An Hedonic Valuation of Landmark Factors on Super High-Rise Residential Building Prices in Seoul (Republic of Korea)

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Abstract
The objective of this study is to analyze the influence of landmark factors on the price of super high-rise residential buildings. The level of influence is analyzed by means of an hedonic pricing model.

In this paper the height and area are identified as landmark factors in analyzing the landmark's influence quantitatively. Also, the concept of relative quantity is introduced regarding the height and area because the landmark factors involve comparisons with neighboring buildings rather than by the building's absolute characteristics alone. Relative height and relative area derived by such an approach were established as independent variables for the hedonic pricing model, along with conventional price-determining factors. Samples subjected to this analysis included thirty super high-rise residential buildings each containing at least thirty stories and all located in Seoul. Results from a linear regression model and a semi-log regression model revealed that p-values were less than 0.05, indicating that the regression coefficients of relative height and relative number of stories are significant.

Keywords: landmark factor; hedonic pricing model; super high-rise residential building

1. Introduction
1.1 Background and Goals of the Research
Super high-rise residential buildings are increasingly being constructed around the world. According to data of the Council on Tall Buildings and Urban Habitat (CTBUH), a review of such structures built since the late 1990's shows that this trend is not confined to only a few countries but appears all over the world.

As shown in Table 1., Korea is ranked 4th in the construction of super high-rise residential buildings. It is considered to be related to the trend in which high-rises are now considered to provide a desirable lifestyle rather than merely a solution to overpopulation.

Actually, the unit price per m² of super high-rise residential buildings is about 40% higher than other buildings. This is a result of the strategy of constructing more large-scale and quality residential buildings in close proximity to commercial areas, thereby having a landmark function of targeting the rich (Han et. al, 2005). Also, Helsley et al. (2008) pointed out that height as a landmark factor plays a key role in determining the price of super high-rise buildings. That is, landmark factors have an influence on the market price of super high-rise residential buildings. There have been numerous studies that used the hedonic pricing model regarding various characteristics that have an influence on the price of super high-rise buildings. In this study, we focus on landmark factors that have a direct influence on the market price of super high-rise residential buildings.

Table 1. Construction of Super High-Rise Residential Buildings Per Country

| No | Country | Qty | No | Country | Qty |
|----|---------|-----|----|---------|-----|
| 1  | China   | 985 | 14 | Israel  | 16  |
| 2  | USA     | 392 | 15 | Malaysia| 15  |
| 3  | UAE     | 134 | 16 | Argentina| 14 |
| 4  | Korea   | 76  | 17 | Panama  | 13  |
| 5  | Japan   | 75  | 18 | India   | 12  |
| 6  | Australia| 59  | 19 | England | 10  |
| 7  | Thailand| 42  | 20 | Venezuela| 6 |
| 8  | Canada  | 37  | 21 | Netherlands| 5 |
| 9  | Singapore| 34  | 22 | Spain   | 5   |
| 10 | Brazil  | 26  | 23 | Qatar   | 5   |
| 11 | Philippines| 22 | 24 | Saudi Arabia| 5 |
| 12 | Indonesia| 17  | 25 | Egypt   | 4   |
| 13 | Russia  | 16  | 26 | Others  | 27  |
|    | Total   | 2056|

Source: Jeong et al., A Comparative Study on the Developing Trends and Characteristics of High-rise Housing of Cities World Wide, 2005

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residential buildings. However, there has been virtually no research analyzing the intrinsic value of the landmark characteristics of super high-rise residential buildings.

Accordingly, the objective of this study is to analyze the influence of landmark factors on the price of super high-rise residential buildings by using the hedonic pricing model. In this study, landmark factors that can be gauged quantitatively are derived and then applied to analyzing the intrinsic value of landmark characteristics for super high-rise residential buildings in Seoul. Also, this study might contribute to comprehending the high prices of super high-rise residential buildings, and suggest reasonable prices for constructing such buildings.

