A Study on the Impact of Demographic Change on Housing Price in South Korea

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Ⅰ. **Executive Summary**

In recent years, the demographic structure of South Korea has been changing. Although the total population is still growing, the population growth rate is shrinking due to the rapid decline in the birth rate and the aging population. On the other hand, the growth rate of the total number of households is decreasing, but the rate of one-person or two-person households is steadily increasing. Data by region from 2003 to 2016 are used to analyze how these changes in the size and composition of population and households affect housing prices. Since the patterns of changes in the housing price and demographic structure by each metropolitan city or the province are different, consequently the regional analyses are implemented as well as the nationwide analysis.

According to the results of the analyses, population variables such as the population growth rate and the elderly dependency ratio have no statistically significant effect on the housing price, while household variables such as the household growth rate and the ratio of small households (1 or 2 people) to all households have a significant effect. In the nationwide analysis, both household factors are statistically significant, but in the regional analysis, only single or two-person household ratio shows meaningful results in the Seoul metropolitan region and the non-metropolitan provinces. Besides the population and household variables, only the growth rate of new housing licenses, which is a housing supply variable, has a significant impact on housing prices regardless of regions.

Therefore, in establishing a housing policy in the future, the government should pay more attention to the household variables than the population variables. Regionally, the small household ratio should be considered more in the Seoul metropolitan region and the non-metropolitan provinces. In addition, it should also examine thoroughly the economic variables such as housing supply.

Ⅱ. Introduction

Over the past several decades, the South Korean government has implemented supply-oriented real estate policies. Although there were exceptional cases such as the financial crisis, the government has developed large-scale public land projects near the Seoul metropolitan area and the five metropolitan cities in which the population was concentrated, and a large number of housing units were built on the public lands. With this supply-oriented real estate policy, the government has been responding to housing demand in the industrialization period (from the 1970s to the 1990s) and striving to stabilize the real estate market. However, when the real estate market stagnated for a long time due to the global economic crisis in 2008, the previous government implemented a deregulation policy to revitalize the market. As one of the key measures, in 2014 it announced a plan to stop large-scale public land development by the end of 2017. This could be regarded as a very unusual action, considering the past real estate policy. Such a policy measure coupling with a low-interest rate was contributed to a steady rise in housing prices since 2015.

The current government, which came into power in May 2017, regarded the recent rise in real estate prices as exceeding reasonable levels and converted the housing policy into the market regulatory policy, including strengthening mortgage standards in order to limit the rise of housing prices. If the housing prices kept rising, should the government resume the supply-oriented housing policy again? In order to answer this question, it is necessary to pay more attention to recent demographic changes in South Korea in addition to economic factors. This is because the recent changes in demography are enough to question the sustainability of this supply-oriented housing policy.

One of the changes in the demographic structure in South Korea is that population growth is slowing due to aging and the sharp drop in the birth rate. According to Statistics Korea (the

national statistics agency, 2017), the birth rate, which was 1.47 children per adult female in 2000, fell to 1.17 in 2016. If the trend continues, Statistics Korea (2017) expects that the total population will begin to decrease from 2032. On top of that, South Korea is the fastest aging country in the world. The UN defines an 'aging society' as a society in which the proportion of elderly people aged 65 or older among the total population is 7% to 14%, an 'aged society' with their proportion ranging from 14% to 20%, and a 'super-aged society' as one with over 20% of elderly people (Ahn & Lim, 2015). According to the Statistics Korea (2017), South Korean society has already entered an aging society in 2000, and it is expected to become an aged society in 2018, and a super-aged society in 2025. The problem is that the pace of aging in South Korea is too fast. It will take just 26 years for South Korea to transfer from aging society to the super-aged society while the advanced countries in the western world took about a century (Ahn & Lim, 2015). Such changes in the demographic structure represented by the low birth rate and aging are expected to have diverse impacts on society as a whole and may be factors in reducing demand for housing.

The other change in demography recently is that the number of one- or two-person households has been increasing while the total household growth rate is slowing down. In other words, a slowdown in the total household growth rate can reduce housing demand, while the increase in one or two-person households may increase demand for small houses, which could be a factor for changing the conventional housing market that centered on the households with three to four people.

Mankiw and Weil (1989) stated that the decline of population led to the decrease in housing demand and prices. Also, Takáts (2012) analyzed the data from 22 Organization for Economic Cooperation and Development(OECD) countries and argued that aging stalled housing prices in these countries.

Judging from the result of this research, the change of population structure in South Korea should lead to the housing price downturn and the government housing policy should be the market activation policy in order to stabilize the market. But in reality, the opposite situation is evolving during recent years in South Korea.

