An Economic Analysis of the Determinants of Studio Apartment Prices in Seoul*

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Abstract

Purpose - There has been little research on the variables influencing studio apartment values. This study aims to identify variables affecting the value of studio apartments in Seoul by empirically examining the interaction between sale prices and characteristics studio apartment characteristics.

Research design, data, and methodology - We have analyzed data pertaining to 142 studio apartments in September 2010. A regression analysis model is constructed to test the significance of the variables in relation to the studio apartment sale prices per m2 in Seoul.

Results - The age of the building is comparatively more significant than land use as the explanatory variable. Land price is the key variable affecting studio apartment sale prices and investors are willing to pay high implicit sale prices for locations that are associated with high land prices.

Conclusions - The age of buildings explains a significant portion of the variability of the sale prices of studio apartment. Higher land prices result in higher sale prices for studio apartments. The older the buildings, the lower the sale prices of the studio apartments.

Keywords: Studio Apartment, Land Price, Age of Building , Size of Building, Reduced Regression Form

JEL Classifications: R31, R32, C14.

1. Introduction

1.1. Background research

Recently, the demands for small apartments and studio apartments are rapidly growing because of the increase of single family as a result of democratic characteristics and social backgrounds. As well, the interests in commercial properties for operating earnings are constantly increasing. the market price for the studio apartment is settled at a various levels based on the location and its usage. For this reason, various information and the standards for its value are required for the government and the public. In fact, it can be said that the market price of the studio apartment is relatively correlated to its physical characteristics. However, there is not enough information or empirical analysis which clarifies its correlation so this research helps understand quantitative relationship and interaction of the market price.

It is difficult to figure out the fair price of the studio apartment. Existing researches are limited in the decision of the market price of studio apartments. The critical measurements that determine the market price of the studio apartment are more complicated. In addition, many of the information about the APT market pricing are confidential, that it makes the collection of data more difficult

The goal of this research is to provide the significant critical measurements in calculating the price of studio apartment more objectively and reasonably in the market. in detail, its main purpose is to analyze how individual and geographical factors influence the pricing of the studio apartment. Second, to suggest the sale price determining model of the studio apartment by using statistically significant independent variable.

1.2. Research Methodology

First, in terms of theoretical research, independent variables that influence the market price will be summarized through literal review of the previous house-pricing theories. Based on the collected data, and selected independent variables, research hypothesis and theoretical model will be established. Then, we figure out and summarize the correlation and distributional tendency of each variable by using the data analysis of established studio apartment characteristics of the market research. In the

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end, we verify the model by modifying raw data to make it suitable as a multiple regression analysis. This research has used multiple regression analysis among the multivariate statistical analysis method in order to figure out the factors that affect the studio apartment.

2. Property Theory

2.1. Studio Apartment

Studio apartment is the place where both residential and business functions be offered. The concept of studio apartment has been adapted to our country since 1984. Korea Development Corp was the first company that has built studio apartment in Mapo redevelopment zone. studio apartment has its values as a replacement and special product. studio apartments keep increasing and mainly in around Mapo and other regions. Recently, studio apartments are built around campus and in the downtown area.

Main characteristics of the studio apartment are as follows : the profits of apartment rent is not as much as its sale, but it is more easily operated with less limits (potential speculative demand). Especially, APT rental business became more easily as studio apartment have adapted various residential functions. The residential function of the office became more active ever since the architecture regulations became relaxed in July of 1995. There has been speculation tendency of development and investment every 3~4 years and structural development plan is in progress by using outstanding brand image.

2.2. Determinants of the value of Studio Apartment

Factors influencing the sale price of the studio apartment be classified into Location, Building, Market condition, and the Contract.

2.2.1. Location

Geographically, Studio Apartments are required to be located nearby subway station, public facilities, parking areas, and neighborhood facilities with good regional image. The important thing in the conditions of the studio apartment is accessible to public transit and facilities. In Gang-book area, real estate developments are for the sake of the earnings from leasing, whereas Gang-Nam area focuses on making profits.

2.2.2. Building

The attribute of the building is divided into external environmental factors, internal environmental factors, and Market condition.