Table 2. Cumulative Number of Super High-rise Residential Buildings in Major Cities

| No | City     | Qty | No | City     | Qty |
|----|----------|-----|----|----------|-----|
| 1  | Hong Kong| 920 | 11 | Honolulu | 28  |
| 2  | Dubai    | 112 | 12 | Toronto  | 27  |
| 3  | New York | 107 | 13 | Shanghai | 18  |
| 4  | Chicago  | 90  | 14 | Shaza    | 17  |
| 5  | Miami    | 61  | 15 | Jakarta  | 17  |
| 6  | Seoul    | 44  | 16 | Melbourne| 17  |
| 7  | Tokyo    | 40  | 17 | Moscow   | 16  |
| 8  | Bangkok  | 36  | 18 | Sunny Isle Beach | 16 |
| 9  | Singapore| 34  | 19 | Las Vegas| 15  |
| 10 | Busan    | 30  | Others (122 cities) | 411 |

Total 1645

Source: Jeong et al., A Comparative Study on the Developing Trends and Characteristics of High-rise Housing of Cities World Wide, 2005

1.2 Scope and Contents of the Study

Table 2. ranks the major cities around the world in terms of the number of super high-rise residential buildings constructed.

According to the table, because super high-rise residential buildings are constructed often enough in Seoul for it to be ranked 6th, it is considered to be easy to obtain enough cases to analyze.

A super high-rise building is defined differently in different countries, depending on the economy and architectural technology level of each country. In Korea it is defined as a building taller than thirty or forty stories. In particular, Lee et al. (2004) discovered, through an analysis of super high-rise residential buildings based on facility information management systems, that buildings taller than thirty stories hardly exist outside Seoul and other major cities in Korea, but that there are more than 8,000 buildings that are between twenty-one and thirty stories high throughout the country. Based on this information, a super high-rise residential building is defined in this study as a building taller than thirty stories. In this study, landmark factors were extracted through a literature review. Additionally, the hedonic pricing model was applied and a multiple regression analysis was conducted after collecting quantitative data on the extracted landmark factors. Through a multiple regression analysis, which was performed by a linear regression model and a semi-log regression, the price variation upon fluctuation of the factors is estimated.

2. Hedonic Pricing Method

The hedonic pricing method breaks down the market price of a certain commodity according to the characteristics that define it, thus enabling the monetary value of each characteristic to be calculated by observing the differences in the market price among commodities sharing the same attributes (Morancho, 2003). This method is used for estimating the resource value of non-marketed goods, along with the travel cost method, contingent valuation method, multi-attribute utility theory, etc. Among these methods the hedonic pricing model has been studied substantially over the course of many years, thereby developing into a precise and elaborate method for gauging the values of characteristics comprising prices of residential property.

\[
Y = \alpha + \sum_{i=1}^{n} \beta_i X_i + \varepsilon
\]

\[Y = \text{Price} \]
\[\alpha = \text{Constant term} \]
\[\beta = \text{Coefficient representing building characteristics} \]
\[X = \text{Attribute of property} \]
\[\varepsilon = \text{Error term} \]

The fundamental proposition of the hedonic pricing method is that a residential property comprises a complex bundle of goods with multiple characteristics, each of which contributes to its selling price (Jim and Chen, 2006).

In the hedonic pricing model, multiple regression analysis is performed by setting the price as the dependent variable and the various characteristics of a building as independent variables.

3. Definition of the Landmark Factor

Prior studies have typically focused on examining landmark factors through surveys.

Appleyard (1969) classified landmark factors into form, visibility, and significance. Variables related to form are defined as movement, contour, size, shape, surface, quality, and sign; while variables related to visibility are defined as viewpoint intensity, viewpoint significance, and immediacy; and finally, variables connected to significance are defined as use intensity, use singularity, and symbolism. Appleyard (1969) analyzed the correlation between landmarks and these variables through a survey about these factors.

Lee et al. (1984) classified landmark factors into physical variables, non-physical variables, and individual characteristic variables.
The physical variables were defined as size, visible distance, locality, crowdedness, and historical aspect. The non-physical variables were defined as architectural form, advertisement function, and symbolism. The individual characteristic variables were defined as employment availability and visit experiences. Lee et al. (1984) analyzed the correlation between landmark recognition and landmark factors in Seoul by using these factors.