Despite the recent demographic changes - declines in population and household growth rate, aging, and increasing small households with one or two members, there seems to be no comprehensive housing policy that reflects the housing demand caused by those changes. Therefore, analyzing the recent changes in the demographic structure that seems to be influencing the housing market will contribute to the establishment of the government 's housing policy in the future.

In this context, the purpose of this study is to verify whether the demographic factors in South Korea such as the population growth rate, the elderly dependency ratio, the household growth rate and one- or two-person household ratio to the total household have a significant effect on the housing price and which factors among those population and household variables have more impact on housing prices through the time series analysis of 16 provinces in South Korea.

Ⅲ. Literature Review

Mankiw and Weil (1989) were the first to investigate whether demographic structure had a significant effect on housing prices. They analyzed the time series data for about 40 years by setting the housing demand as an additive function of household members. As a result, they argued that population change led to a change in housing demand, which had a significant impact on house prices. They found that there was little housing demand until age 20, but the demand for housing increased sharply between the ages of 20 and 30, and the demand for housing declined after age

30. Thus, they concluded that the baby boomers of the 1950s caused a rapid rise in housing demand in the 1970s and predicted that demand for housing would slow in the 1990s, when the baby buster generation[1], which was born in the 1970s, turned 20 years old. That was because the population of the baby buster generation was much smaller than that of the baby boomer generation.

Using the Mankiw and Weil (1989) model, Engelhart-Poterba (1991) analyzed Canadian data (a country with a similar demographic structure to the U.S.) and found that, unlike the results of Mankiw and Weil (1989), the demographic variables had no significant effect on housing prices[2]. In Germany, Maennig and Dust (2008) studied the relationship between the population and single-family house prices from 1992 to 2002 in 98 German cities. They suggested that there was no statistically significant relationship between housing prices and population growth, whereas the declining population had a significant negative impact on housing prices.

In Japan, Ohtake and Shintani (1996) analyzed Japanese housing prices using the housing demand index of the demographic factors proposed by the Mankiw and Weil (1989) model. Unlike the results for the United States, they found that demographic changes affected housing stocks rather than housing prices in the long-term, but it influenced housing prices through short-run adjustments in Japan.

With respect to aging, Takáts (2010) analyzed the impact of population aging on asset prices using panel data for OECD countries from 1970 to 2009. He found that asset prices were affected by economic and demographic factors. In other words, the rise in housing prices in OECD

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[1]Mankiw and Weil called the generation born after the 1970s the 'Baby Buster' as the opposite notion of the 'Baby Boomer' born in the 1950s. In the mid-1970s, rising house prices in the United States coincided with the baby boomer generation entering the home purchasing age group.
[2] The population composition of the two countries was similar, but the real house prices had different trajectories. In the United States, housing prices increased rapidly from the mid-1970s to the early 1980s, but Canada had a sharp rise in the early 1970s and a deep decline followed from the mid-1970s to 1985. And then surged again.

countries was stimulated by population growth, meaning the aging population had a negative impact on real house prices.

In the case of South Korea, Kim (1999) divided the population data of South Korea into 10 eight-year age bands using the Mankiw and Weil model (1989) and analyzed the effect of demographic variables on the housing price. He suggested that the sign and statistical significance of the house price equations were different depending on the combination of other explanatory variables, such as the definition of the housing price index[3], whereas the real income and the real interest rate, the supply side variables such as the real land price and the actual building cost had a statistically significant positive effect. Kim interpreted these results as meaning that supply side factors were more important than demand side variables in explaining South Korean housing prices. In addition, Park and Kim (2014) used panel data from Seoul and the 6 metropolitan cities in 2003 to 2012 to examine the impact of demographic changes on the housing market, including the aging population and the retirement of the baby boomers. They analyzed that housing price change was affected by demographic factors and income-related economic factors, but they showed that the housing supply factors were not significant. They estimated that if the elderly population increases by 1%, house prices fall by 0.12%. Lim (2016) analyzed also the effect of demographic changes in South Korea on housing prices using the panel fixed effects model. In order to compare the size effect of population and the composition effect of population structure, she divided the model into three categories - the model considering only the population growth rate, the model considering only the elderly dependency ratio, and the model considering both. As a result, the elderly

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[3] Kim used three dependent price indexes. First of all, like Mankiw and Weil (1989), he used the relative housing price which was the housing investment deflator divided by the GNP deflator. Unlike the study by Mankiw and Weil, the housing demand variable and real income showed a statistically significant negative value. Also, he used the housing cost index among the CPI, the result was not statistically significant. Lastly, he used the house price index, the result showed statistically significant.

dependency ratio was more influential on the housing price than the population growth rate. Especially, she found that the aging can cause the housing price to fall.

Ⅳ. Research Design

1) Research questions

The first research question is whether the population factors in size and composition have a significant impact on housing prices. If the population variables affect housing prices as in previous studies, the growth rate of the housing prices will have a tendency to decline as demand for housing slows down due to the decline of the population growth rate and the incline of the elderly dependency ratio.