External environmental factors : Commercial spaces are considered as such as street, access road, meeting and conversational points. These places provide various functions to the public such as resting, conversational, smoking, information trading,

snack areas. At the same time, these are the places which should be protected from noise and other audio visual stress. Such significant external spaces can work as a positive factor to the workers, visitors and pedestrians of the office building and we have to figure out how these positive roles should be reflected in the rent.

Internal environmental factors : These are the elevator halls, public washroom, hallways, actual retail areas, lobby, underground parking lots and rooftop. There are cases where roof tops are open to the public with greens so that people can have break time at the rooftop, this is the best environment to provide a green environment to landlords. Public washrooms in a building or public area where many people assess very often. Thus, making washroom areas clean and tidy will give a positive impression to everyone. Also, it can be the parking lot where visitors receive the first impression of a building. The parking lot area also can be a factor that influences the rent.

Market condition : vacancy rate, changes in macroeconomic variables, changes in population are all considered as market conditions. The correlation between the vacancy rate and the rent changes according to time-series analysis and cross-sectional analysis. In terms of time-series analysis, vacancy rate and rent are only considered as variables. Time-series analysis shows that vacancy rate and rent have a negative relationship. Which means, rent declines when vacancy rate increases while rent inclines when vacancy rate declines. However, in case of cross-sectional analysis of vacancy rate and rent, the relationship between them is very uncertain. It seems like vacancy rate does not play a significant role when determining rent of an office building, or vacancy rate gives positive influence to rent. Such results are derived from the process of supply in elasticity of office space, demand elasticity, and landlord's research for market information. In consideration of various variables such as GDP, production-related and employment-related variables that represent economic status, other financial variables such as the price index of stocks are also added to apply appropriate lag, considering the terms of construction. Rent also can be affected by the over-population in the metropolitan area.

2.2.3. Contract type

In recent days, as the economic recession continues, many of marketing methods have been introduced into the extremely shrunk market. that is called rent-free method that is the rent free for a certain period of time. Considering the time for interior design, rent free for about 1-2 month(s), and this period even becomes longer these days. Even more, some retail or office holders who support outgoings and interior design. Some vacant shops or offices choose to go with commission method, which only requires rent without deposit for a short period of time to cut down the outgoings or mortgage interests or choose to collect monthly rent according to the sales volume. There are two methods that estimate the house sale price, which are time-series analysis and cross-sectional analysis that analyzes

variables from the previous prices. First, there are VAR model that is extended from multi-variable models and simultaneous equations model that is based on the interrelation of different economic factors. Yun (2000) had predicted contract perform-ance of Construction Company with ARMA model and also used intervention analysis model when attempting to predict price of contract performance. On the other hand, Kim (1998) has used ARIMA model and a dynamic State Space model to estimate sale price and lease price. prior to researches regarding the house-pricing has set one whole city as a range of space and set up the house-pricing models which enable the estimation of the sale price

2.3. Literature review

The Results of the prior research show that school zone and physical improvement of the house have an influence on the sale prices. Generally, the factors for pricing the house are div-ided according to the types or services being provided, its phys-ical factors are actual measure, direction and others.; the major factors are the year of construction and the structure of the apartment. The geographical factors are the quality of education, air pollution and others. Typically macro-economic variables be-ing used to analyze the national housing market. the gross na-tional product, monetary, financial, inflation, employment, savings, investment, balance of payments, changes in technology, and industrial structure affecting on house price in the prior research. In addition, there has been substantive the apartment price re-search that is correlated to the characteristics of the regional area. for example, Woo, Kyong and Hong, Ki-Yong (2002) have divided the factors of the determination of house price into resi-dential environment characteristics and physical features. First, for the residential environmental index for the residential environ-mental characteristics are including convenience of trans-portation, comfort of the residential area, physical features, house sub-type and interior structures as independent variables. this research can be discriminated from prior researches is fo-cusing on the sale price of the studio apartment for the analysis. recently, Jang, Kyoung-Seok, Hur, Youn-Kyoung, Kim, Hyung-Min, Kim, Sung-Jin(2009) show that the Apartment sale price and unemployment, Apartment sale price and consumer price have a positive relationship. so, the government bonds and interest rates affect on the housing price greatly. also, Lee, Ju-suk and cho, Joo-Hyun (2010) show the distance of the sub-way station affecting House prices. Kim Tae Hoon, Lee, Chang-Moo, Cho, Joo-Hyun, and Park, Han (2007) suggest that the affecting housing size on house prices and Real Estate Research Institute(2007) Show that the age of housing affecting the price of the house price.