These studies are quite significant, as the construction market for super high-rise residential buildings intended to become landmarks of cities is rapidly expanding.

Referring to the abovementioned studies, landmark can be defined as "perceivable property" that results from relative differences between a target building and the surrounding buildings. For example, if several buildings of the same height and space were bunched together, it would be hard to single out one of them as a "landmark." In other words, landmark property can be acknowledged when a target building stands out among the surrounding buildings in terms of area and height so that people can easily recognize the building. This also applies to other landmark factors such as shape and sign that have been examined in previous studies. In this research, landmark is interpreted as a relative property, and the influence of landmark factors on value of super high-rise residential buildings is quantitatively analyzed.

This study defines factors related to size such as the height and area of buildings that may be represented quantitatively as landmark factors, considering the weaknesses of prior studies. This is because factors such as design and external form that were employed by Appleyard (1969) and Lee et al. (1984) cannot be represented quantitatively, and visit experiences and employment availability have to rely on surveys, making it difficult to quantify the data.

In this study, landmark variables are suggested concerning the aspect of size as follows. Results from a study by Appleyard (1969) show that relativity is important to landmark factors.

In other words, the landmark attribute is not determined by the absolute size of a building itself, such as height and area, but by its relative size to that of neighboring buildings.

Fig. 1. demonstrates that a high-rise building in picture (b) has greater perceptive capacity and higher "landmark level" compared to the building in picture (a) due to its height difference with surrounding buildings.

In Fig. 2., buildings of the same area are bunched together in picture (c), while the target building has relatively greater area than surrounding buildings in picture (d), thus increasing its perceptive capacity and landmark level.

Accordingly, in this study, relative height and area are defined as landmark variables for analyzing the influence of landmark factors on the price of super high-rise residential buildings.

Relative height and area share many common qualities with other elements that were examined in earlier studies. In particular, viewing ability is very similar to landmark factors that are specified in this study, as it is affected by the relative scale difference between a target building and its surrounding buildings. However, the existing literature on viewing ability reveals that in most cases, viewing ability was considered in a comprehensive manner in relation to the surrounding landscape elements such as a park, river, or mountain (Jim and Chen, 2006; Morancho, 2003; Lange and Schaeffer, 2001). Thus, this study can be distinguished from others in the sense that the relative characteristics of landmark factors alone can influence the value of residential buildings, regardless of surrounding elements.

4. Empirical Models

4.1 Sample areas and data

In this study, research was conducted by targeting thirty super high-rise residential buildings containing a total of 3,600 units located within eleven administrative districts of Seoul.

Fig. 3. shows the distribution of the selected buildings, revealing that they are quite concentrated in the areas south of the Han River. In Seoul, rapid urbanization has resulted in planar expansion and in the relocations of various functions, causing the area to the south of the Han River to become more desirable than the area to the north of the river.

This has resulted in higher residential property values in the south, reflecting the fact that residents...
in the south have higher average incomes than their northern counterparts. In the end, super high-rise residential buildings, which represent a high-end living environment, saw more demand in the south, resulting in the consequent concentration of super high-rise residential buildings there.

4.2 Selection of model variable

In this study, price per m$^2$ (P) was used as the dependent variable, and housing unit attributes, building attributes, location attributes and landmark attributes were used as independent variables.

First, housing unit story ($H_1$), housing unit space ($H_2$), the number of rooms ($H_3$), and the number of bathrooms ($H_4$) were defined as housing unit attributes. Additionally, the building height ($B_1$), the gross building space ($B_2$), years since building completion ($B_3$), the number of housing units ($B_4$), and the number of parking spaces ($B_5$) were defined as building attributes.

