A Study on the Hedonic Analysis of Housing Market in the U-City


Abstract— The concept of U-City is to integrate ubiquitous information technology services to our city space in order to increase citizen’s convenience, quality of life, safety with organized city governance, city management, and creation of new business etc. (Ministry of Land, 2007). In March, 2008, the first ubiquitous master plan was established and further developed into policy in South Korea. Today the second ubiquitous plan has been initiated and it is under the phase of diffusing its system to the whole nation.

With its major policy swing, the U-City construction has been the cornerstone of today’s projects. However, the utility of U-Services came into question whether it is applying appropriate technology that is useful for urban dwellers. In addition to its technological application, the U-City construction received much criticism for its excessive budget expenditure. Under these disputes, this paper was to analyze the effectiveness of U-City and found ways for U-Services to raise city competitiveness and quality of life.

Therefore, the purpose of this study was to analyze how U-City construction projects influenced housing price. The empirical analysis focused on Eunpyung newtown in Seoul, Korea where it was the first designated area for the U-City project in Seoul and applied the hedonic price model to measure the improvement in residential environments and its effects on housing prices. Further, the paper compared the Gireum newtown in Seoul as a control group where the town redeveloped to non-U-City area and set the time frame in 2012 because the U-City project was started in 2010 in Eunpyung newtown first district and it can be revealed effectiveness of U-City after construction.

The result is that the U-City construction project has enhanced the housing prices comparing to non-U-City area. Therefore, it means that this study has significance of empirical analysis for fundamental grounds of U-City projects.

Keywords—U-City,Ubiquitous, Housing Price, Hedonic Price Model

I. INTRODUCTION

The term of U-City refers to urban space which are combined a state-of-art information and communication to enhance the quality of life and improve efficiency of the city management. It is a new urban paradigm for solving urban problems using IT technologies that started in Korea for the first time. At this point, the second ubiquitous plan is established to spread and promote U-City entered a stage of settlement. The first U-City master plan heightened expectations about investment activation and construction market vitalization from the establishment phase. And the first plan wanted to be the world market leader by making an export model of U-City as a new growth power in the future. But according to projects progressed, the project caused confusion between companies and local governments because there were no agreements of standards among business entities and were unable to provide a high quality of service due to lack of technical application for optimum level(Yonsei university U-City research and development, 2013). Moreover there were presented of problems because of applying excessive technology wasting budget. Despite considerable effort of government, U-City projects experienced stormy passage caused by legal system maintenance issues, budget issues, and service model problem etc.

In this study, there were aware of the problem that researches were insufficient to prove the effectiveness after U-City construction projects. Therefore this paper intended to provide basic evidence for U-City project by performing empirical analysis about the effectiveness of U-City project area. In particular targeting residential area, there are based on the assumptions that U-City construction projects will affect real estate prices due to increasing the effectiveness of providing a residential environment. And through the comparison of non-business area, this study observed the effectiveness of U-City.

II. LITERATURE REVIEW

A. Theory

There are two approaches of determining housing prices. One is an approach of the principles of market economy that is determined by demand and supply of housing alike other commodities. The other is an approach of the external and internal factors of housing that is determined by summing the
intrinsic value. Especially, the latter one is deal with housing such as complex commodities featuring physical and regional characteristics. Theory based on the intrinsic value means that housing prices are determined by many properties inherent in the price. The implicit price is estimate undocumented housing price about characteristics of houses. This approach is useful as a theory to analyze heterogeneity of housing, neighborhood characteristics, difference of regional price, etc. and to find the factors affecting the housing price and variation concretely. Generally, the factors determining the implicit price are physical characteristics such as types of housing, construction materials, areas for exclusive use, stories, the number of years of buildings, floor plans etc. and regional characteristics. Therefore this study based on assumption that U-City project increased implicit housing prices.

B. Review Stage

Previous studies performed dividing into two types like table I. One is study about U-City and the other is study about implicit housing price.

