
Demographic Changes and Characteristics of the Housing Supply in Korea

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Abstract:

Purpose: This study aims to predict the impact that rapid demographic changes will have on the housing market in Korea if current trends in population, household size, and supply continue.

Design/Methodology/Approach: Two hypotheses concerning the housing oversupply were formulated. Estimates of population, households, and housing are done using time-series analysis with ARIMA modelling. The determination of household-housing size distribution was analyzed by quantile regression model.

Findings: The results indicate that there will be 612.7 houses per thousand people in Korea by 2045 and that the housing supply ratio will reach 140.2%. Furthermore, evidence suggests that there will be an oversupply of medium-to-large-sized dwellings. If current demographic and housing patterns continue, there could be devastating consequences.

Practical Implications: This study urges awareness about the present shifts in population and household size and suggests that resultant changes in housing supply patterns are inevitable. Moreover, by presenting empirical figures, these findings could also lead to the implementation of concrete policies.

Originality/Value: The study suggests that the continuation of current patterns may lead to serious problems, especially considering the fact that these population changes not only affect Korea but all countries that underwent rapid industrialization. Therefore, this study provides a good source of insight for other countries that are experiencing similar phenomena in Korea's wake, and it may help prepare them to address these issues.

Keywords: Demographic change, quantile regression model, housing, ARIMA, single-person household.

JEL codes:

Paper type: Research article.

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1. Introduction

Housing and demographic factors are closely related. One's dwelling is an essential commodity and a substantial part of the one's wealth, meaning that either a shortage or excessive surplus of housing will cause social issues (Pattillo, 2013). Demographic factors influence housing demand, with both population and household size greatly affecting the housing market (Mankiw and Weil, 1989). Population growth and decline upheaves the demand for housing, and shifts in household size affect its scale and structure (Chung and Cho, 2005; Chiuri and Jappelli, 2010).

South Korea has experienced unprecedented economic growth and subsequent rapid social progress; as a result, a drastic demographic transformation has occurred. Now with the world's lowest birth rate and an increased average life span, Korea as of 2017 had already entered the stage of having an aged society and is expected to become a super-aged society by 2025 (UN, 2015). Household sizes have diminished rapidly, shifting from a norm of four members to that of only one or two.

Although it is very difficult to envision the future of social phenomena, the human life is relatively long, making social changes somewhat predictable (Cho, 2016). Of course, this is only true by excluding extreme variables, such as war and pestilence. Dramatic demographic changes call for drastic changes in various sectors of society, but housing has never been a commodity known for its flexibility (Kim, 2011). Moreover, the housing supply in Korea has catered to the typical four-person household until recently, making the recent changes and decrease in household size even more troublesome.

This study aims to predict the impact that these rapid demographic changes will have on the housing market in Korea. To achieve this, the study will first analyze Korea's demographic changes and then compare that analysis to the theoretical studies associated with them. Then, the quantile regression model will be used to analyze housing preferences by household size. Finally, the ARIMA model will be used to predict changes in population, households, and housing.

2. Major Trends in the Korean Context

After enduring colonialism and war, South Korea, one of the poorest countries in the early 20th century, experienced rapid economic development that has been called the "Miracle of the Han River." Per capita GDP increased from \$79 in 1960 to \$27,097 in 2015. As a result of these economic developments, Korean society showed changes in many different dimensions in addition to demographics. The urban population rose as people searched for work. The percentage of the population living in urban areas quickly shifted from 28% in 1960, to 52% in 1975, and reached 80% in 2000 (UN, 2015). Accordingly, it was difficult for urban infrastructure and housing to keep up with the sudden demand, resulting in anti-birth policies being

adopted, even in the 1990s, when the birthrate was already below 2.0. In addition, the gender ratio became a social issue because of the traditional preference for male children (Sudha and Rajan, 1999).

Presently, the city population has stabilized, and gender issues have been addressed. However, the nation's low birthrate and aging population are causing a population cliff that is now a major issue. Additionally, new social problems have arisen, such as an increase in the number of elderly people living alone, a trend against marriage, and increasing divorce rates, which are all now in need of attention. The problem could be exacerbated by the continuation of a four-person-centric housing supply. This research focuses on this particular factor of the issue.

2.1 Low Birthrate and an Aging Society

In the late 1970s, the average birthrate of developed countries dropped below 2.0, raising concerns about both the low rate of births and the aging population. As a result, extensive studies have been conducted on the causes, effects, and continuity of this phenomenon (Kohler *et al.*, 2002; Goldstein *et al.*, 2009; Lesthaeghe and Willems, 1999). Low birthrates and an aging population were soon identified as major threats to a society's vitality and economic growth (Barro, 1991), education (Ondrich and Spiess, 1998), and energy (Yamasaki and Tominaga, 1997). In particular, the impacts of such a population change tend to be more devastating when the changes occur rapidly (Cho, 2016). This issue is not a problem Korea has to face alone; it is also occurring in the United States (Coleman, 2006), the European Union (Kohler *et al.*, 2002; Goldstein *et al.*, 2009), Japan (Bumpass *et al.*, 2009), Australia (McDonald, 2000), and numerous other countries. Research about this issue is being carried out worldwide.