Building height ($B_1$) refers to the height of the

| No | Building          | Height (m) | GFA (m$^2$) | No | Building          | Height (m) | GFA (m$^2$) |
|----|-------------------|------------|-------------|----|-------------------|------------|-------------|
| 1  | Tower Palace III | 262.82     | 223,538     | 16 | Nasan Sweet       | 132.90     | 84,165      |
| 2  | Hyundai Hyperion  | 250.73     | 387,632     | 17 | The# Star River   | 128.10     | 76,449      |
| 3  | Tower Palace I   | 211.50     | 457,999     | 18 | Trump World II    | 127.20     | 68,423      |
| 4  | The# Star City   | 192.40     | 418,415     | 19 | Hyundai Parkvill  | 126.15     | 46,653      |
| 5  | Tower Palace II  | 184.65     | 296,652     | 20 | Lotte Castle Empire | 126.00   | 129,489    |
| 6  | Academy Sweet    | 169.70     | 102,379     | 21 | Samsung Shervill  | 125.20     | 112,140     |
| 7  | Daerim Acrovill  | 163.00     | 202,983     | 22 | AcroRiver         | 123.32     | 64,879      |
| 8  | Boramae Shervill | 125.20     | 76,593      | 23 | 9th Avenue        | 122.38     | 80,254      |
| 9  | Hyundai Supervill| 150.60     | 226,180     | 24 | AcroVista         | 119.63     | 258,338     |
| 10 | Brown Stone Seoul| 150.40     | 75,078      | 25 | Lotte Gwanak Tower | 118.44   | 60,188      |
| 11 | Galleria Palace  | 149.40     | 265,698     | 26 | Lotte Castle Ivy  | 112.25     | 140,423     |
| 12 | Lotte Castle Gold| 148.35     | 242,282     | 27 | Hanwha Obelisk    | 109.85     | 120,054     |
| 13 | Richensia        | 145.30     | 86,880      | 28 | Twinvill          | 107.06     | 96,516      |
| 14 | Academy Tower    | 141.90     | 81,848      | 29 | Hyundai Tower     | 106.55     | 30,808      |
| 15 | Trump World I    | 132.90     | 78,667      | 30 | Trump World III   | 100.00     | 52,965      |

Table 3. Sample Building List

Fig.3. Location of Sample Buildings
tallest building in the complex; gross building space ($B_2$) and the number of housing units ($B_4$) were calculated by summing up all the space and housing units of each complex. By utilizing these, the physical volume of each complex was identified. Furthermore, to identify the depreciation expense, the years since building completion ($B_3$) were used, and to examine the convenience of parking as complex characteristic variables, the number of parking spaces ($B_5$) was used.

To identify the convenience of transportation as a location attribute, the distance to the nearest subway station ($D_1$) was used, while the distance to the nearest major shopping district ($D_2$), distance to the nearest green area ($D_3$), and distance to the central business district ($D_4$) were used to identify the spatial proximity to key areas.

The landmark factors of relative height ($L_1$) and relative space ($L_2$) were used as landmark attributes. First, the relative height was calculated as the difference in height between the analyzed building and the average height of neighboring buildings within a 200 m radius.

$$H_r = H_a - E(H_c)$$

$H_r$ = Relative height
$H_a$ = Height of analyzed building
$H_c$ = Average height of comparative buildings within a 200 m radius

Relative area was defined as the difference between the building area of the analyzed building and the average building area of neighboring buildings within a 200 m radius.

$$A_r = A_a - E(A_c)$$

$A_r$ = Relative area
$A_a$ = Building area of analyzed building
$A_c$ = Average building area of comparative buildings within a 200 m radius

Detailed data for each variable was collected through on-site investigation, GIS (Geographic Information System), real estate portal sites, and the building references.

### 4.3 Analyzing the hedonic pricing models

In this study, the hedonic model was used to determine, by analyzing the intrinsic value of the landmark attribute, that is, whether landmark factor is a statistically significant variable.

In this study, a linear regression model and a semi-log regression model were first set up.

The estimated equations are expressed as follows:

**Linear regression model:**

$$P = \alpha + \sum_{i=1}^{n} \beta_i X_i + \sum_{k=1}^{r} \tau_k \theta_k + \epsilon$$

$P$ = Price per m$^2$
$\alpha$ = Constant term
$\beta_i$ = Coefficient representing housing unit attributes, building attributes, location attributes
$X_i$ = Housing unit attributes, building attributes, location attributes of property
$\tau_k$ = Coefficient representing landmark attributes
$\theta_k$ = Landmark attributes of property
$\epsilon$ = Error term

$\alpha$ is a constant, $\beta_i$ is the coefficient representing housing unit attributes, building attributes, and location attributes, and $\tau_k$ is the coefficient representing landmark attributes.