The second research question is whether the household variables have a significant impact on housing prices. House prices will rise if the number of households increases, and if the proportion of small households increases.

Lastly, the third research question is which variables between the population and household factors have a more significant impact on housing prices.

2) Data Source

To address the research questions, three kinds of data collected - demographic factors, demand and supply factors in the housing market – for each of South Korea's sixteen provinces. First, as demographic factors, population and household data were collected to be able to represent recent demographic changes. Second, there are some demand side factors such as personal income, real Gross Regional Domestic Production(GRDP), and unemployment. Lastly, there is a supply side factor, namely new housing license growth rate. These data are derived from Statistics Korea.

The dependent variable is the growth rate of real housing prices. This is converted by dividing the apartment sale price index announced by Kookmin Bank by the consumer price index announced by the Statistics Korea. The population growth rate and the elderly dependency ratio are used as independent variables related to population structure. The former is related to the total size of the population (size effect) and the latter to the aging (composition effect). As the income data, the growth rate of personal income per capita released by Statistics Korea was used. As the supply side data, the increasing rate of the new housing license was used. The source and basic statistics for the variables used in the analysis are shown in Table 1.
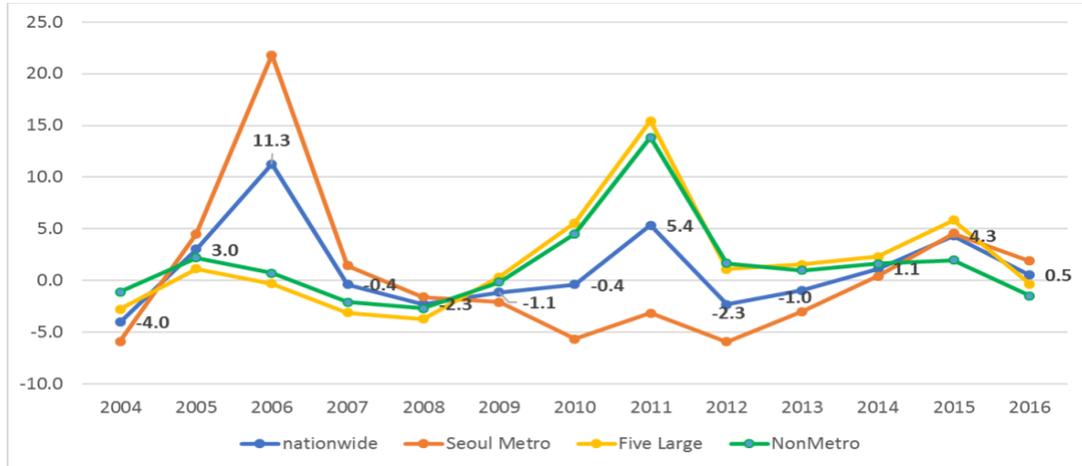
<Table 1> Summary of Variables

Variable	Variable Description	sources	Mean	Std. Dev.	Min.	Max
Real house sales price increase rate (IRHP)	% change of apartment sales price index/% change of consumer price index	KB Bank, Statistics Korea	1.3981	5.7366	-7.5061	25.3776
Population Growth Rate (PGR)	%change of population	Statistics Korea	0.3682	0.8372	-3.4506	2.8446
Elderly Dependency Ratio (EDR)	population 65 and older/ working age population		16.4087	5.3554	6.9321	30.8245
Increase Rate of Personal Income per capita (IRPIC)	% change of personal income per capita		4.8996	2.1643	0.0260	13.8003
Growth rate of new house licenses (GRNHL)	%change of new housing licenses		15.1335	63.1582	-87.2973	389.2415
Growth rate of the number of households (GRHH)	%change of number of households		1.5703	0.6643	-0.0326	3.6874
Small Households Ratio (SHR)	percentage of households with 1 or 2 members/ total households		48.7176	6.7892	34.8872	63.2364
Real GRDP(RGRDP)	%change of real gross regional domestic product		3.4455	2.5563	-3.6063	11.7817
Unemployment Rate (UER)	unemployment rate		3.0697	0.9222	1.3	5.1

3) Demographic Data Trend

Figure 1 shows the change in the real house sales price, which is a dependent variable, from 2004 to 2016. The trends of Seoul metropolitan area and other provinces show a slightly different pattern as seen in Figure 1. In the Seoul metropolitan area, it showed a rise from 2005 to 2006, and then a decrease until 2013. It has recently recovered in 2014.

Figure 1.   Real house sales price index increase rate

On the other hand, in the case of other regions, the negative growth rate was seen from 2004 to 2009. Then, there was a significant increase in 2010 and 2011. And after that, the locals caught their breath. Finally, the decoupling between the Seoul Metropolitan areas and the local areas was resolved in the recent year.

