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Consideration about factors that influence Property Price in Seoul

*** Short Abstract**

- Property price in Seoul keeps changing every time. There are lots of factors that influence it. This paper shows those factors. The main results are as follows: Transportation and Welfare were the main factors in multiple regression as well as simple regression. The result implies that if we exclude the outlier 'Jung-gu', the outcome will be different.

1. Introduction

The purpose of this study is to clarify influence factors of property price in Seoul. Nowadays property price is increasing continuously in Korea, especially in Seoul. However, there is a difference between Gangbuk and Gangnam. Some specialists expect that the polarization of rich and poor will be increased more and more. Effects on property price differ due to several factors. In our research, we focus on 5 factors: Transportation, Education, Welfare, Crime Accidents, and Income.

Transportation is the number of transfer subway stations. Education is the number of high schools which have high education-achievement. Welfare Facilities are the number of facilities, such as Park, Facilities for Handicapped, Nursery Facilities. Crime accidents are the number of major crimes. And Income is monthly income. We analyze these five factors, using simple and multiple regression methods.

2. Background of Project and Research Question

Seoul is the place where we live in. We are likely to live in Seoul, after we graduate. Thus, this is the issue which is very related to our lives. Generally speaking, the difference of property price is quite big even if they are all in Seoul. We start to wonder why does it happen.

We build up five hypotheses with Transportation, Education, Welfare (including Park, Handicapped & Nursery Facilities), Crime Accidents, and Income.

(Hypothesis 1) If there are more transfer stations, property price would be higher.

(Hypothesis 2) If there are more schools that have high-education achievement, property price would be higher.

(Hypothesis 3) If a number of welfare facilities are located around a area, property price of the area would be higher than the other areas.

(Hypothesis 4) The more the crime occurs, the higher property price would be.

(Hypothesis 5) If residents in a area get more financial income, the property price would be higher.

3. Research Method

1) Sampling

In this report, the property price of Seoul is extracted from the data set in Seoul Open Data Plaza(2014). It is originally based only about price of lands, not about buildings. We think that it is more meaningful to compare the price of lands. So after now we call only the price of lands as the property price. Classify the

property price by borough which Korean name is “-Gu” and make an average of each Gu’s property price.

2) Measure main factors

After searching factors, we select 5 factors which seem to have a significant effect to the property price. There are Transportation, Education, Welfare facilities, Crime accidents, Income.

Transportation is measured in the number of transfer station. Because Seoul city’s metro system is well-developed, we count the number of station where more than 2 metro lines are crossed. This data is based on 2015. Normally we can think that this variable has positive relation to the property price.

We think that good educational environment affects the property price. So, education is measured in the number of high schools which have high education achievement. We use the data of education achievement in 2013. We can think that this variable has positive relation to the property price.

Welfare facilities contain park, facilities for handicapped, nursery facilities which are provided with support of government. This data is collected in 2015. We can also think that this variable has positive relation to the property price.

Crime accidents means the number of major crimes in 2014. Major crimes contain murder, robbery, rape, theft, violence. Normally region which exposes to crime, it would have less property price. We can think that this variable has negative relation to the property price.

Income is considered a mainly factor which affects to property price. We measure average income of each ‘Gu’ by month.

4. Research Result

1) The property price of ‘Gu’

The property price of ‘Gu’ represent Won of 1m². Almost of them gather between ₩2,500,000 to ₩3,500,000. Maximum of the property price is ₩6,409,498 in Jung-gu and minimum of the property price is ₩1,876,427 in Jungnang-gu. By looking at the plot below down, we may consider Jung-gu’s data as an outlier.