To determine the correlation between the variables used for the hedonic pricing model, a correlation analysis was performed and the results are as shown in

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**Table 4. Definition of Variables Related to the Quality of Housing Units**

| Attributes category | Variable | Units | Description of variables |
|---------------------|----------|-------|--------------------------|
| Dependent variable  | Price    | P     | KRW (10,000 / m$^2$)     |
| Independent variables | Housing unit attributes | $H_1$ | story | Height of the housing unit |
|                     | $H_2$ | m$^2$ | Floor area of the housing unit |
|                     | $H_3$ | Num  | Number of rooms |
|                     | $H_4$ | Num  | Number of bathrooms |
| Building attributes | $B_1$ | m    | Height of the tallest building in the complex |
|                     | $B_2$ | m$^2$ | Gross space of the tallest building in the complex |
|                     | $B_3$ | year | Years since building completion |
|                     | $B_4$ | units | Number of housing units in the complex |
|                     | $B_5$ | Spaces/complex | Number of car spaces in garage |
| Location attributes | $D_1$ | m    | Distance to the nearest subway station |
|                     | $D_2$ | m    | Distance to the nearest major shopping district |
|                     | $D_3$ | m    | Distance to the nearest green area |
|                     | $D_4$ | m    | Distance to the central business district |
| Landmark attributes | $L_1$ | m    | Difference in height between the analyzed building and the average height of neighboring buildings within a 200 m radius |
|                     | $L_2$ | m$^2$ | Difference between the building area of the analyzed building and the average building area of neighboring buildings within a 200 m radius |
Table 5.
As shown in Table 5., relative height (L₁) and relative area (L₂) had a positive correlation with price per m² (P). Relative height (L₂) was also shown to have a high correlation with height (B₁), and there were other cases of high correlations between variables as well.

This indicates that there is the potential for multicollinearity.

To precisely identify the multicollinearity, the tolerance and Variance Inflation Factor (VIF) are generally utilized, and in this paper, multicollinearity was checked by using tolerance. Generally, when the tolerance is less than 0.1, it is assumed that there is multicollinearity. However, as shown in Table 6. (the linear regression model), the tolerance was less than 0.1 with 0.096 of height (B₁), 0.044 of the gross building space (B₂), and 0.082 of the number of housing units. The semi-log regression model yielded the same results. Examining the variables that caused the multicollinearity from Table 5., it can be seen that there is a high correlation between those that caused multicollinearity. In other words, when excluding one variable among those that caused multicollinearity, it is possible that the remaining variables would not cause multicollinearity. Therefore, rather than simply excluding all the variables that caused multicollinearity, the model's capability of explaining the price of super high-rise residential buildings is raised by allowing as many variables as possible to remain in the model and then eliminating the variables one by one according to their degree of multicollinearity.

Accordingly, in this paper, the previous hedonic pricing model was adjusted by excluding the variables of height (B₁) and gross building space (B₂) which caused significant multicollinearity. As shown in Table 9., the adjusted R² of the adjusted linear regression

Table 5. Correlation Coefficients between Building Attributes

| Variable | Coefficient | t-ratio | p-value | Tolerance |
|----------|-------------|---------|---------|-----------|
| P        | -482.423    | -15.912 | 0.000   |            |
| H₁       | 1.398       | 7.023   | 0.000   | 0.680     |
| H₂       | 1.392       | 14.145  | 0.000   | 0.202     |
| H₃       | 20.184      | 4.406   | 0.000   | 0.218     |
| H₄       | 15.276      | 2.092   | 0.036   | 0.388     |
| B₁       | 3.239       | 25.170  | 0.000   | 0.096     |
| B₂       | 0.001       | 7.129   | 0.000   | 0.044     |
| B₃       | 1.987       | 1.142   | 0.254   | 0.571     |
| B₄       | -0.083      | -3.847  | 0.000   | 0.082     |
| D₁       | 129.014     | 24.729  | 0.000   | 0.451     |
| D₂       | 0.082       | 6.890   | 0.000   | 0.549     |
| D₃       | 0.053       | 8.777   | 0.000   | 0.213     |
| D₄       | 0.041       | 14.166  | 0.000   | 0.294     |
| D₅       | -0.020      | -7.406  | 0.000   | 0.300     |
| L₁       | -2.178      | -15.500 | 0.000   | 0.121     |
| L₂       | 0.040       | 23.331  | 0.000   | 0.261     |