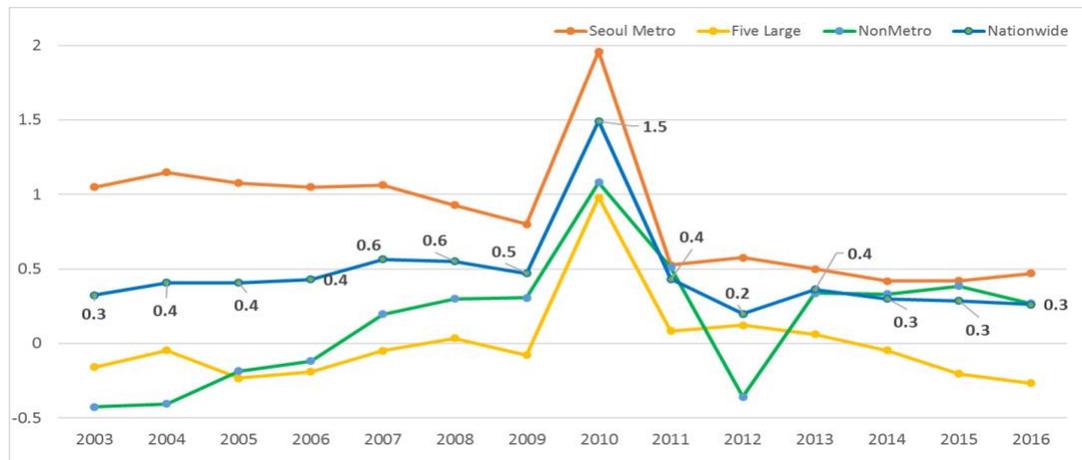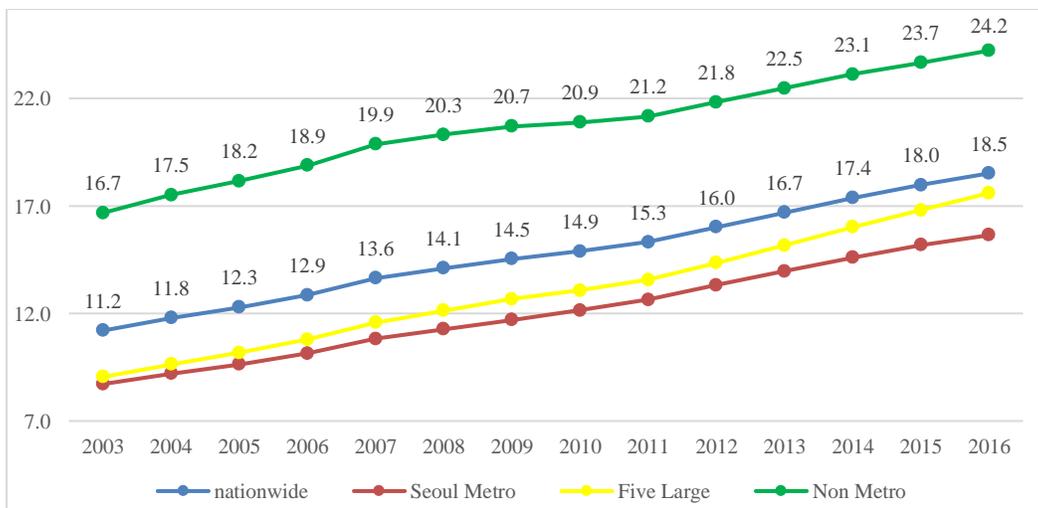**Figure 2. Population Growth Rate Trend**

Figure 2 shows the population growth trend. It is showing a downward trend starting from 2010 nationwide. In particular, the population of the five metropolitan cities is continuously decreasing except from 2009 to 2011. In the case of the provinces, the population continued to increase until 2010 but tended to decline thereafter. However, the population growth rate is recovering from 2012, which seems to be the result of the government transferring public institutions from the Seoul metropolitan area to each province.[4]

On the other hand, the elderly dependency ratio continues to rise in an upward direction as the population ages. Figure 3 shows that the elderly dependency ratio across the country, which was 11.2% in 2003, rose steadily year-to-year to 18.5% in 2016. In addition, the elderly dependency ratio in non-metropolitan areas is relatively high, indicating that the pace of aging is faster than that of metropolitan areas.

Figure 3. Elderly dependency ratio trend

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[4] From 2010 to 2015, the government transferred 89 public institutions in the Seoul metropolitan area to the provinces in order to promote balanced regional development. As a result, 32,000 public employees were reported to be transferred to the provinces (National Assembly Budget Office, Evaluation of Public Transfer Projects, 2016, pp13-25).