3. Model
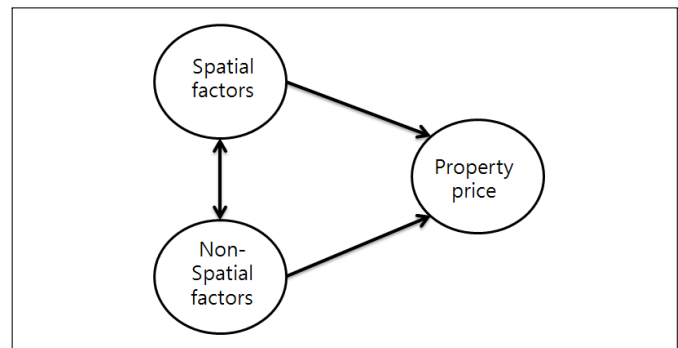
<Figure 1> a simple model of a rent determinant

The hypothesis of this study is "the Characteristics of studio apartment affects the sale price."

$$OP = \beta + \beta 1 \text{ Spatial factor} + \beta 2 \text{ Non-Spatial factor} \quad \text{(equation 1)}$$

3.1. Spatial factors

In this study spatial factors are classified into site, and build-ing factors. for example, the studio apartment is two major physical attributes. (1) the land attributes consist of accessibility and visibility. (2) the building attributes include building size, quality of facilities, location, placement within the neighborhood area.

3.2. Non-Spatial factors

In general, population, income, and the rent for the apartment affects to some extent living preference. the rent for the studio apartment depend on the land price and its service. and land price is important as the determinant of an apartment sale price. so, The more high land prices are high housing prices.
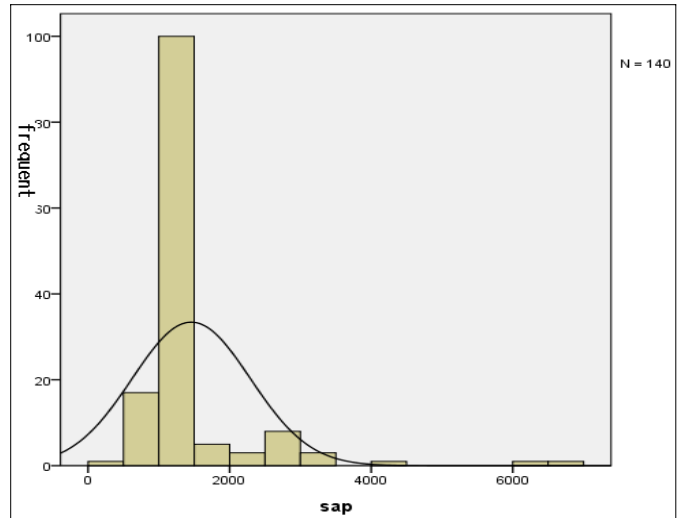
4. Empirical results

4.1. Data

The information in this research is collected from price in-formation from real estate distribution market during September of 2011 in Seoul, the studio apartment characteristics and geo-graphical characteristics to find the significant factors of setting the sale price. the sale prices per ㎡ for the studio apartment are concentrated in lower price rather than higher price, so it is spread mostly in the lower price level.