R² = 0.789  Adjusted R² = 0.789  F-ratio = 895.824  N=3600

Table 6. Price Determinants (Linear Regression Model)

| Variable | Coefficient | t-ratio | p-value | Tolerance |
|----------|-------------|---------|---------|-----------|
| C        | 5.135       | 138.544 | 0.000   |            |
| H₁       | 0.001       | 4.191   | 0.000   | 0.680     |
| H₂       | 0.001       | 11.256  | 0.000   | 0.202     |
| H₃       | 0.036       | 6.467   | 0.000   | 0.218     |
| H₄       | 0.013       | 1.503   | 0.133   | 0.388     |
| B₁       | 0.003       | 21.315  | 0.000   | 0.096     |
| B₂       | 1.104E-06   | 12.027  | 0.000   | 0.044     |
| B₃       | -0.008      | -3.741  | 0.000   | 0.571     |
| B₄       | 2.500E-04   | -9.451  | 0.000   | 0.082     |
| B₅       | 0.020       | 31.611  | 0.000   | 0.451     |
| D₁       | 1.811E-04   | 12.401  | 0.000   | 0.549     |
| D₂       | 6.069E-05   | 8.200   | 0.000   | 0.213     |
| D₃       | 3.859E-05   | 10.979  | 0.000   | 0.294     |
| D₄       | -3.723E-05  | -11.512 | 0.000   | 0.300     |
| L₁       | -0.002      | -13.965 | 0.000   | 0.121     |
| L₂       | 5.151E-05   | 24.463  | 0.000   | 0.261     |

R² = 0.815  Adjusted R² = 0.814  F-ratio = 1053.097  N=3600

Table 7. Price Determinants (Semi-log Regression Model)

| Variable | Coefficient | t-ratio | p-value | Tolerance |
|----------|-------------|---------|---------|-----------|
| C        | 5.135       | 138.544 | 0.000   |            |
| H₁       | 0.001       | 4.191   | 0.000   | 0.680     |
| H₂       | 0.001       | 11.256  | 0.000   | 0.202     |
| H₃       | 0.036       | 6.467   | 0.000   | 0.218     |
| H₄       | 0.013       | 1.503   | 0.133   | 0.388     |
| B₁       | 0.003       | 21.315  | 0.000   | 0.096     |
| B₂       | 1.104E-06   | 12.027  | 0.000   | 0.044     |
| B₃       | -0.008      | -3.741  | 0.000   | 0.571     |
| B₄       | 2.500E-04   | -9.451  | 0.000   | 0.082     |
| B₅       | 0.020       | 31.611  | 0.000   | 0.451     |
| D₁       | 1.811E-04   | 12.401  | 0.000   | 0.549     |
| D₂       | 6.069E-05   | 8.200   | 0.000   | 0.213     |
| D₃       | 3.859E-05   | 10.979  | 0.000   | 0.294     |
| D₄       | -3.723E-05  | -11.512 | 0.000   | 0.300     |
| L₁       | -0.002      | -13.965 | 0.000   | 0.121     |
| L₂       | 5.151E-05   | 24.463  | 0.000   | 0.261     |

R² = 0.815  Adjusted R² = 0.814  F-ratio = 1053.097  N=3600

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Table 8. Tolerance Fluctuation According to the Exclusion of Variables Causing Multicollinearity

| Variable          | Coefficient | t-ratio | p-value | Tolerance |
|-------------------|-------------|---------|---------|-----------|
| Height (B₁)       | 0.096       |         |         |           |
| Gross building space (B₂) | 0.044       | 0.097   |         |           |
| Number of housing units (B₃) | 0.082       | 0.386   | 0.484   |           |