Figure 4 shows the growth rate of the total number of households from 2003 to 2016. In general, the growth rate has been slowing down over time, but the growth rate in the eight provinces area has changed direction to rise since 2013. This seems to be due to the transfer of public institutions based in the Seoul metropolitan area to the provinces, in accordance with the government's balanced regional development policy as mentioned earlier.
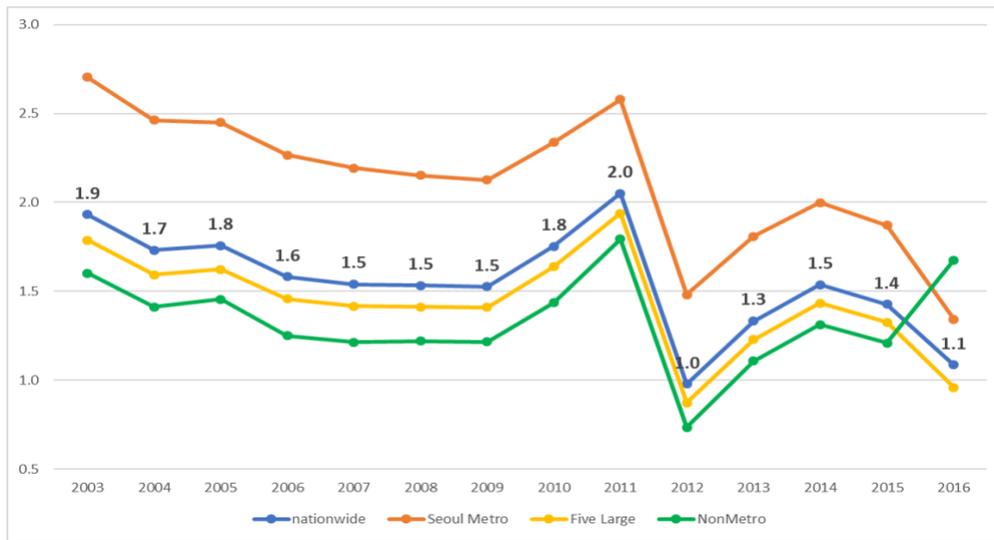
Figure 4. Total household growth rate
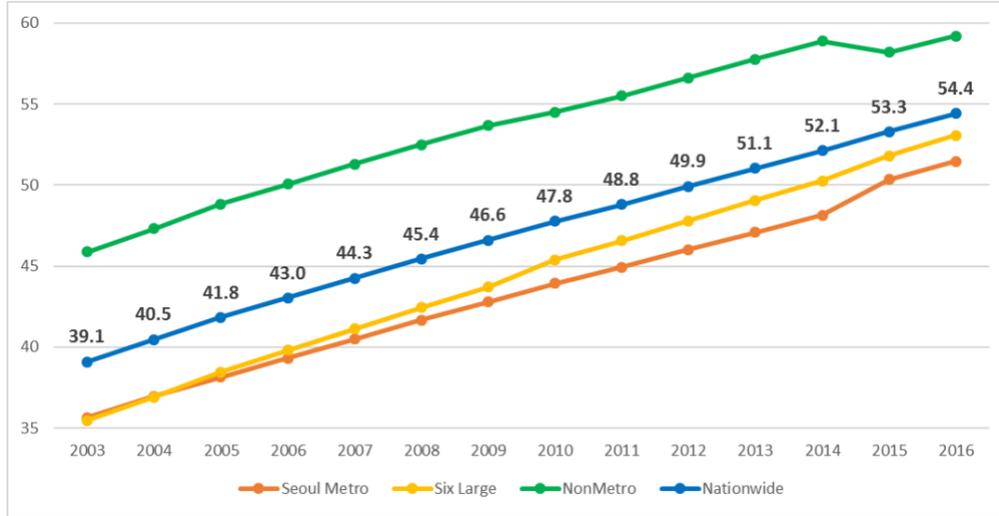

Figure 5 shows the ratio of small households with one or two members to the total number of households. The ratio of small households has been steadily increasing. As of 2013, more than half of all households are small households. By 2045, Statistics Korea (2017) predicts that 7 out of 10 households will be small households.

Figure 5. Small Households ratio to Total Households

Ⅴ. Research Method

Based on the Takáts (2012) model in which housing prices are affected by economic and population variables and Lim's (2017) panel analysis model, the following linear regression model was used. The difference with the two models is that supply side factors, the growth rate of new housing authority licenses, is added to the model.

$$\triangle P_{it} = \alpha + \beta 1 \triangle Pop_{it} + \beta 2 \, Old_{it} + \beta 3 \triangle Income_{it} + \beta 4 \triangle HA_{it} + \beta 5 \triangle RGRDP_{it}$$

$$+ \, \beta 6 Unemploy_{it} + \mu_i + \varepsilon_{it} \tag{1}$$

where $\triangle P_{it}$ represents real house price growth rate in province i between time period t and t-1, $\triangle Pop_{it}$ is percentage growth in total population, Old_{it} is the elderly dependency ratio (the elderly population to working age population), $\triangle Income_{it}$ is the percentage growth in personal income, $\triangle HA_{it}$ is the percentage growth in new housing authority licenses, $\triangle RGRDP$ is the percentage growth in real gross regional domestic production (RGRDP), Unemploy is the unemployment rate, μ_i represents unobserved fixed effects of regions, and ε_{it} is a composite error term.

