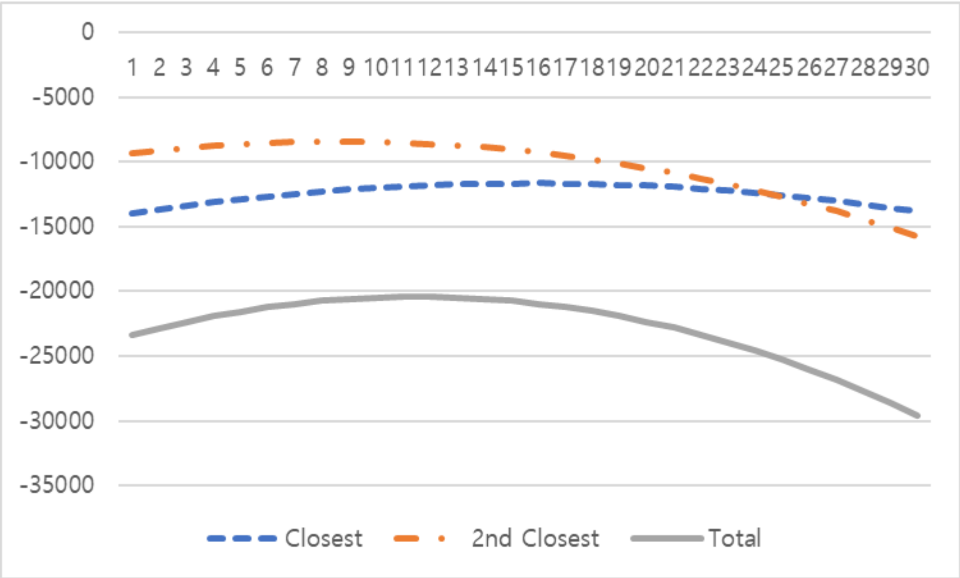

Figure 9. Ordinary Linear Model of hypothesis 2 model (new town)

Figure 10.Spatial Lag Model of hypothesis 2 model (new town)

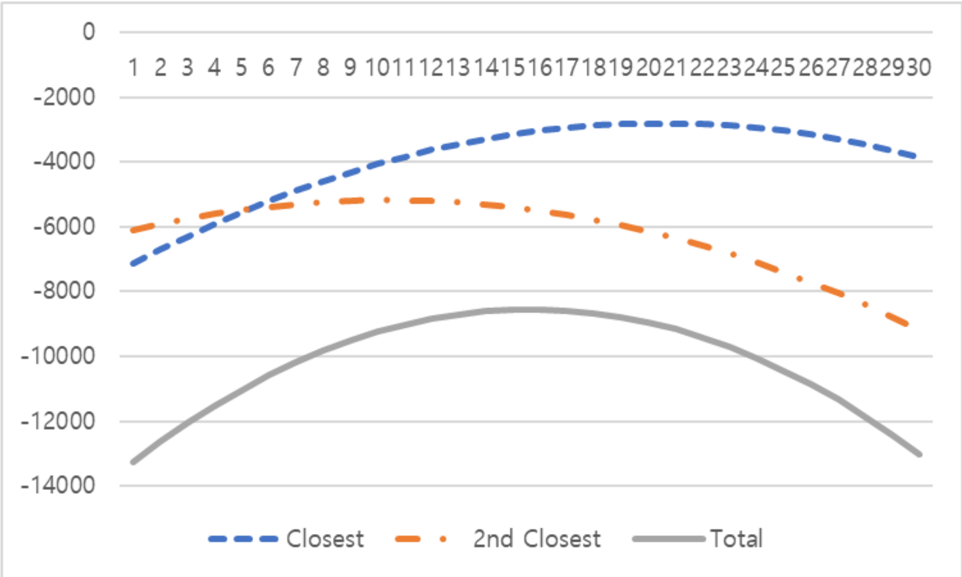

Figure 11. Spatial Error Model of hypothesis 2 model (new town)

As for the cities those are not new town, it shows a different form of distance influence than that of the 1st new town models. All models, OLS, SLM, SEM show a gradually increasing influence due to nearby developments. It also does show similarity where the closest city's influence exceeds the second closest as it gets further away. For those cities with are not new towns, the effect of expanded infrastructure gives a greater positive impact than the negative impact from oversupply of housing. However, for houses located within approximately 5km, there are given a negative impact in prices where the effect of oversupply is bigger.