Gu	Price	Gu	Price	Gu	Price
Gangnam	4,182,722	Dobong*	2,696,825	Songpa	3,710,737
Gangdong	2,701,596	Dongdaemun*	2,523,271	Yangcheon	2,301,531
Gangbuk*	2,627,384	Dongjak	3,472,655	Yeongdeungpo	2,611,703
Gangseo	2,918,286	Mapo*	3,067,527	Yongsan*	4,035,095
Gwanak	3,704,778	Seodaemun*	2,617,948	Eunpyeong*	2,024,626
Gwangjin*	2,713,902	Seocho	4,173,793	Jongno*	4,267,212
Guro	3,080,530	Seongdong*	2,791,784	Jung*	6,409,498
Guemcheon	3,220,735	Seongbuk*	2,144,723	Jungnang*	1,876,427
Nowon*	2,747,567				

Unit : Won/m²

Before see the result about analyzing factors, there is a interesting test about the property price. Normally in our mind, there is a stereotype that the property prices of Gangnam area are more expensive than those of Gangbuk area. The property prices of Gangbuk area are marked with '*' There is a t-test with a null hypothesis that the price of two regions has no significant difference.

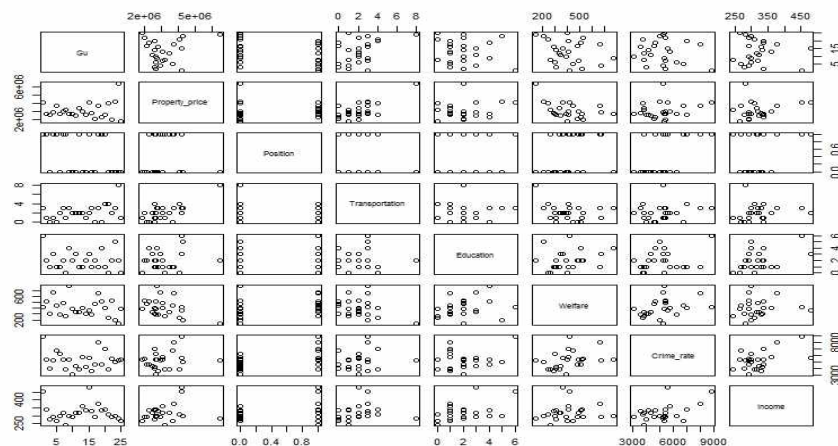
	mean	t-value	df	p-value
Gangbuk	3,038,842	-0.6567	20.588	0.5186
Gangnam	3,279,915			

If we erase the data of Jung-gu's price as an outlier, the result is different. We can say that there is a significant difference between two regions' property price at a 90% significance level. It is a remarkable result.

	mean	t-value	df	p-value
Gangbuk	2,779,561	-1.8541	21.886	0.07725
Gangnam	3,279,915			

2) Analysis Result

First of analysis, we look at a plot of entire variables. In plot, there is no significant relation between independent variables. So we can consider multiple regression with no covariance.



	Estimate	Std. Error	t value	Pr(> t)
Intercept	2303768.6	925838.1	2.488	0.02228
Transportation	312638.6	87716.3	3.564	0.00207
Education	96734.0	101972.3	0.949	0.35472
Welfare facilities	-2304.4	1083.2	-2.127	0.04670
Crime accidents	133.1	124.8	1.066	0.29964
Income	702.0	3128.0	0.224	0.82481

$$R^2 = 0.6216, \text{ Adjusted } R^2 = 0.5221$$

$$F\text{-statistic} = 6.243, \text{ df} = (5,19), \text{ p-value} = 0.001383$$

In the result, the multiple regression model can explain the property price at 62.16% and this model is statistically significant at a 99% significance level. When see each variable, intercept, Transportation and Welfare facilities reject the null hypothesis that the variable has no significant effect on the property price. So Transportation and Welfare facilities variables are meaningful variables.

After the multiple regression, we doubt the result that the other variables, Education, Crime accidents and Income, have no significant effect. We consider the interaction effect on the variables, so we do simple regression of each variable.