Although the purchase of a home is substantially personal, the possession or lease of the home can be regarded as the creation of new households. Therefore, it will be possible to

reconstruct equation (1) by substituting the number of households instead of population. In addition, the following model can be set up by including the growth rate of the recent one- and two-person households in order to catch the effect of small houses on the housing price.

$$\triangle P_{it} = \alpha + \beta 1 \triangle Households_{it} + \beta 2\ SHR_{it} + \beta 3 \triangle Income_{it} + \beta 4 \triangle HA_{it} + \beta 5 \triangle RGRDP_{it}$$
$$+ \beta 6 Unemploy_{it} + \mu_i + \varepsilon_{it} \qquad (2)$$

where $\triangle$Households represents the household growth rate and SHR is the ratio of small households to the total households. Comparing the results of equations (1) and (2), it is able to see the differences between the impact of population variables and that of household variables on the housing price.

Moreover, equation (3) is intended to analyze changes in housing prices when population and household factors are considered together.

$$\triangle P_{it} = \alpha + \beta 1 \triangle Pop_{it} + \beta 2\ Old_{it} + \beta 3 \triangle Households_{it} + \beta 4\ SHR_{it} + \beta 5 \triangle Income_{it} + \beta 6 \triangle HA +$$
$$B7 \triangle RGRDP_{it} + \beta 8 Unemploy_{it} + \mu_i + \varepsilon_{it} \qquad (3)$$

In addition, the speed of progress of aging and the degree of differentiation of one or two-person households may vary by region. In the metropolitan area where population and capital are concentrated, the pace of aging can be relatively slow compared with that of the other areas. Therefore, to analyze the impact of demographic changes by region, panel data for each city and province from 2003 to 2016 are constructed. Then, in order to control the characteristics of each city and province and to determine the effective analysis method, a Hausman test was conducted to choose the fixed effect or the random effect regression analysis. Also, to analyze the difference in impacts by region, the country was divided into three areas - Seoul metropolitan region, five metropolitan cities, and non-metropolitan provinces. In the Seoul metropolitan region Seoul, Gyeonggi, and Incheon are included, the five metropolitan cities are Busan, Daegu, Kwangjoo,

Daejeon, and Ulsan, and non-metropolitan provinces include the eight provinces - Gangwon, Chungbuk, Chunnam, Jeonbuk, Jeonnam, Kyungbuk, Kyungnam, and Jeju.

Ⅵ. Findings

1) Nationwide analysis

First, the Hausman test was conducted to determine whether the fixed effect model or the random effect model is more suitable for the analysis. As a result of the test, it is reasonable to use the fixed effects model rather than the random effects model because the null hypothesis of random effects uncorrelated with explanatory variables is rejected at a significance level of 0.01 ($p < 0.0066$). Table 1 shows the results of analyzing nationwide using three models.

Table1. Nationwide Analysis

Rate of change of real housing price	Model 1. Population	Model 2. Households	Model 3. Population + Households
Population Growth Rate(PGR)	-0.1369 (0.7643)	-	-0.2696 (0.756)
Elderly Dependency Ratio(EDR)	0.1659 (0.2577)	-	-1.5206 (0.7832)
Growth Rate of The Number of Households(GRHH)	-	6.7892*** (1.7758)	7.3927*** (1.9113)
Small Households Ratio(SHR)	-	0.3106** (0.117)	1.0456** (0.3905)
Increase Rate of Personal Income per capita (IRPIC)	-0.1659 (0.1789)	-0.1496 (0.1512)	-0.1307 (0.1295)
Growth Rate of New Housing Licensing(GRNHL)	0.0415*** (0.0053)	0.0308*** (0.0046)	0.0288*** (0.0049)
Real GRDP(RGR DP)	-0.0476 (0.1302)	-0.1778 (0.1366)	-0.2238 (0.1237)
Unemployment Rate(UER)	-0.5738 (0.7927)	-1.5747 (0.8072)	-1.3579 (0.922)
R^2(within)	0.2402	0.3118	0.3333

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$, robust standard errors in parentheses.