Table 9. Price Determinants after Eliminating Collinear Regressors (Linear Regression Model)

| Variable          | Coefficient | t-ratio | p-value | Tolerance |
|-------------------|-------------|---------|---------|-----------|
| C                 | -270.460    | -9.338  | 0.000   | 0.717     |
| H₁                | 2.471       | 11.614  | 0.000   | 0.203     |
| H₂                | 1.290       | 12.001  | 0.000   | 0.225     |
| H₃                | 30.580      | 6.171   | 0.000   | 0.391     |
| H₄                | 3.429       | 0.430   | 0.668   | 0.540     |
| B₁                | 15.499      | 8.955   | 0.000   | 0.696     |
| B₂                | 0.171       | 17.491  | 0.000   | 0.484     |
| B₃                | 173.207     | 31.952  | 0.000   | 0.503     |
| D₁                | 0.008       | 0.643   | 0.520   | 0.580     |
| D₂                | 0.010       | 1.632   | 0.103   | 0.299     |
| D₃                | 0.004       | 1.405   | 0.160   | 0.450     |
| D₄                | -0.038      | -13.831 | 0.000   | 0.327     |
| L₁                | 0.870       | 11.890  | 0.000   | 0.540     |
| L₂                | 0.036       | 22.756  | 0.000   | 0.365     |

R² = 0.746  Adjusted R² = 0.745  F-ratio = 811.519  N=3600

Table 10. Price determinants after Eliminating Collinear Regressors (Semi-log Regression Model)

| Variable          | Coefficient | t-ratio | p-value | Tolerance |
|-------------------|-------------|---------|---------|-----------|
| C                 | -5.289      | 150.580 | 0.000   | 0.717     |
| H₁                | 0.002       | 8.102   | 0.000   | 0.203     |
| H₂                | 0.001       | 9.955   | 0.000   | 0.225     |
| H₃                | 0.053       | 8.747   | 0.000   | 0.391     |
| H₄                | -0.003      | -0.318  | 0.750   | 0.540     |
| B₁                | 0.011       | 5.282   | 0.000   | 0.696     |
| B₂                | 0.000       | 13.282  | 0.000   | 0.484     |
| B₃                | 0.249       | 37.897  | 0.000   | 0.503     |
| D₁                | 9.550E-05   | 6.172   | 0.000   | 0.580     |
| D₂                | 1.044E-05   | 1.344   | 0.179   | 0.229     |
| D₃                | -1.04E-05   | -3.352  | 0.001   | 0.450     |
| D₄                | -5.65E-05   | -16.762 | 0.000   | 0.327     |
| L₁                | 0.001       | 15.955  | 0.000   | 0.540     |
| L₂                | 5.340E-05   | 27.545  | 0.000   | 0.365     |

R² = 0.781  Adjusted R² = 0.781  F-ratio =982.301  N=3600

5. Conclusion

The purpose of this study has been to analyze the influence of landmark factors on the price of super high-rise residential buildings. The level of influence has been analyzed by means of an hedonic pricing model. To do so, landmark factors were categorized based on prior studies, and relative height (L₁) and relative space (L₂) were defined in order to analyze the landmark factors in a quantitative manner. Based on this, by employing the hedonic pricing model, data was collected targeting thirty super high-rise buildings of over thirty stories tall, and containing over 3600 housing units, in eleven administrative districts of Seoul. Data was then analyzed according to a linear regression model and a semi-log regression model. As a result, the linear regression model showed that each additional meter of relative height (L₁) increased the sales price per m² by ₩ 8,700 and each additional 1
m² of relative space (L₂) increased the sales price per m² by 360. Additionally, the semi-log regression model showed that each additional meter of relative height (L₁) increased the sales price per m² by about 0.1%, and each additional 1 m² of relative space (L₂) increased the sales price per m² by about 0.005%. In other words, it was confirmed that landmark factors do indeed affect the super high-rise residential buildings' price determination. However, there were limitations, in that only the aspect of size was considered among various landmark factors. According to survey results of prior studies, even though the external design of a building can be a major landmark factor, it is relatively difficult to quantify this factor. In the future, more in-depth research should be performed in these regards in order to augment our understanding of quantifying landmark factors.

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