<Table 1> Variable

Model1	Symbol	Variable
Dependent variable	sap	Sale price
Independent variable	lp	Land price
	cz	Commercial area
	rz	Residential area
	ls	Land size
	bs	Total floor area of building
	cs	Apartment lot
	bsr	Building floor area ratio
	rc	Coverage ratio
	rf	Building floor area ratio
	tr	Number of households
	age	Elapsed years

In this study, the sale price is the dependent variable and is collected in units, and Independent variables were the 11 variables.
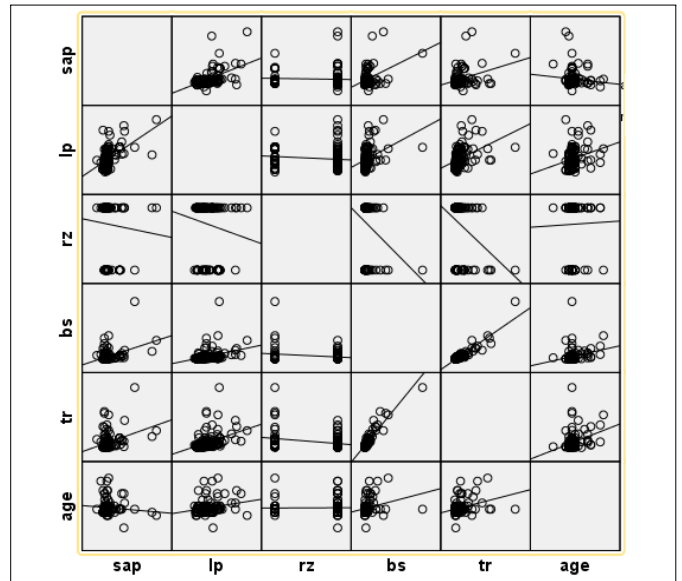
<Table 2> Descripive Statistics

Units ; 1,000 won, ㎡, %

Variable	Minimum	Maximum	Mean	Standard deviation
Sale price	133	6,776	157.63	835.44
Land price per ㎡	1,470	9,860	3,610	1,560
Land size	105.1	8365.7	737.05	971.63
Commercial area	0	1	0.31	0.46
Residential area	0	1	0.74	0.44
Land size	105.1	8,365.7	737.05	971.63
Total floor area of building	358.7	92,449.3	4,720.27	9,644.00
Construction area	62.78	5,014.45	406.89	566.39
Building floor area ratio in law(%)	295.9	64,210.	3,444.71	6,433.53
Coverage ratio(%)	32	69	57	8
Building floor area ratio(%)	199	1,068	412.26	182.25
Number of households	9	779	76.71	102.77
Elapsed years	3	19	9.44	2.08

Therefore, empirical studies have used modified data by taking the natural log for the continuous variables with the raw data. Many variables affects the sale price are land value, building total floor area, household, Elapsed years. Their characteristics are as follows. The average of total floor area of building 4,706㎡, the maximum value is 92,449 ㎡, the minimum value is 358 ㎡.

<Figure 2> Sale price of distribution

<Figure 2> as shown, in the distribution of sale price, in this study, sale price per square meter is low-value, the distribution of the <Figure 2> shows that many of sale price are with a long tail to the right, but the sale price per square meter is on the right side of the distribution biased shape.

5. Empirical Analysis and Results

* Note: sap - sale price; lp - Land price ; rz - Residential area ; bs-Total floor area of building ; tr - Number of households ; age - Elapsed years

<Figure 3> Scatter plot matrix of response variables and major explanatory variables

<Table 3> Correlation Matrix

	Sale price	Land price	Residential area	Total floor area of building	Number of households	Elapsed years
Sale price	1					
Land price	+0.519**	1				
Residential area	-0.057	-0.129	1			
Total floor area of building	+0.407**	+0.337**	-0.222*	1		
Number of households	+0.333**	+0.412**	-0.279**	+0.926**	1	
Elapsed years	-0.100	+0.241**	+0.017	+0.245**	+0.321**	1

** $p<0.01$, * $p<0.05$

According to <Table 3>, correlation coefficient matrix by using the independent variables, sale price per ㎡ and the entire households have high correlation. As a result, the sale price of studio apartment increases as land price per ㎡ is increasing, but the sale price of a studio apartment decreases when the lapsed year of studio apartment increases. As well, households have 5% of the significance of correlation with the price of the studio apartments and the price of land has a high correlation with the area variable. Therefore, the common factors that influences to the sale price and land price seems to be total floor area of building and households. In this research, if the variables with high correlation, for example, Apartment Lot and building-to-land ratio be multi-collinearity problem. therefore, Apartment Lot or building-to-land ratio variable was selected. Thus, a final model was selected with the price of land and elapsed years in the sale price determining model.