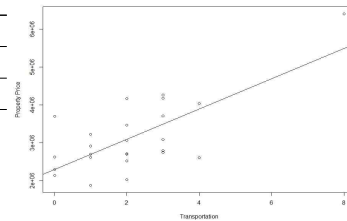
<Table 1>

	Estimate	Std.Error	t value	Pr(> t)
Intercept	2298458	223123	10.301	4.35e-10
Transportation	399272	82469	4.842	6.91e-05

$$R^2 = 0.5047, \text{ Adjusted } R^2 = 0.4832$$

$$\text{F-statistic} = 23.44, \text{ df} = (1,23), \text{ p-value} = 6.913\text{e-}05$$

$$\text{Correlation} = 0.7104499$$



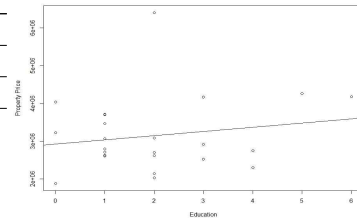
<Table 2>

	Estimate	Std.Error	t value	Pr(> t)
Intercept	2920590	323540	9.027	5.08e-09
Education	112162	129520	0.866	0.395

$$R^2 = 0.03158, \text{ Adjusted } R^2 = -0.01053$$

$$\text{F-statistic} = 0.7499, \text{ df} = (1,23), \text{ p-value} = 0.3954$$

$$\text{Correlation} = 0.177697$$



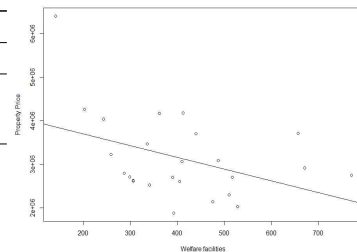
<Table 3>

	Estimate	Std.Error	t value	Pr(> t)
Intercept	4244870	528399	8.033	3.99e-08
Welfare facilities	-2710	1225	-2.212	0.0372

$$R^2 = 0.1755, \text{ Adjusted } R^2 = 0.1396$$

$$\text{F-statistic} = 4.894, \text{ df} = (1,23), \text{ p-value} = 0.03715$$

$$\text{Correlation} = -0.4188744$$



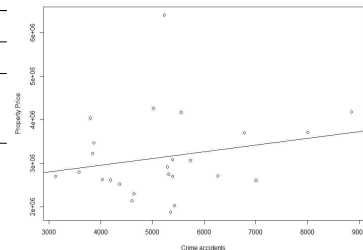
<Table 4>

	Estimate	Std.Error	t value	Pr(> t)
Intercept	2343878	773829.2	3.029	0.00597
Crime accidents	153.3	143.4	1.069	0.29631

$$R^2 = 0.04731, \text{ Adjusted } R^2 = 0.005884$$

$$\text{F-statistic} = 1.142, \text{ df} = (1,23), \text{ p-value} = 0.2963$$

$$\text{Correlation} = 0.2174987$$



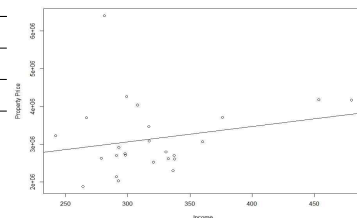
<Table 5>

	Estimate	Std.Error	t value	Pr(> t)
Intercept	1841285	1180553	1.560	0.132
Income	4074	3640	1.119	0.275

$$R^2 = 0.05164, \text{ Adjusted } R^2 = 0.01041$$

$$\text{F-statistic} = 1.252, \text{ df} = (1,23), \text{ p-value} = 0.2746$$

$$\text{Correlation} = 0.2272486$$



In <Table 1>, Transportation variable has a significant relationship with the property price($p\text{-value} < .05$). So 'Hypothesis 1' can be accepted and we can say that the region with more transfer stations are richer than less.

<Table 2> shows that Education variable does not have a significant effect on the property price. The property price is independent to this variable, so 'Hypothesis 2' is rejected.