Table I:

<table>
<thead>
<tr>
<th>Studies On U-City</th>
<th>Operation and Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A Case Study on the Successful Old-Town u-City Construction by an Effective Financing(2012)</td>
</tr>
<tr>
<td></td>
<td>A Study on the Characteristics of the U-City Industry Using the I-O Tables(2013)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Empirical Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Study on Influence of If-Service to Housing Price through Repeated Sales Measure(2010)</td>
</tr>
<tr>
<td>Analysis of cost-benefit for the life cycle cost of u-city: with focus on Hwaseong Dongtan district(2013)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Studies On Housing Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>The influences of Aesthetic Design Factors on Apartment Prices - Focused on Gang-Nam District in Seoul –(2007)</td>
</tr>
<tr>
<td>A Static • Dynamic Study on the Economic Value Change of Housing Price Determinants(2001)</td>
</tr>
<tr>
<td>A Study on Regional Factors Affecting Housing Market Prices(2007)</td>
</tr>
</tbody>
</table>

The U-City related researches consisted of operation and the characteristics in [3], [6], [8] and the empirical analysis in [2], [5], [7]. In study on the operation and characteristics, overall analysis of macroscopic characteristics of U-City mainly done. And the study on the empirical analysis remained in its infancy. As a result of dealing with the subject of U-City for the operation and characteristics and empirical researches, there are lacks of specific empirical studies for the effectiveness of local people and show breaking points that cannot be compared with other regions.

Most previous studies on determinants of housing prices were used the hedonic price model and researched on the effects of specific factors of housing prices. Through these studies, this paper derives the essential determinants of housing prices and considers the factors as control variables.

III. DATA AND METHODOLOGY

A. Data

EunPyung Newtown and Gireum Newtown in Seoul, Korea were selected for analysis. Only apartment prices were targeted in the newtowns. Among Newtown area, EunPyung was selected because it was the first U-City project area in Seoul and Gireum was selected as a control group of non-U-City for comparing with EunPyung. Because some characteristics of Gireum were similar to EunPyung such as total floor area, number of households, population size, Gireum were deemed suitable for the analysis. Note that the 1, 2 districts of EunPyung were completed U-City, but 3 district of EunPyung were not established, so 3 district was classified as non-U-City area. In this study, the first step was that the regional characteristics of EunPyung Newtown and Gireum Newtown were controlled. After the first step, the second step was that 1, 2 districts of EunPyung Newtown of U-City project area were compared with 3 district of non-U-City project area. Therefore, the overview of the target area was like table II.

The year of the temporal range. This paper derives variables based on previous studies and divided into three types such as characteristics of buildings, apartment blocks, and region intending to use for control variables. Finally, there are classified into four types by adding variables of the characteristics of the U-City for evaluate the effect of U-Services.

Data were that 9383 apartment prices of EunPyung Newtown and 10670 apartment prices of Gireum Newtown were used for the sample. Rental apartments were excluded from the sample.
because most rental apartments were small apartment and it tended to distort the normal prices.

**B. Model and Variables**

Hedonic price model is presented that the dependent variable is housing price \( (P_j) \) and the explanatory variables are constituted of the attribute values of housing price. According to the implicit price theory, this paper classified the determinant factors into 4 characteristics such as buildings \( (A_j) \), apartment blocks \( (B_j) \), regions \( (C_j) \), and U-City \( (D_j) \). This is expressed as a functional formula as follows.

\[
P_j = f(A_j, B_j, C_j, D_j)
\]

The variables for the analysis were in the table III. The dependent variable was an apartment price per unit area, and presented ten thousand won. The explanatory variables consisted of 4 kinds of characteristics. The first, the characteristics of buildings were the area of exclusive use space, the number of rooms, the number of bathrooms. Previous studies analyzed that the number of rooms and bathrooms affected housing prices positively. The second, the characteristics of apartment blocks were the number of households, the awareness of construction firms, the number of layers, the number of apartment building units, the number of parking lots per households, the number of years of buildings. The awareness of construction firms referred to the ranking of construction ability of 2012 of Construction Association of Korea and was presented as a dummy variable expressed 1 within 10 of rank. The third, the characteristics of regions consisted of the accessibility of the subway station and the newtown area. The variable of the accessibility of the subway station was a dummy variable expressed 1 within 500m of radius from the apartment. The variable of the newtown area was a dummy variable expressed 1 whether it was Eunpyung. The last, the characteristics of U-City was presented a dummy variable expressed 1 within the U-City area to quantify the effectiveness of the project.

