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An Empirical Analysis on the Effect of the Abandoned Building Maintenance Project on the Price of Neighboring Apartments

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요 약

This paper empirically analyzes the changes in the price of apartments which are adjacent to an abandoned building before and after the selection of the building as a target of a maintenance project by the Ministry of Land, Infrastructure and Transport in Korea. The analytic model to capture a public value from the project is a difference-in-differences framework, and the data used for the analysis correspond to the actual transaction prices. According to the empirical results, after the selection of the abandoned building by the maintenance project, the prices of the neighboring apartments increased by approximately 82.6 dollars per one square meter of the apartments compared to those of apartments which are across a river. The existence of such positive external effects would support the public intervention in managing the abandoned buildings.

Keywords : Abandoned Building, Maintenance Project, Difference-In-Differences, House Price

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Ⅰ. Introduction

When a privately-led real estate development project is stopped and left unattended for personal reasons, it is empirically suggested in related prior research that it not only damages the landscape, but also causes negative externalities that lower the price of nearby real estate. In addition, the negative external effects from an abandoned building are analyzed to appear in various aspects, for example, crime (Branas et al., 2016; Cui & Walsh, 2015; Kondo et al., 2015; Pais & Wolf, 2010), environments (Han, 2014; Schachterle et al., 2012; Wallace & Schalliol, 2015), and health or well-being (Garvin, 2013; Kruger et al., 2007).

According to a press release from the Ministry of Land, Infrastructure, and Transport (September 13, 2016), there are a total of 387 construction sites neglected nationwide, with an average completion rate of 41% and a neglect period of 153 months. An abandoned building is defined as a building that has been abandoned for more than two years. In Korea, 322 locations nationwide were included in the second Construction Status Survey conducted in 2019. Among them, 241 (62%) have stopped construction for more than 10 years. By planned use, 121 (31%) apartment buildings, 99 (26%) sales facilities, and 67 (17%) lodging facilities account for the majority. The main reasons for the suspension of construction were lack of funds (177 sites) and bankruptcy (157 sites), and litigation and disputes accounted for 12% of the cases.

The maintenance project solves urban safety and landscape disturbances caused by the abandoned buildings by applying various methods, such as completing, dismantling, and reconstructing buildings in consideration of the state of the abandoned buildings and surrounding development conditions. If selected as a leading project, the Ministry of Land, Infrastructure and Transport supports the cost of establishing a maintenance business plan for discovering customized maintenance methods, and the Korea Land and Housing Corporation directly participates as a development entity (for example, as a consigned business or business agent), or indirectly by providing consulting to the building owner.

This paper empirically analyzes the changes in the price of neighboring apartments

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following the selection of the Ministry of Land, Infrastructure and Transport maintenance project for abandoned buildings. It is based on the hedonic model, which is a typical analytic tool for apartment price determination, but uses a difference-in-differences analysis framework to estimate the effect of the selection of a maintenance project target, that is, the public value. In particular, by comparing the change in actual transaction price before and after the implementation of the policy between the treatment group, which is defined as apartments near the abandoned building subject to the maintenance project, and the comparison group, which is defined as apartments physically adjacent but geographically and socially separated by a river, the counterfactuals, for example, the economic fluctuations are controled for and the net effect of the policy is estimated. Since the maintenance project solves problems in the private sector by injecting a considerable amount of public budget, the legitimacy of government intervention in the private real estate market can be secured only when its effect is revealed through empirical analysis. In particular, from the public perspective, the effect of the maintenance project is not limited to the maintenance of the abandoned building itself, but more focus should be placed on the positive external effect of improving the living conditions in the neighborhood through maintenance. This paper contributes to the literature in the sense that, to our best knowledge, there has not been a study that empirically analyzed the effect of the maintenance project. Also, the methodology used in this paper is a double difference where a natural feature, that is, a river between the treatment and comparison groups is drawn upon as a identification strategy.