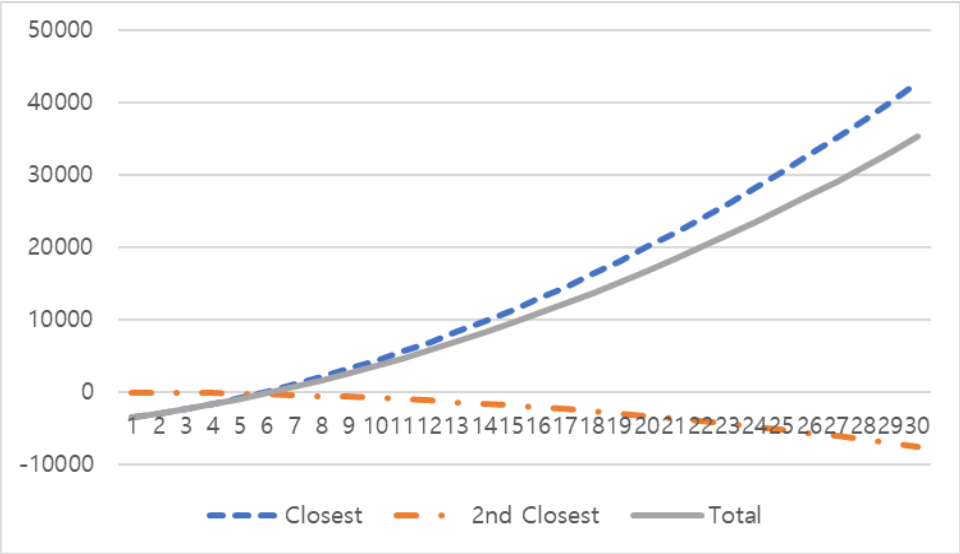

Figure 12. Ordinary Linear Model of hypothesis 2 model (other cities)

Figure 13. Spatial Lag Model of hypothesis 2 model (other cities)

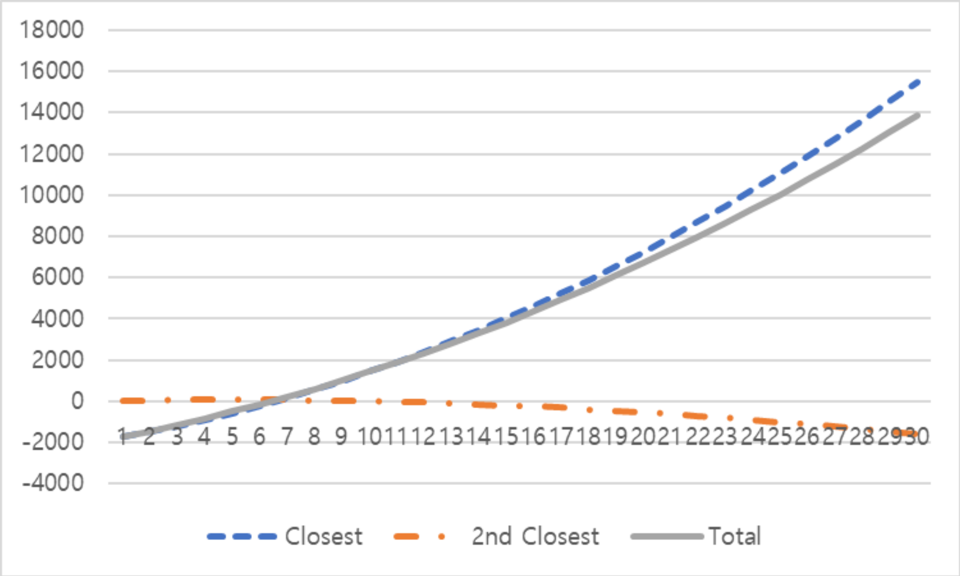

Figure 14. Spatial Error Model of hypothesis 2 model (other cities)

By comparing the two models of different datasets, on whether the cases are located in a new town or not, the second hypothesis was accepted. The benefit of additional infrastructure does not greatly impact the prices positively, due to the infrastructure already provided. Therefore, the apartment prices of new towns show a decrease, when a new development is placed nearby. For those apartments not located in new towns, the housing prices do decrease in close boundary due to the effect of contest but shows increase gradually as it gets further away.

Chapter 6. Conclusion

The purpose of this study was to analyze the influence of newly developed cities on nearby apartment transaction prices and how it varies depending on actual distance. South Korea has a great concentration and attention towards real estate and its prices, especially on housing. The developments of cities and towns are mainly to provide more affordable and enough housing for everyone. As these new developments are implemented, they impact nearby environments, and one of the major changes regard prices. This study therefore analyzed the impact of the distance of the newly developed districts and compared the impact due to where the impacted apartment is located – whether it is a new town or not. The spatial scope of the study covers mainly five cities – Bundang-gu, Suwon, Ilsan, Gimpo, and Sujung-gu. The main variables of the model are the distance variables, more specifically the closest distance and the second closest distance. By the assumption that the impact is proportionate to its size, interaction variables were also included in the empirical analysis process. Since distance can be interpreted in 2-dimentional or 3-dimensional, spatial regression models were also used along with ordinary linear models to specify the impact of distance more accurately. The result of the models showed that the two hypotheses were all accepted. The first hypothesis was accepted due to the influence of distance showing a generally negative impact on housing prices. The second hypothesis was accepted by comparing the results between those of the cases within new towns and those which are not. The cases within new towns showed having a negative impact from the newly developed apartments due to the oversupply effect while the cases not within new towns showing a positive effect from boundaries outside of 5km due to the effect of infrastructure expansion.