**IV. EMPIRICAL ANALYSIS**

**A. Descriptive Statistics Quantity**

The descriptive statistics quantity of the sample was expressed as follows table IV and divided into three regions to ensure the data whether these were proper. In order of expensiveness, the apartment prices per unit area were listed following 3 district of Eunpyung, 1, 2 districts of Eunpyung, and Grieum newtown. In the case of the area of exclusive use space, Eunpyung newtown were medium(99.9㎡) to large(108.3㎡) area and Grieum newtown was medium(83.5㎡) area averagely. The number of rooms and bathrooms were similar in all areas. According to the number of households, layers, and apartment building units, Grieum newtown was formed of a large complex compared to Eunpyung. The apartment well-known within 10 of the ranking of brand value occupied 70% of the sample and all apartments in the 3 district of Eunpyung newtown were built by famous construction firms. Each number of parking lots per households was similar in all areas. The number of years of buildings of Grieum(6.8 years) was older than Eunpyung(4.2 years and 3.0 years). The accessibility of the subway station expressed within 500m from the apartment was 30% of the sample.

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-category</th>
<th>Unit</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable</td>
<td>[a] Apartment Price per unit area</td>
<td>ten thousand won/m²</td>
<td>Apartment price per the area of exclusive use space</td>
</tr>
<tr>
<td>Characteristics of Buildings</td>
<td>[b] the area of exclusive use space</td>
<td>m²</td>
<td>the area of exclusive use space</td>
</tr>
<tr>
<td></td>
<td>[c] the number of rooms</td>
<td>#</td>
<td>the number of rooms</td>
</tr>
<tr>
<td></td>
<td>[d] the number of bathrooms</td>
<td>#</td>
<td>the number of bathrooms</td>
</tr>
<tr>
<td></td>
<td>[e] the number of households</td>
<td>#</td>
<td>the number of households</td>
</tr>
<tr>
<td></td>
<td>[f] the awareness of construction firms</td>
<td>Dummy variable</td>
<td>within 10 of the ranking of construction ability = 1</td>
</tr>
<tr>
<td></td>
<td>[g] the number of layers</td>
<td>#</td>
<td>the number of layers</td>
</tr>
<tr>
<td></td>
<td>[h] the number of apartment building units</td>
<td>#</td>
<td>the number of apartment building units</td>
</tr>
<tr>
<td></td>
<td>[i] the number of parking lots per households</td>
<td>#</td>
<td>the number of parking lots / the number of total households</td>
</tr>
<tr>
<td></td>
<td>[j] the number of years of buildings</td>
<td>years</td>
<td>the number of years of buildings</td>
</tr>
<tr>
<td>Characteristics of Regions</td>
<td>[k] the accessibility of the subway station</td>
<td>Dummy variable</td>
<td>within 500m of the nearest subway station = 1</td>
</tr>
<tr>
<td></td>
<td>[l] newtown area</td>
<td>Dummy variable</td>
<td>Eunpyung newtown = 1, Grieum newtown = 0</td>
</tr>
<tr>
<td>Characteristics of U-City</td>
<td>[m] U-City project area</td>
<td>Dummy variable</td>
<td>1, 2 districts of Eunpyung newtown = 1, 3 district of Eunpyung newtown and Grieum newtown = 0</td>
</tr>
</tbody>
</table>
TABLE IV
DESCRIPTIVE STATISTICS QUANTITY