The structure of this paper is as follows. The next chapter discusses the theory of the negative economic effects caused by abandoned buildings, that is, the neighborhood effect or neighborhood selection model. The data and variables used in the empirical analysis of this paper are explained in Chapter 3. Chapter 4 presents the results of empirical analysis on the economic impact of the selection of targets for maintenance projects for abandoned buildings. The last chapter summarizes the results of this paper, and presents the policy implications of the analysis results, limitations and future tasks to be done.

Ⅱ. Theoretic Background and Analytic Model

1. Theoretic Background

Many studies empirically analyze the negative effect of abandoned buildings. According to Kondo et al. (2015), the City of Philadelphia, USA, enacted the Doors and Windows Ordinance in 2011 requiring owners of abandoned buildings to install working doors and windows in abandoned buildings, which reduced crime and was significantly associated with a decrease in violent gun crimes in some parts of the city. In addition, it is analyzed that it does not simply move crime from one area to another. Cui & Walsh (2015) also conducted an empirical analysis of Pittsburgh, Pennsylvania, showing that the violent crime rate in the neighborhood increases by approximately 19% when seized real estate is left unattended. Furthermore, this increase in the crime rate appears to be proportional to the period of abandonment.

Damage to the surrounding environment of abandoned buildings is also raised in several studies. First, Wallace & Schalliol (2015) suggest that abandoned buildings cause serious social chaos through analysis of 36 abandoned buildings and 587 neighboring areas in Chicago, USA. Moreover, Kruger et al. (2007) suggest that such social chaos adversely affects social relationships among members, which in turn negatively affects individual mental health and well-being. According to Schachterle et al. (2012), which analyzed the city of Baltimore, USA, when the proportion of vacant buildings in the census tract increases by 10%, the fire rate appears to increase by 9.9% on average.

The effect of abandoned real estate on the value of nearby real estate is reported by Han (2014) and Im & Hong (2020). The former, through empirical analysis of Baltimore, USA, shows that abandoned buildings decrease the price of nearby real estate, as well as that the longer the abandonment period, the larger the scale of these negative effects and the wider the geographic scope. The latter empirically shows the decline in housing prices in the neighborhood of abandoned buildings in Korea and uses the difference-in-differences to control for changes in neighboring housing prices caused by economic fluctuations. In particular, in setting the control group, only the effects of the abandoned

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building were estimated by limiting the samples to the houses that were geographically adjacent to the treatment group, but not affected by the abandoned building because the two groups were geographically separated by the railroad.

2. Analytic Model

The building that has been abandoned for analysis in this paper is a building located at 743-8, Choji-dong, Danwon-gu, Ansan-si, Gyeonggi-do (see 〈Fig. 1〉). It was approved as a complex sales facility with 2 stories below ground and 7 above the ground on a site area of 3,677 square meters, and was left unattended with the completion rate of 80%. The original use of the building was a commercial complex, and construction was stopped in July 2010, and it was left unattended for 6 years and 4 months at the time it was selected for the maintenance project (December 2016). The reason for the suspension of construction was investigated as the developer's personal lack of funds. In other words, the stagnation of the nearby real estate market, such as a decrease in the price of a neighboring house or a decrease in the rent of a nearby commercial building, is not a factor in stopping the construction. Therefore, the result of analyzing

〈Fig. 1〉 The abandoned building

the effect of the maintenance project on the price of a neighboring house is relatively free from an endogeneity issue. If the construction was stopped by a concern that the profitability of the building would deteriorate due to the stagnation of the nearby real estate market during the construction period of the building, and thus difficulties in realizing the expected rental income or lucrative sales after completion, it includes the possibility of overestimating the results on the effect of selecting the target for the maintenance project through the relative increase in prices of nearby real estate.

In this paper, we empirically analyze the change in the price of neighboring houses according to the selection of a specific abandoned building as a maintenance project target through a double-difference model. The value of a housing unit is supposed to be a function of the quality of the unit and its amenity. It is a basic concept of hedonic approach in determining the housing prices. The conversion of the abandoned building by public intervention would improve the amenity of the neighboring houses, and this improvement would be capitalized into a housing price. Thus, the effect of the project evaluated by the change in housing prices is not pecuniary. According to Shubik (1971), when a change in a price is observed by a partial equilibrium perspective, it is misunderstood as an externality by some economic agents even though it is a change in equilibrium price and thus does not belong to a market failure. The increase in the value of the abandoned building itself by the government's management project is not an externality. However, it is a typical market failure because the owners of the housing units in the vicinity of the building obtain some windfall, that is, the increase in their housing price due to the improved amenity without paying for the cost of the project. Thus, there exists Pareto improvement, and the increase in the price of the nearby homes is not a *pecuniary* externality but a *true* externality. It indicates the change in people's valuation of the improvement in amenity.