<Table 3> shows that Welfare facilities variable has a significant relation with the property price($p\text{-value} < .05$). But, this result is different with our hypothesis. We think welfare facilities have positive relation with the property price at first, negative relation is observed between two variables.

<Table 4> shows that the Crime accidents have no relation with the property price, so our 'hypothesis 4' is rejected. It has no linear relationship.

In <Table 5>, Income variable has no significant effect to the property price.

5. Discussion

After analysis, we have a question about unexpected result. First, most of the variables we considered as explanatory variables are not accepted. So we think about other condition about analysis. We think the outlier in the data set before the analysis, so this time we analyze once again without outlier(Jung-gu's data). The result is interesting. Transportation variable does not have a significant effect any more ($p\text{-value} = .2219$). Only Welfare facilities variable is statistically significant ($p\text{-value} < .1$).

The results of the simple regression of each variable are also different to the previous results. Transportation and Income variables are statistically significant ($p\text{-value} < .05$), but Welfare facilities variable is not significant any more($p\text{-value} = .26$). In this condition, Hypothesis 1 and 5 are accepted.

As a result, it is better that removing the outlier because the outlier may cause high variance.

Another thing of discussion is the result of Welfare facilities variable by regression. Unlike our hypothesis, welfare facilities has negative relation. In our discussion, we guessed that there is a NIMBY effect on the facilities for handicapped and this effect is more powerful than other variables in Welfare facilities variable.

6. Conclusion and future direction

In this research we analyze the factors which are considered to be meaningful factors of property price and see these factors to have significant effect in real.

There are some variables that have significant effect by multiple regression. Transportation and Income variable are statistically significant, so they influence the property price strongly. In simple regression, Transportation and Income variables have a significantly positive effect to the property price.

In our research, we simply focus the data set on the 'Gu' units and analyze the data by 5 variables. To analyze this study more specifically, making smaller unit of area will be better. Thus, we compare the areas by purpose of the use. We hope the research to progress satisfactorily.

7. References

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8. Appendix

-data set

Gu	Property price	Position	Transfer station	Education	Welfare	Crime accident	Income
Gangnam	4,182,722	1	3	6	412	8,851	453.6
Gangdong	2,701,596	1	1	2	517	5,392	337.3
Gangbuk	2,627,384	0	0	1	306	4,030	278.5
Gangseo	2,918,286	1	1	3	671	5,289	292.6
Gwanak	3,704,778	1	0	1	440	6,781	266.7
Gwangjin	2,713,902	0	2	1	299	6,268	297.9
Guro	3,080,530	1	3	2	487	5,389	317.3
Geumcheon	3,220,735	1	1	0	259	3,842	241.8
Nowon	2,747,567	0	3	4	770	5,312	297.8
Dobong	2,696,825	0	2	2	390	3,124	290.8
Dongdaemun	2,523,271	0	2	3	341	4,363	320.7
Dongjak	3,472,655	1	2	1	336	3,869	316.7
Mapo	3,067,527	0	2	1	410	5,740	360.2
Seodaemun	2,617,948	0	1	2	306	4,194	332.4
Seocho	4,173,793	1	2	3	362	5,558	479.8
Seongdong	2,791,784	0	3	1	287	3,582	330.8
Seongbuk	2,144,723	0	0	2	475	4,606	290.9
Songpa	3,710,737	1	3	1	657	8,004	376.2
Yangcheon	2,301,531	1	0	4	510	4,642	336.2
Yeongdeungpo	2,611,703	1	4	1	405	7,003	337.5
Yongsan	4,035,095	0	4	0	243	3,799	307.8
Eunpyeong	2,024,626	0	2	2	528	5,431	292.3
Jongno	4,267,212	0	3	5	203	5,021	299
Jung	6,409,498	0	8	2	141	5,231	281.2
Junngang	1,876,427	0	1	0	392	5,353	264