Model 1 has population variables and model 2 uses household variables. This is to infer which factors between the population and household variables are more significant when other economic variables such as per capita income growth rate, new housing license growth rate, real GRDP growth rate, and unemployment rate are controlled. Model 3 shows the results when considering both population and household variables. First, in model 1, the results show that population variables do not have a statistically significant effect on house prices. On the other hand, in Model 2, both the growth rate of households and the ratio of small households have statistically significant effects. House prices increased by about 6.79% when the total household growth rate increased by 1%, and house prices increased by about 0.31% when the small households increased by 1%. Therefore, it can be inferred that household variables reflect housing prices more than population variables, assuming that other economic variables are constant. In Model 3, which takes both population and household variables into consideration, the results are similar to those of model 2. House prices increased by about 7.39% when the total household growth rate increased by 1% and 1.04% increased as the small households increased by 1%. It can be inferred that when the population and the household factor are considered together, the household factor has a statistically significant impact on the house price.

In the case of economic variables, the growth rate of new housing authority licenses is only statistically significant in all three models, but the growth rate of individual income and the unemployment rate were not significant. According to the result, if the growth rate of new housing licenses, which represents a measure of housing supply, increases, the housing price increases. In general, as the supply increases, the price tends to be lower, based on general economic principles. However, in these models, the rate of new housing licenses has a positive impact on housing price. This might be due to a time lag between demand and supply in the asset market, reflecting

expectations of suppliers for the economy in the near future.

2) Regional Analysis

As seen in Figure 1, the pattern of change in housing prices varies by region. In addition, the impact of population change on housing prices may vary from region to region. Therefore, to analyze the impact of population change on housing prices by region, the whole country was divided into three areas. Also, in order to determine the fixed effect model and the random effect model for each region, Hausman tests were conducted. As a result, the null hypothesis of random effects uncorrelated with explanatory variables is not rejected, so the random effects model were applied to the regional analyses.

Table 2. Seoul Metropolitan Region

Rate of change of real housing price	Model 1. Population	Model 2. Households	Model 3. Population + Households
Population Growth Rate(PGR)	-1.0503 (0.4667)	-	-1.3578 (0.963)
Elderly Dependency Ratio(EDR)	-1.1941 (0.3922)	-	-2.1625 (0.0736)
Growth Rate of The Number of Households(GRHH)	-	-1.2903 (0.973)	1.2231 (1.3115)
Small Households Ratio(SHR)	-	-0.4818 (0.1866)	0.4878*** (0.144)
Increase Rate of Personal Income per capita (IRPIC)	-0.6436 (0.5245)	-0.647 (0.4743)	-0.6387 (0.4911)
Growth Rate of New Housing Licensing(GRNHL)	0.0353*** (0.0052)	0.0331*** (0.0065)	0.035*** (0.007)
Real GRDP(RGRDP)	-0.038 (0.6795)	-0.3345 (0.6743)	-0.0656 (0.6665)
Unemployment Rate(UER)	-0.7725 (0.9501)	-0.4065 (1.6776)	-0.7095 (1.8431)
R^2(within)	0.112	0.0984	0.1151

***$p<0.01$, **$p<0.05$, *$p<0.1$. robust standard errors in parentheses.

First, in the case of the Seoul metropolitan region, no statistical evidence is found that the

population has an impact on the housing prices in any model of the regional analysis. In model (3), only the small household ratio has statistically significant impact on housing prices. Housing prices increased by about 0.49% in the models when the small household ratio increased by 1%. Namely, the population variables do not influence the housing market, but in the household variables, just small household ratio has an impact on housing prices. In economic variables, only the growth rate of new housing authority licenses has influenced housing prices in the Seoul metropolitan area. Housing prices increased by about 0.035% in the models when the growth rate of new housing licenses increased by 1%.

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Table3. Five metropolitan cities

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Rate of change of real housing price	Model 1. Population	Model 2. Households	Model 3. Population + Households
Population Growth Rate(PGR)	-0.1876 (0.7007)	-	-0.6659 (0.9716)
Elderly Dependency Ratio(EDR)	0.3331 (0.2564)	-	1.0126 (0.6125)
Growth Rate of The Number of Households(GRHH)	-	-0.0846 (1.3393)	2.3327 (1.6397)
Small Households Ratio(SHR)	-	0.1689 (0.1711)	-0.3309 (0.3044)
Increase Rate of Personal Income per capita (IRPIC)	0.1123 (0.4169)	0.1258 (0.4117)	0.0028 (0.42)
Growth Rate of New Housing Licensing(GRNHL)	0.0433*** (0.0082)	0.0432*** (0.0065)	0.0411*** (0.0067)
Real GRDP(RGRDP)	0.0125 (0.1401)	-0.0247 (0.1452)	-0.0146 (0.1402)
Unemployment Rate(UER)	-2.7066 (0.6784)	-2.1167 (0.8619)	-3.633 (1.2287)
R^2(within)	0.5517	0.5531	0.5684

***$p<0.01$, **$p<0.05$, *$p<0.1$, robust standard errors in parentheses.

In the case of the five metropolitan cities, as shown in Table 3, the demographic variables have no significant influence on the housing price. In addition, as in the result of the Seoul metropolitan area, a supply-side variable of all models showed a significant influence on house

prices. There is a slight difference between the models, but when the growth rate of new housing licensing changes by 1%, the house price changes to 0.04%.