Abandoning a building that has been suspended under construction harms the aesthetics of nearby residents and has negative externalities on the local real estate market. Therefore, the maintenance project gives public value by removing these negative influences. The price of a house near an abandoned building will rise due to the maintenance project or only by being selected as a maintenance project target.

 https://doi.org/10.52344/hfr.2021.5.2.5

However, if the local real estate markets are affected by economic fluctuations which are irrelevant to the maintenance project, it would include estimation errors in capturing a public value of a policy. Therefore, we try to minimize this estimation error through a double-difference model using an appropriate control group, and a typical regression equation for this can be defined as follows:

$$price_{jt} = \beta_0 + \beta_1 treat_j + \beta_2 post_t + \beta_3 (treat*post)_{jt} + X_j\gamma + \sum_k \zeta year_k + \epsilon_{jt}$$

Here, the dependent variable, $price_{jt}$ corresponds to the sale price per unit area (10,000 Korea Won per square meter) for the year, t of the apartment, j. $treat_j$ is a dummy variable indicating whether the apartments locate near the abandoned building and, thus, are assumed to be positively affected by the maintenance project or not. $post_t$ corresponds to a dummy variable indicating the time after the selection of the abandoned building as a target of the maintenance project. And, through the coefficient of the intersecting term of these two, β_3 the influence of the selection of an abandoned building as a maintenance project target, that is, the public value is estimated. This double difference analysis framework is also applied to Cui & Walsh (2015), Han (2014), and Kondo et al. (2015). X_j is a matrix that includes an exclusive area, floor, and month of the transaction of the apartment j. Even though the regression equation controls for the heterogeneity of individual apartments by including exclusive area, floor, and month of the transaction as independent variables, matching apartments between the treatment and the comparison groups would improve the methodology in wiping out the counterfactuals. Unfortunately, the apartments included in the comparison group are the only ones built in the same year, that is, 2001 as those in the treatment group. Among other factors, age of the apartment is a key determinant of its price. Thus, matching has not been applied in this paper. $year_k$ and ϵ_{jt} are a dummy variable indicating the year of transaction and a usual error term, respectively.

The treatment group corresponds to the Gojan Greenville 18 apartment complex (“Greenville 18”), and the control group corresponds to the Lake Park Daerim e-Pyunhansesang apartment (720 Gojan-dong). As can be seen in 〈Fig. 2〉, the

〈Fig. 2〉 Defining the treatment and the control group

treatment group would have a negative effect, for example, eye-sore on the people living in the apartment complex because it is physically adjacent to the building subject to the maintenance project.

Ⅲ. Data and Variables

1. Data

The data used for the empirical analysis of this study correspond to the actual transaction price provided through the Ministry of Land, Infrastructure and Transport's actual transaction price disclosure system. It provides the date when the contract was made and classifies housing units into apartment, townhouse, single-detached housing, and officetel. In addition to the address of the house, that is, lot number or street address, information about the complex name, exclusive area, transaction amount, floor, and year of construction is provided.

 https://doi.org/10.52344/hfr.2021.5.2.5

The treatment group corresponds to the Gojan Greenville 18 apartment complex ("Greenville 18"), and the control group corresponds to the Lake Park Daerim e-Pyunhansesang apartment ("Lake Park"). Both apartments were built in 2001, and the number of sales belonging to the treatment group was 202 in 2013 and 286 in 2017 or later. The control group included 141 cases in 2013 and 265 cases in 2017 or later. By year, there were 343 cases in 2013, 194 cases in 2017, 130 cases in 2018, and 227 cases in 2019.

