The Effect of Agri-Marketing Facilities Location on Nearby House Price

-The Case of the Agricultural Wholesale Market and Supermarket in Korea

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Research Background

Agri-marketing facilities can be classified into markets in producing areas (shipment stage), agricultural wholesale market (wholesale stage), and supermarket (retail stage) according to the distribution stage. Among them, the agricultural wholesale market is a socially essential facility because it plays central roles, such as supply and demand control, price formation, and risk management, for the distribution of agricultural products. Most of all, the agricultural wholesale market distributes agricultural products with more freshness and safety, providing social benefits through the whole distribution channel. Meanwhile, nearby residents tend to regard it as one of undesirable facilities in the following reasons: first, wasted products discharge odors and pollutants. Second, at dawn, the noise and the light from the agricultural wholesale market cause inconvenience to residents. Such impacts correspond to negative externalities. That is, the agricultural wholesale market has both positive and negative effect in terms of public benefits and individual damages.

Melachrinoudis (2011) defined undesirable facilities as what are necessary at the social level but harmful at the individual level because they can reduce values of the adjacent real assets. If the agricultural wholesale market has the characteristics of undesirable facilities, it is necessary to enforce its roles as a socially essential facility and to devise countermeasures in order to minimize damages to local residents. Preceding this issue, we need to verify whether the agricultural wholesale market corresponds to an undesirable facility. In this regard, this study aims to analyze the effect of the agricultural wholesale market location on the price of real assets, based on the definition that undesirable facilities reduce the price of adjacent real assets. For this purpose, this study considers nearby house price as a proxy variable reflecting the value of real assets. Specifically, this study selects apartments recognized as a representative type of house in Korea for measuring the value of real assets. As most of apartments are homogeneous in size and composition, it is relatively easy to collect data concerning information including price.

Our study requires attention as there are various factors affecting house prices other than the agricultural wholesale market location. In order to control other variables, this study introduces supermarkets location, retail stage of agri-marketing facilities, together for comparison with the case of the agricultural wholesale market. The reason why supermarkets location is incorporated reflects the recent trend that supermarkets are competing with the agricultural wholesale market; supermarkets have economies of scale through the nationwide logistic network due to the opening of the distribution market, expanding its market dominance. They increase direct transactions that do not go through the agricultural wholesale market, decreasing the volume of products through the agricultural wholesale market (Byun et al., 2008).

Research Object

The purpose of this study is to analyze the effect of the location of agricultural wholesale market and supermarket, on the prices of nearby apartments. Specifically, this study analyzes whether the agricultural wholesale market has characteristics of undesirable facilities by comparing the sign and magnitude of the effect of each facility on apartment price.

Previous Literature

Conventionally, previous literature used mainly hedonic price models to estimate various factors affecting house prices (Linneman, 1980; Lutzenhiser and Netusil, 2001; Rosen, 1974). However, the hedonic price model does not take into account that house prices may have spatial dependence due to their interaction with the surrounding environment. To solve these problems, Brasington and Hite (2005) and wang (2005) used a spatial econometric model considering spatial dependence to analyze factors affecting house prices.

Model

$$Y_i = \alpha + \sum_{i=1}^{n} \beta_i X_i + \epsilon, \quad \epsilon \sim N(0, \sigma^2 I_n) \qquad (1)$$

In this study, the hedonic price model is set up as a basic model. The hedonic price model, expressed in equation (1), is one of the methodologies used to analyze factors affecting apartment prices. However, the hedonic price model does not consider spatial dependence. An apartment with a fixed location and the same flat structure is highly likely to have spatial dependence. Spatial dependence means that there exists a correlation among dependent variables, corresponding to house prices in this study. It reflects that the closer spatial units are, the stronger their association is. Specifically, this study first determines whether spatial dependence exists through Moran's I test. If it does, the spatial econometric model considers adding space weights. The spatial dependence can be solved by including the spatial weighting matrix as a kind of independent variable.

$$Y = \rho WY + X\beta + \upsilon \qquad (2)$$
$$\upsilon = \lambda W\upsilon + \epsilon, \quad \epsilon \sim N(0, \sigma^2 I_n)$$

Spatial econometric model considering spatial dependence is classified into SAR, SEM, SAC model. The Spatial Autoregressive Model (SAR) deals with a case that the spatial weighting matrix multiplied by the dependent variable is one of independent variables. This means that $\rho = 0$ in equation (2). The Spatial Autoregressive Error Model (SEM) introduces the multiplication of error term and the spatial weighting matrix as one of independent variables. This means that $\lambda = 0$ in equation (2). Both the SAR and the SEM composes the General Spatial Model (SAC) (Anselin, 2013). The most suitable model among the above three models is used for the final analysis in this study. Finally, this study compares the results of final model with the results of hedonic price model to examine whether the model considering spatial dependence yields better results or not.