<table>
<thead>
<tr>
<th>Category</th>
<th>Unit</th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>Average</th>
<th>Sd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>ten thousand won / m²</td>
<td>7910</td>
<td>267.2</td>
<td>484.9</td>
<td>384.6</td>
<td>43.5</td>
</tr>
<tr>
<td>[b]</td>
<td>m²</td>
<td>7910</td>
<td>59.0</td>
<td>168.0</td>
<td>99.9</td>
<td>30.0</td>
</tr>
<tr>
<td>[c]</td>
<td>#</td>
<td>7910</td>
<td>2.0</td>
<td>5.0</td>
<td>3.3</td>
<td>0.5</td>
</tr>
<tr>
<td>[d]</td>
<td>#</td>
<td>7910</td>
<td>1.0</td>
<td>3.0</td>
<td>2.0</td>
<td>0.4</td>
</tr>
<tr>
<td>[e]</td>
<td>#</td>
<td>7910</td>
<td>143.0</td>
<td>947.0</td>
<td>475.9</td>
<td>189.3</td>
</tr>
<tr>
<td>[f] Dummy</td>
<td></td>
<td>7910</td>
<td>0.0</td>
<td>1.0</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td>[g]</td>
<td>#</td>
<td>7910</td>
<td>10.0</td>
<td>20.0</td>
<td>14.5</td>
<td>2.5</td>
</tr>
<tr>
<td>[h]</td>
<td>#</td>
<td>7910</td>
<td>3.0</td>
<td>22.0</td>
<td>10.9</td>
<td>4.5</td>
</tr>
<tr>
<td>[i]</td>
<td>#</td>
<td>7910</td>
<td>1.1</td>
<td>2.0</td>
<td>1.4</td>
<td>0.3</td>
</tr>
<tr>
<td>[j] Years</td>
<td></td>
<td>7910</td>
<td>3.0</td>
<td>5.0</td>
<td>4.2</td>
<td>0.7</td>
</tr>
<tr>
<td>[k] Dummy</td>
<td></td>
<td>7910</td>
<td>0.0</td>
<td>1.0</td>
<td>0.2</td>
<td>0.4</td>
</tr>
</tbody>
</table>

3 district of Eunpyung Newtown(non U-City)

<table>
<thead>
<tr>
<th>Category</th>
<th>Unit</th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>Average</th>
<th>Sd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>ten thousand won / m²</td>
<td>1928</td>
<td>310.1</td>
<td>447.2</td>
<td>397.3</td>
<td>26.8</td>
</tr>
<tr>
<td>[b]</td>
<td>m²</td>
<td>1928</td>
<td>85.0</td>
<td>167.0</td>
<td>108.3</td>
<td>24.8</td>
</tr>
<tr>
<td>[c]</td>
<td>#</td>
<td>1928</td>
<td>3.0</td>
<td>5.0</td>
<td>3.2</td>
<td>0.5</td>
</tr>
<tr>
<td>[d]</td>
<td>#</td>
<td>1928</td>
<td>2.0</td>
<td>3.0</td>
<td>2.0</td>
<td>0.2</td>
</tr>
<tr>
<td>[e]</td>
<td>#</td>
<td>1928</td>
<td>125.0</td>
<td>571.0</td>
<td>364.4</td>
<td>164.5</td>
</tr>
<tr>
<td>[f] Dummy</td>
<td></td>
<td>1928</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>[g]</td>
<td>#</td>
<td>1928</td>
<td>11.0</td>
<td>20.0</td>
<td>16.3</td>
<td>3.1</td>
</tr>
<tr>
<td>[h]</td>
<td>#</td>
<td>1928</td>
<td>3.0</td>
<td>15.0</td>
<td>11.5</td>
<td>4.2</td>
</tr>
<tr>
<td>[i]</td>
<td>#</td>
<td>1928</td>
<td>1.2</td>
<td>2.0</td>
<td>1.6</td>
<td>0.3</td>
</tr>
<tr>
<td>[j] Years</td>
<td></td>
<td>1928</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>0.0</td>
</tr>
<tr>
<td>[k] Dummy</td>
<td></td>
<td>1928</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Grieum Newtown(non U-City)