2. Variables

〈Table 1〉 presents the basic statistics of the actual transaction price per exclusive area of the houses included in the analysis and their characteristics, that is, age, exclusive area and floor. The actual transaction price per square meter of exclusive area is 366.66 million Won, and it ranges from a minimum of 295.1 million Won to a maximum of 51334 million Won. In terms of exclusive area, the average of the treatment group was 45.4 square meters, which is statistically significantly smaller than the 100.5 square meters

〈Table 1〉 Summary statistics

Variables	Mean	Std. Dev.	Min.	Max.	Difference in means
Sales price	366.6	37.9	295.1	513.4	
Treatment	364.3	38.8			5.15*
Control	369.4	36.6			(2.03)
Exclusive area	70.4	31.2	39.3	163.5	
Treatment	45.4	6.2			55.11**
Control	100.5	21.0			(55.1)
Floor	6.4	3.8	1	24	
Treatment	5.4	3.0			2.17**
Control	7.6	4.3			(8.85)

Note: *t*-values in parentheses. Sales prices are in Korean million Won per square meter and exclusive areas are in square meters.

of the control group. In the case of the number of floors, the treatment group had an average of 5.4 floors, while the control group had 7.6 floors, showing a significant difference. In this paper, the unit of analysis is the actual transaction price of individual apartments. Unlike single-detached houses, the properties of individual apartments in the same apartment complex are quite similar, and there is only a difference in the area of exclusive use, the number of floors, or internal facilities due to individual internal remodeling. In the case, the difficulty of controlling for the heterogeneity of individual observations is much smaller.

Ⅳ. Empirical Results

〈Table 2〉 shows the results of a regression analysis on changes in neighboring house prices following the selection of a maintenance project for abandoned buildings using the difference-differences framework. Column (1) does not include the characteristics of individual actual transaction houses, that is, exclusive area, floor, and transaction period (month) as explanatory variables, but columns (2) and (3) include them. In all columns, the apartment near the abandoned building, that is, the treatment group shows, on average, the lower actual transaction price at all time points before and after the abandoned building is selected for the maintenance project. As can be seen from the basic statistics in 〈Table 1〉, this is because the houses included in the treatment group have a smaller area and lower number of stories on average, and the housing price per unit area has a proportional relationship with these two characteristics. For example, Han & Lee (2019) shows that the higher the number of floors, the higher the apartment price is statistically significant in an empirical analysis of apartments in Korea.

For all the apartments included in the analysis, it can be seen that the actual transaction price after the selection of the abandoned building for the maintenance project is higher on average than the actual transaction price before that. This indicates that, at least in the region (that is, Ansan City in Korea) the real estate market became

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〈Table 2〉 Empirical results on sales price of apartments neighboring a building which was abandoned and selected for a maintenance project

	Policy effect			Placebo test
	(1)	(2)	(3)	
Treat	−14.817**	−14.008*	−15.924**	−32.439**
	(−6.32)	(−2.36)	(−2.66)	(−4.74)
Post	68.280**	64.610**	64.757**	7.887*
	(19.43)	(19.25)	(19.21)	(2.09)
Treat × Post	5.260	8.965**	9.868**	6.937
	(1.47)	(2.60)	(2.86)	(1.64)
Exclusive area		−0.029	−0.057	0.439**
		(−0.30)	(−0.58)	(3.39)
Floor		2.301**	2.319**	2.013**
		(9.37)	(9.34)	(7.16)
Transaction year				
2018	−47.477**	−49.075**	−49.168**	
	(−13.67)	(−14.62)	(−14.41)	
2019	−61.540**	−62.495**	−63.428**	
	(−22.02)	(−23.80)	(−23.72)	
Constant	353.453**	341.908**	343.814**	296.368**
	(169.85)	(32.50)	(31.26)	(23.14)
Fixed effect				
Month of transaction	−	−	12	12
Number of observations	894	894	894	584
Adjusted *R*-squared	0.5260	0.5733	0.5743	0.6587

Note: Numbers in parentheses are White-Huber's robust *t*-values.
**, *, and + indicate statistical significance at 1%, 5%, and 10%, respectively.
The last column is for a placebo test where the data are limited to the transactions in 2010 and 2011, and "Post" indicates 2011.

more lively around 2017, and housing prices rose overall. In the case of comparing changes in actual transaction prices between before and after the selection of the maintenance project only for the treatment group without using the double-difference model, it is not possible to control for the price change due to these economic fluctuation factors, so the public value that is the effect of the selection of the maintenance project will be overestimated.