<Table 4> ANOVA

Source	Sum of Mean	DF	Mean Square	F-Value	Pr > F
Model	4.553E7	9	5,691,048.587	14.479	0.000
Error	5.149E7	131	393,051.038		
Corrected Total	9.702E7	139			

<Table 5> Regression model

model	R	R-Square	adj R-Square	Standard deviation	Pr > F	Dubin-Waston
Sale price model	0.685	0.46	0.43	626.93	0.00	1.883

<Table 6> Regression Coefficients

Model	Parameter Estimate β	t-Value	Prob > |t|	VIF
Constant	279.463	0.535	0.594	
Land price	0.000	4.917	0.000	1.970
Commercial area	329.989	1.542	0.126	3.451
Residential area	422.027	1.821	0.071	3.718
Total floor area of building	0.066	4.334	0.000	7.725
Building-to-land ratio	1091.675	1.583	0.116	1.100
Building floor area ratio	0.396	0.854	0.395	2.521
Number of households	-4.266	-2.723	0.007	9.167
Elapsed years	-91.478	-3.263	0.001	1.208

If we take a look at the <Table 5>, <Table 6>, F-value of variance analysis of sale price is 14.47 and that implies its significance. As well, the coefficient of modification determination was 0.43. In t-value of each variable, elapsed years and the households were selected as statistically significant value. land price variable has a relatively more contribution to the determination of the studio apartment price compared to the physical variables. The coefficient of determination and regression models are significant. while there is a possibility of multi-collinearity when individual t-value is not significant enough. Thus, VIF (Variance inflation factors) has been investigated to diagnose the existence of multi-collinearity, resulting in VIF of below 10 for all of the independent variables. it means that multi-collinearity does not exist. After looking into the regression model for sale price per square meter. F-value of the model was significant and modified coefficient of determination was 0.46. it was satisfactory enough. t-value was significant as well and the result means that regression analysis was satisfactory overall.

To check the autocorrelation of residuals in statistics and Durbin-Watson statistic value was 1.88. it show that residuals in statistics have no problem with autocollinearity. the first auto-correlation was very close to 0. there is no singular value with high influence. The main purpose of this research is to find out the correlation the sale price and characteristics of the studio apartment, to estimate sale price based on the studio apartment characteristics.

6. Conclusion and Implications

According to the analysis of studio apartment's sale prices and land prices, two variables have a positive relationship. Especially, sale price of the studio apartments has a important influence variable in estimating the sale price. it means that hypothesis be selected. Furthermore, when the sale price is settled during the developmental process, reasonable studio apartment's price be valuated by using land price and land use variables.

It shows that land price and the land use measure are important in calculating sale price. It is widely known that high land prices result in higher sale price, but it shows that sales price have different relationship according to the environmental factors such as demand and supply in regional housing market.

Sale price has increased when the land price increases. And the sale price of apt is influenced by land price. At last, the sale price is highly positive relation with apt location. the result implies that it requires relatively more management in land use. Also, studio apartment of demand and supply factors in Seoul be shocked by house sale price. in summary, it is more reasonable to estimate studio apartment's sale price based on the factors such as site, building and market conditions.

7. Limitations

This research has limit as it is difficult to collect the data from the studio apartment in a regional area. Therefore, we investigated the relationship the studio apartment sale price and affecting the sale price of the studio apartment by using small data in seoul. However, this research is significant as it has modeled more specifically to determination model for the sale price by different regions and this be the basis for similar researches in the future.

The limitation of the study is that the factors affecting the sale price of the studio apartment are limited. the model has constructed using only a small number of independent variables. we'll investigate to the better the model that will explain studio apartment sale prices using macroscopic and microscopic model variables at the national level next.

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