Data

The apartment data used in this study composed of prices, apartment characteristics, and location characteristics. Each variables has 256 observations. The dependent variables are apartment prices, which has traded during 2017. Then, both apartment characteristics and location characteristics are set as the independent variables. The distance variables among location characteristic variables are calculated by using the haversine formula. For the nonlinearity of each variable, the square of elapsed years, the square of the agricultural wholesale market distance, and the square of the supermarket distance are added as the independent variables.

The existence of multi – collinearity would make the parameter estimation to be inappropriate, so that we calculate the VIF(Variance Inflation Factors) to test the existence of multi - collinearity among variables. VIF shows that there is no multi-collinearity problem among the variables because all the values are smaller than 10.

<Table 1> Variable composition & VIF Result

		Variable	Name (unit)	description	VIF
Dependent Variable		ln_price_i	Apartment price (₩10,000)	Logarithm form	-
Independent variable	Apartment	$area_i$	Area of exclusive use space (m^2)	Area of actual living space	1.28
		$year_i$	elapsed years (year)	Building age	1.43
		$year_i^2$	The square of elapsed years	-	-
		$floor_i$	The number of floors (floor)	The highest floor of an apartment	1.43
		$brand_i$	Brand awareness by construction company (dummy)	Whether the construction company is within the brand awareness top 15	1.16
	Location	$population_i$	Total population of Neighborhood (1,000 unit)	Total population of Neighborhood where the apartment is located	1.33
		$agir_i$	Distance to agricultural wholesale market (km)	Shortest distance between agricultural wholesale market	2.80
		$agri_i^2$	The square of Distance To agricultural wholesale market	-	-
		$market_i$	Distance to supermarket (km)	Shortest distance between supermarket	3.47
		$market_i^2$	The square of Distance to supermarket	-	-
		$mall_i$	Distance to shopping mall & theaters (km)	Shortest distance between apartment and shopping mall & theaters	3.43
		$park_i$	Distance to park (km)	Shortest distance between apartment and park	1.45
		$middle_i$	Distance to middle school (km)	Shortest distance between apartment and middle school	1.17

Results

<Table 2> Moran's I test result

bandwidth	Moran's Index	z	p-value
3km	0.215	6.338	0.000
5km	0.206	6.276	0.000
10km	0.201	6.210	0.000

<Table 2> shows the results of Moran's I test for verifying the existence of spatial dependence. In this study, a spatial weighting matrix is computed by row standardization based on the reciprocal of values that are squares of distance between apartments. The bandwidth values are set 3 km, 5 km, and 10 km. The results of <Table 2> show that there exists a positive spatial dependence at all the bandwidths. Furthermore, it shows that Moran's I value is higher, as the bandwidth is narrower. This means that if the neighboring areas are set more strictly, then the spatial dependence is higher.