This study's result showed that newly developed apartments in new towns can give a negative impact on those apartments already in used in general. In addition, when these new developments are located in places that are short or in need of additional infrastructure can give a positive impact to neighborhood cities. These results are hoped to aid in consideration of locating the 3rd new town developments planned in South Korea, due to the fact that many citizens protest of having new towns located near their households.

However, the limitations of the study are that when the impact given from many cities were considered, the first and second cities were only considered. This was due to the fact that the cases were generally further apart so the distance of the third and fourth closest distance did not make a big difference. Moreover, some new developments were made far after the transaction year for some cases, which resulted into not even having distances of the third and fourth closest cities. If all distances were considered, there would have been many null cases making the variable meaning less to consider. Regarding distance, the clear interpretation of its impact is lacking. As for the result regarding the first hypothesis, the two spatial regression models show that from much further than each 5km or 11km, the impact of the second closest region is bigger than that of the closest region. The explanation for this result is not explicit, but can be interpreted that in those areas, the expansion of infrastructure gives a stronger and bigger impact than of the oversupply effect. The lack of explicit interpretation is a major limitation of this study. However, this limitation is expected to be overcome by redrawing the impact graph with cases of the distance of 3rd and 4th closest regions. Another limitation lies in that the cases analyzed are not enough considering there are five 1st new towns and additionally twelve 2nd new towns. The construction of 2nd new towns are still in progress, adding up to the limitations of applying the results into future decisions. In further studies, more cases of new town developments should be considered along for objectivity and representation of the results.

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국문 초록

대한민국 내 주요 관심사인 부동산은 도시개발사업과 맞닿아 있는데, 최근 3기 신도시가 활발히 추진 중에 있으며 이러한 주택공급을 목표로 한 개발계획은 다양한 영향을 끼친다. 대규모 주거공급이 끼치는 영향 중에는 기존에 주변에 위치했던 아파트 가격의 변동이 있으며, 신규 개발지가 어디에 위치하는지는 이러한 영향 정도를 좌우한다. 가격 결정에 있어 위치가 중요함에도 불구하고 신규 공급 아파트와 기존 아파트 간의 실제 거리를 기반으로 이가 미치는 영향력을 분석한 논문은 적으며, 최근 데이터까지 활용한 연구는 더욱이 부족한 실정이다. 따라서 본 연구는 신도시 개발 대상지의 주변 도시 내 기존에 위치한 아파트 가격이 영향을 받는지, 그 영향력이 실제 거리에 따라 달라지는지 분석하는 것에 목적을 둔다.

신도시 개발은 신규 공급된 주거에 경합효과를 발생시키며, 개발지에 따라 주거의 과잉 공급과 기반시설확충 효과 정도가 달리 나타날 것이다. 이와 같은 내용을 전제로 본 연구는 신도시 사업으로 인해 주변에 위치한 기존 아파트의 가격은 하락할 것이며, 기존의 아파트가 신도시에 위치하거나 아닌 경우에 따라 그 영향 정도가 다르게 나타날 것이라는 가설을 설정한다. 가설을 검증하기 위하여 헤도닉 가격 모형에 기반을 둔 일반회귀모형, 공간시차모형, 공간오차모형을 활용하여 신도시 개발지 내 신규 아파트와의 거리가 기존 아파트의 실거래가에 미치는 영향 정도를 분석한다. 분석 결과로 신도시 개발로 인해 아파트 가격은 전반적으로 음의 영향을 받은 것으로 나타났으며 신도시의 경우, 전반적으로 음의 영향력을 받았으나 신도시 외 지역에 위치한 경우, 일정거리 이

후부터 신도시 개발로 인해 긍정적인 영향을 받는 것으로 나타났다. 본 연구는 거리구간에 따라 분석한 선행연구와 달리 실제 거리에 따른 영향력을 실증 분석했다는 점에 의의가 있다. 분석 결과에 따라 미래의 도시 개발사업에서 위치와 관련하여 거리에 대해 고려할 것을 제안한다.

주요어 : 신도시, 도시개발사업, 공간회귀모형, 헤도닉가격모형, 거리 영향력

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