In the case of the non-metropolitan provinces, as shown in Table 4, there is no significant evidence that the population variables affect the housing price. On the other hand, the 1- and 2-person household ratio among the household variables is statistically significant. Housing prices increase by 0.32% if the 1- and 2-person household ratio rises by 1% in model 3. Among the economic variables, the growth rate of licenses for new houses is statistically significant on all three models. Housing prices increase by 0.038% to 0.042% if it rises by 1%.

Table4. Non-metropolitan Region

Rate of change of real housing price	Model 1. Population	Model 2. Households	Model 3. Population + Households
Population Growth Rate(PGR)	-0.1619 (0.3845)	-	-0.7732 (0.5132)
Elderly Dependency Ratio(EDR)	-0.0358 (0.816)	-	-3207 (0.1612)
Growth Rate of The Number of Households(GRHH)	-	0.9361 (0.6688)	1.4666 (0.8272)
Small Households Ratio(SHR)	-	0.1043 (0.0789)	0.3238** (0.1512)
Increase Rate of Personal Income per capita (IRPIC)	-0.2372 (0.161)	-0.1764 (0.1615)	-0.1452 (0.1467)
Growth Rate of New Housing Licensing(GRNHL)	0.0421*** (0.0056)	0.0399*** (0.0052)	0.0383*** (0.0049)
Real GRDP(RGRDP)	-0.0554 (0.1352)	-0.8416 (0.144)	-0.0608 (0.1392)
Unemployment Rate(UER)	-0.5366 (0.3707)	-1821 (0.4047)	-0.5031 (0.3437)
R^2(within)	0.2342	0.2604	0.2709

***p<0.01, **p<0.05, *p<0.1, robust standard errors in parentheses.

Ⅶ. Conclusion

The housing market is a market where there is asymmetric information. Generally speaking, suppliers have more information about the market than consumers. Policy objectives

through government intervention in South Korea focus on price stability in the real estate market. In order to achieve price stability, it is helpful to examine how the changes in population and household structure affect the housing prices, such as the recent population aging and the increase in 1- or 2-person households. Therefore, in this paper, the effects of recent population and household structure changes on housing prices were analyzed by using panel data for the whole country and three regional areas – the Seoul metropolitan region, the five metropolitan cities, and 8 non-metropolitan provinces.

The results of the nationwide analysis show that the household variables have a more significant effect on the housing price rather than the population variables. Household variables have statistically significant results, while population variables do not. In the regional analysis, only the 1- and 2-person household ratio among demographic changes has statistically significant impact on the housing prices in the Seoul metropolitan region and the non-metropolitan provinces. On the other hand, in the case of the five metropolitan cities, there is no evidence of an effect of the demographic variables on the housing price. Among the economic variables, only the growth rate of new housing licenses has a meaningful significance in the all three models. Therefore, the following policy implications can be deduced from these results.

Policy Implications

 1) The housing policy focus should be on the household factors rather than the population factors. The population variables have no significant effect on the housing price regardless of the region, while the household variables have significant influence across the nation. Especially, in the metropolitan area and non-metropolitan areas, the policy should be established considering the increase of single or two-person households. This suggests that when the government establishes

the housing policy, it should keep in mind that the direction of housing policies may differ by region.

2) The government should take notice of the adequacy of housing supply. Among the economic variables, the growth rate of housing licenses for new houses has an effect on the house price, regardless of the region or model. This implies the importance of supply variables to house prices. The change in the rate of increase of licensing reflects the housing demand and expectation of the economy, so the misunderstanding about supply variables may distort the housing market. Therefore, the government needs to thoroughly examine and control the annual supply scale when issuing licenses for the new housing unit and implementing public housing supply policies.

Limitations

On the other hand, the limit of this paper is that the real estate related data of South Korea is available from the 2000s onwards, which is a relatively short period of time. In addition, although the aging population of South Korea and the increase in small households are rapidly progressing, it may not yet reach a large enough threshold to change past trends. In fact, in the case of population growth, the Statistics Korea (2017) expects the population growth rate to turn negative in 2032. However, the rate of aging in South Korea is much faster than that of other OECD countries. It took a century for the advanced western countries to shifts from an aging society to a super-aged society, but it takes just about 26 years for South Korea, compared with 36 years for neighboring Japan. Therefore, when establishing the housing policy in the future, the structure of the population and the households might become more important for the characteristics and supply conditions of each region.

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