The public value of the maintenance project (selection) for a building that has been abandoned under construction, that is, the relative rise in the price of a neighboring house, is determined by the estimate of the coefficient of the interaction term between the dummy variable representing the treatment group and the dummy variable representing the time point after the selection of the building for the maintenance project. In Column (1), its estimate has a positive value of 5.260, but is not statistically significant. However, in columns (2) and (3), which control for the properties of individual apartments, that is, exclusive area and floor, the estimates of the corresponding coefficients are 8.965 and 9.868, respectively, which are much larger than the estimates in Column (1) and statistically significant at the 5% level. These results show that the maintenance project by public intervention of an abandoned building has a positive externality, that is, public value that raises the price of a neighboring house.

The positive externality of the maintenance project for an abandoned building estimated through the last column of Table 2 is estimated to be 98.68 thousand Korean Won per square meter. Considering that the average exclusive area of the treatment group is 45.404 square meters, the result implies that the price of an apartment in the treatment group has increased by 4.48 million Korean Won. Im & Hong (2019) suggests that abandoned buildings under construction lower the prices of neighboring houses. According to the results of their analysis, it appears that the price of neighboring apartments is reduced by 880 thousand Korean Won per square meter. Although the abandoned building to be analyzed is different, a simple comparison shows that the price increase according to the selection of the maintenance project is only about 11.2% of the price decrease that occurs by being abandoned. This implies that the promotion

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of the maintenance project is important, but it is more important to prepare measures to prevent the abandonment of buildings that have been suspended from construction.

The last column of Table 2 reports a placebo test result where the data are limited to the transactions in 2010 and 2011. "Post" is defined as a dummy variable indicating a year, 2011. The coefficient of "Treat×Post" has a statistically insignificant estimate even at the 10% level, and it implies that before the implementation of the policy the two groups of apartments do not seem to have different trends in their prices. Thus, this result would show the robustness of the key findings in columns (1) through (3).

V. Discussion and Conclusion

As of 2019, it was found that there were 322 abandoned buildings nationwide in Korea. Previous studies suggest that this has a negative effect on the aesthetics, safety, and real estate value of nearby residents. This paper empirically analyzes the effect of the selection of the target for the maintenance project of the Ministry of Land, Infrastructure and Transport on the abandoned building in Ansan City using the double-difference analysis framework. By setting the apartments adjacent to the abandoned building as the treatment group, and by setting the physically adjacent but socially isolated apartments due to Lake Sihwa as the control group, price changes caused by simple economic fluctuations are controlled for. According to the analysis result, it appears that the price of a nearby apartment increases by approximately 90,000 to 100,000 Korean Won per square meter of exclusive area through the selection of the abandoned building as a maintenance project target.

The abandonment of the building was caused by the financial problem of the owner. However, if the recession of the local real estate market had caused the building under construction to be abandoned by the decrease in the expected profitability when the construction would be completed, the decrease in the prices of neighboring houses could not be regarded as an externality from a market failure.

Based on the rational decision-making of economic actors and the public confidence

of government policies, the selection itself as a maintenance project target is expected to have a positive effect on residents near buildings that have been abandoned, and the empirical analysis results of this paper support this. Nevertheless, through a simple comparison, it appears that preventing the abandonment of a building that is under construction prior to the promotion of the maintenance project is more important from the viewpoint of external effects related to the abandoned building. However, this is limited to cases where the increase in the price of neighboring houses is not sufficiently large after the actual maintenance project is carried out. In the end, it should be concluded through the analysis of changes in the price of neighboring houses between the time when the abandoned building was abandoned, when it was selected for the maintenance project, and when the maintenance project was completed.

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