<Table 3> Hedonic price model & Spatial Econometrics Model Result

	Hedonic	SAR	SEM	SAC
constant	8.4416*** (0.1388)	7.0813*** (0.4448)	8.5363*** (0.1642)	8.6400*** (0.7754)
$area_i$	0.0173*** (0.0006)	0.0169*** (0.0006)	0.0171*** (0.0006)	0.0171*** (0.0006)
$year_i$	-0.0400*** (0.0061)	-0.0420*** (0.0058)	-0.0457*** (0.0063)	-0.0457*** (0.0063)
$year_i^2$	0.0006*** (0.0002)	0.0006*** (0.0002)	0.0007*** (0.0002)	0.0007*** (0.0002)
$floor_i$	0.0091*** (0.0029)	0.0081*** (0.0028)	0.0079*** (0.0028)	0.0079*** (0.0028)
$brand_i$	0.0601* (0.0334)	0.0560* (0.0318)	0.0488 (0.0323)	0.0485 (0.0324)
$population_i$	0.0035*** (0.0008)	0.0032*** (0.0007)	0.0032*** (0.0009)	0.0032*** (0.0009)
$agir_i$	0.1690** (0.0648)	0.1546** (0.0618)	0.1454* (0.0787)	0.1449* (0.0797)
$agri_i^2$	-0.0270*** (0.0096)	-0.0253*** (0.0091)	-0.0239** (0.0120)	-0.0238* (0.0122)
$market_i$	-0.2390*** (0.0893)	-0.2256*** (0.0851)	-0.2255** (0.1063)	-0.2256** (0.1073)
$market_i^2$	0.0892*** (0.0318)	0.0814*** (0.0303)	0.0803** (0.0372)	0.0801** (0.0376)
$mall_i$	0.0411 (0.0294)	0.0412 (0.0280)	0.0605 (0.0382)	0.0619 (0.0402)
$park_i$	0.0978* (0.0541)	0.0863* (0.0516)	0.0865 (0.0633)	0.0867 (0.0638)
$middle_i$	-0.1854*** (0.0455)	-0.1578*** (0.0442)	-0.1663*** (0.0529)	-0.1662*** (0.0533)
ρ	-	0.001	-	0.8910
Λ	-	-	0.000	0.0030
AdjustedR^2	0.8687	0.8770	0.8740	0.8730
Log Likelihood	64.0920	69.0904	72.6478	72.6571
AIC	-100.184	-106.1808	-113.2955	-111.3143

a) *** P<0.01, ** P<0.05, * P<0.1
b) Numbers in brackets indicate standard errors.

As a result, the spatial econometric model provides better results than the hedonic price model because the spatial econometric model has higher fitness and evaluates the significance level more strictly than hedonic price model. SEM with a bandwidth of 5 km is selected as the most suitable model for the analysis using the spatial regression coefficient (ρ, λ), log likelihood, AIC.

The interpretation of the apartment characteristic variables is as follows. If the Area of exclusive use space increases by $1m^2$, apartment prices get 1.71% higher. In addition, apartment prices get 4.57% lower when the elapsed years increases by one year. The square of the elapsed years has a positive effect on apartment prices, which shows that apartment prices increase after a certain period of time has elapsed. This means that the possibility of reconstruction is embedded in the price of the apartment. When the apartment floor is raised one unit, the apartment prices get 0.79% higher. This is because people tend to prefer relatively high-rise apartments.

The interpretation of the apartment location characteristic variables is as follows. If the total population of the neighborhood increases by 1,000 residents, the apartment prices get 0.32% higher. This is because the apartment is high in scarcity value due to the increase in apartment demand.

As the distance from the agricultural wholesale market to the apartment lengthens 1 km, the apartment prices get 14.54% higher. This result shows that the prices get lower for the apartments, where adjacent to the agricultural wholesale market, due to noise, odor and pollution caused by the agricultural wholesale market. In addition, the results of squared variables show that the apartment prices fall after a certain distance (turning point) from agricultural wholesale market.

On the other hand, the apartment prices get 22.55% lower when the distance from a supermarket to the apartment increases by 1 km. The supermarket is a facility that sells daily necessities such as groceries. Therefore, as the accessibility to the supermarket get higher, the apartment prices rise more. The results of squared variables show that the apartment prices rise after a certain distance (turning point) from the supermarket. When the distance from middle school to the apartment lengthens by 1 km, apartment price falls by 16.63%. This is because parents prefer schools close to their apartments due to educational factors as well as social factors such as exposure to criminal.

Conclusions

This study indirectly showed the local residents' perception about the agri-marketing facilities. Consequently, we found that the agricultural wholesale market has characteristics of undesirable facilities compared to supermarket. This study implies that it is necessary to determine compensation to minimize the damage caused by the location of the agricultural wholesale market, in order to transform the negative perceptions of local residents about the agricultural wholesale market. Furthermore, we expect that the result of this study would provide basic implications for policy makers to emphasize the role of agricultural wholesale markets as a socially essential facility.

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