<table>
<thead>
<tr>
<th>Category</th>
<th>Unit</th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>Average</th>
<th>Sd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>ten thousand won / m²</td>
<td>10670</td>
<td>268.0</td>
<td>496.1</td>
<td>394.8</td>
<td>53.2</td>
</tr>
<tr>
<td>[b]</td>
<td>m²</td>
<td>10670</td>
<td>59.0</td>
<td>143.0</td>
<td>83.5</td>
<td>19.5</td>
</tr>
<tr>
<td>[c]</td>
<td>#</td>
<td>10670</td>
<td>3.0</td>
<td>4.0</td>
<td>3.2</td>
<td>0.4</td>
</tr>
<tr>
<td>[d]</td>
<td>#</td>
<td>10670</td>
<td>1.0</td>
<td>2.0</td>
<td>1.9</td>
<td>0.3</td>
</tr>
<tr>
<td>[e]</td>
<td>#</td>
<td>10670</td>
<td>434.0</td>
<td>1634.0</td>
<td>1249.4</td>
<td>380.9</td>
</tr>
<tr>
<td>[f] Dummy</td>
<td></td>
<td>10670</td>
<td>0.0</td>
<td>1.0</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>[g]</td>
<td>#</td>
<td>10670</td>
<td>9.0</td>
<td>29.0</td>
<td>20.1</td>
<td>4.5</td>
</tr>
<tr>
<td>[h]</td>
<td>#</td>
<td>10670</td>
<td>6.0</td>
<td>28.0</td>
<td>18.9</td>
<td>6.8</td>
</tr>
<tr>
<td>[i]</td>
<td>#</td>
<td>10670</td>
<td>1.1</td>
<td>1.3</td>
<td>1.2</td>
<td>0.1</td>
</tr>
<tr>
<td>[j] Years</td>
<td></td>
<td>10670</td>
<td>3.0</td>
<td>10.0</td>
<td>6.8</td>
<td>2.6</td>
</tr>
<tr>
<td>[k] Dummy</td>
<td></td>
<td>10670</td>
<td>0.0</td>
<td>1.0</td>
<td>0.3</td>
<td>0.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Model 1</th>
<th>Model 2</th>
<th>VIF</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>[b]the area of exclusive use space</td>
<td>0.03* (0.01)</td>
<td>0.17*** (0.01)</td>
<td>2.50</td>
<td>2.65</td>
</tr>
<tr>
<td>[c]the number of rooms</td>
<td>-14.38*** (0.74)</td>
<td>-13.19*** (0.72)</td>
<td>2.00</td>
<td>1.98</td>
</tr>
<tr>
<td>[d]the number of bathrooms</td>
<td>1.21 (0.82)</td>
<td>1.54* (0.80)</td>
<td>1.20</td>
<td>1.19</td>
</tr>
<tr>
<td>[e]the number of households</td>
<td>0.00* (0.00)</td>
<td>-</td>
<td>15.01</td>
<td>-</td>
</tr>
<tr>
<td>[f]the awareness of construction firms</td>
<td>22.10*** (0.58)</td>
<td>21.87*** (0.56)</td>
<td>1.13</td>
<td>1.13</td>
</tr>
<tr>
<td>[g]the number of layers</td>
<td>0.54*** (0.07)</td>
<td>0.62*** (0.07)</td>
<td>1.76</td>
<td>1.68</td>
</tr>
<tr>
<td>[h]the number of apartment building units</td>
<td>-1.38*** (0.10)</td>
<td>-1.57*** (0.04)</td>
<td>7.98</td>
<td>1.55</td>
</tr>
<tr>
<td>[i]the number of parking lots per households</td>
<td>-11.74*** (1.36)</td>
<td>2.94* (1.41)</td>
<td>1.62</td>
<td>1.82</td>
</tr>
<tr>
<td>[j]the number of years of buildings</td>
<td>-11.67*** (0.14)</td>
<td>-11.48*** (0.13)</td>
<td>2.14</td>
<td>1.85</td>
</tr>
<tr>
<td>[k]the accessibility of the subway station</td>
<td>29.94*** (0.63)</td>
<td>30.55*** (0.58)</td>
<td>1.32</td>
<td>1.19</td>
</tr>
<tr>
<td>[l]town area</td>
<td>-44.28*** (1.46)</td>
<td>-41.81*** (1.25)</td>
<td>9.31</td>
<td>7.18</td>
</tr>
<tr>
<td>[m]U-City project area</td>
<td>5.28*** (0.97)</td>
<td>6.00*** (0.91)</td>
<td>3.91</td>
<td>3.61</td>
</tr>
<tr>
<td>Constant</td>
<td>522.58*** (3.59)</td>
<td>496.23*** (3.61)</td>
<td>496.23*** (3.61)</td>
<td>522.58*** (3.59)</td>
</tr>
</tbody>
</table>

B. Regression Analysis

In this study, multiple regression analysis demonstrated the hypotheses that U-City project increased the apartment prices. After attributes of buildings, apartment blocks, and regions were controlled in the first step, the variable of U-City was added to the model. Model specification process follows table V with model 1 and 2.

After specification of model 1, the Breusch-Pagan test was performed for a problem of heteroskedasticity. As a result of Breusch-Pagan test, the F statistics was 2.17 and p-value was 0.14. It failed to reject the null hypothesis at 10% of a significance level, so it met the assumption about the homoscedasticity. Although model 1 satisfied the basic assumptions of classical linear regression, there were some problems of outcomes. In explanatory variables, the number of bathrooms was not significant of its t-value. Further, the number of households had a multicollinearity problem presenting the
the additional explanatory variables and this point was the missing of explanatory variables. So the final model needed to test showed that there was a model misspecification of limitation of the research. Because the direction of apartment price per unit area increased 0.17 ten thousands won. the area of exclusive use space increased by one unit, the when other factors were fixed. The analysis was as follows. As 319.19 and the p-value was 0.00 which were statistically serious and was decided not to take any action because it was a VIF of the newtown area was relatively large, it did not seem important variable in the model for controlling the regional level. As a result of the multicollinearity test, most variables had approximately 51% of the explanation ability and the for the fitness of the explanatory variables was examined. The result appeared that there was no problem. An Additional test was performed for examining of heteroskedasticity and the model 2 was revised from the problems of model 1. First, the number of households was removed as to improve a serious multicollinearity problem. After the removal, the problem of multicollinearity of the number of apartment building units was solved expressing the VIF as 1.55 and the newtown area was mitigated too. Also, the area of exclusive use space had the synergy effect on the housing price, but it had the limit on increasing. For considering this effect, the square of the variable of the area of exclusive use space was added to the model for specification. As a result of improvement of explanatory variables, all independent variable become statistically significant at 1% to 10% levels. For verification of the model, the Breusch-Pagan test was performed. The F statistics was 0.84 and p-value was 0.35 so it failed to reject the null hypothesis of homoskedasticity. Finally, model 2 was selected as a model of apartment price determination in this study.

C. The model of apartment price determination
The final formula of apartment price determination is as follows.

\[ a = 496.23 + 0.17 \cdot b - 0.0016 \cdot b^2 - 13.19 \cdot c + 1.54 \cdot d + 21.87 \cdot f + 0.62 \cdot g - 1.57 \cdot h + 2.94 \cdot i - 11.48 \cdot j + 30.55 \cdot k - 41.81 \cdot l + 6.00 \cdot m \]

The meanings of [a] to [m] were in the table III. This model had approximately 51% of the explanation ability and the overall fit of the model was statistically significant at 1% level. And each variable was statistically significant at 1% to 10% level. As a result of the multicollinearity test, most variables had no problem showing 1.13 to 3.61 except of [I]. Although the VIF of the newtown area was relatively large, it did not seem serious and was decided not to take any action because it was a very important variable in the model for controlling the regional differences. After the model formulation, the Breusch-Pagan test was performed for examining of heteroskedasticity and the result appeared that there was no problem. An Additional test for the fitness of the explanatory variables was examined. The result of the RESET test was analyzed that the F statistics was 319.19 and the p-value was 0.00 which were statistically significant at 1% significance level. The outcome of the RESET test showed that there was a model misspecification of missing of explanatory variables. So the final model needed to the additional explanatory variables and this point was the limitation of the research.

The interpretation of the model assumed that it was analyzed when other factors were fixed. The analysis was as follows. As the area of exclusive use space increased by one unit, the apartment price per unit area increased 0.17 ten thousands won. Because the direction of \( b^2 \) was negative, the housing price and the area of exclusive use space had a non-linear relationship. The fact that the number of rooms had negative effects on the housing price was analyzed that the apartments in the newtown had floor plans which consisted of many rooms from small to large area averagely. The number of bathrooms, the awareness of construction firms, the number of layers, and the number of parking lots per households had positive effects on the housing prices. In contrast, the number of apartment building units had negative effects and it showed that high layers and few building units were preferred. The number of years of buildings had negative effects which was similar to the previous studies. In the case of regional factors, the accessibility of the subway station affected positively. The Eunpyung newtown had lower housing price per unit area than Griem because of its locational features. The main variable of this study was the U-City project area. The U-City project area had high prices of 6.00 ten thousands won per unit area than non-U-City area so it showed the effectiveness of the U-City project.

V. CONCLUSION
This study demonstrated the utility increase of residents according to the U-City construction project empirically. But there was a limitation of time period because the U-City project of Eunpyung was completed just 2 years ago. Although this paper analyzed the effectiveness of the U-City for the housing price, there was no finding that which U-Services contributed concretely. In future, targeting wider areas and long-term observations need to be studied to develop this result. Further the supplementation of data need to overcome the limitations.

REFERENCES