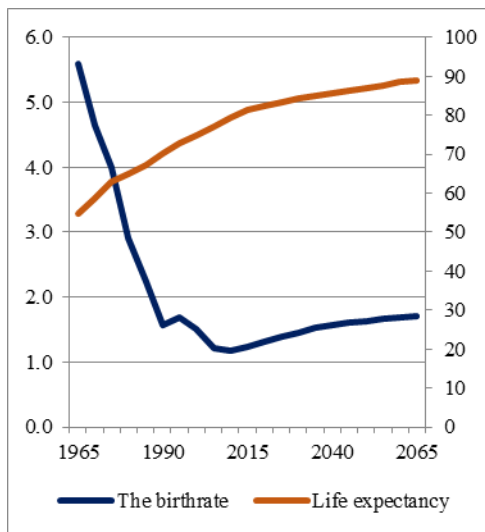


Figure 1. The birthrate and life expectancy in Korea

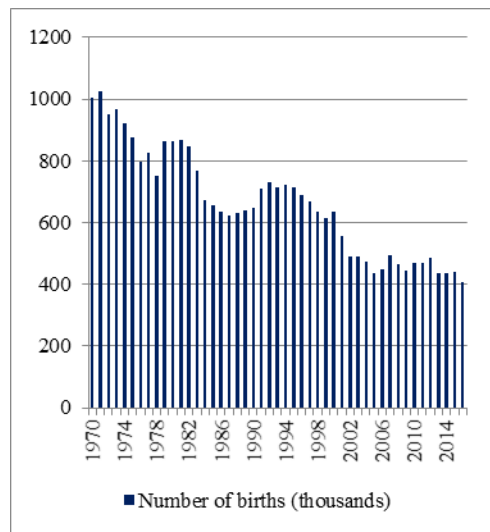


Figure 2. Birth trends in Korea

In Korea, however, it has taken a stronger toll because of the rapidity of the social changes. The following is a review of some statistics regarding this. In 1965, the country had a low life expectancy and high birthrate, phenomena commonly found in early developing countries. However, this did not remain the case for long. The life expectancy was 54.8 years in 1965, but it had risen to 81.3 by 2015; it is expected to be the highest in the world by 2065 at 89.1 years (Figure 1). The birthrate was 5.6 in 1965 but dropped to 1.17 by 2010. The actual number of births has decreased from 1.01 million in 1970 to 650,000 in 1990; it had declined to 440,000 in 2015 and continues to fall (Figure 2). When the low-birth generation reaches the age of parenthood, this phenomenon is expected to accelerate even more.

Changes can also be seen in the development of the economically active population (ages 15 to 64). In 1965, Korea's economically active population rate stood at 53.1%, lower than that of other industrialized countries. This is due to the exorbitant cost of child support resulting from high birthrates. However, by 2015, that ratio rose to 73.4%, higher than the norm. One of the reasons behind this is that the baby boomers in most developed countries were born starting from after 1947, around when World War II ended. In contrast, Korea's baby boomers were born after 1955, near the end of the Korean War. Another reason is the dramatic increase in expected lifespan and decrease in birthrates, which resulted in a reduction in childcare costs that was greater than the concurrent increase in the costs of the senior citizens' welfare. However, as the baby boomers of 1955 reach senior status around 2020, the outflow of the economically active population is expected to be significantly larger than the influx, and that gap is expected to continue increasing. The rate of decrease in the economically active population is so rapid that the ratio peaked as the highest

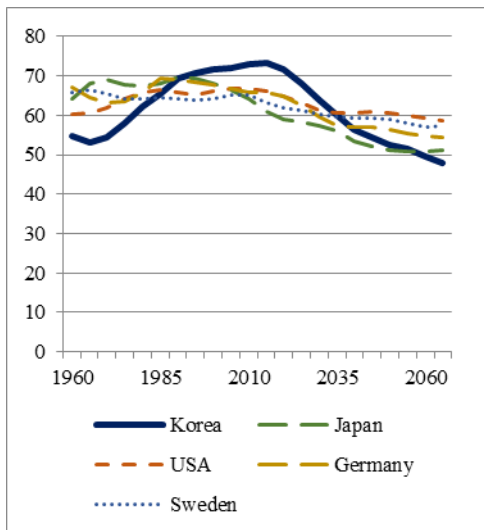


Figure 3. Proportion of economically active population

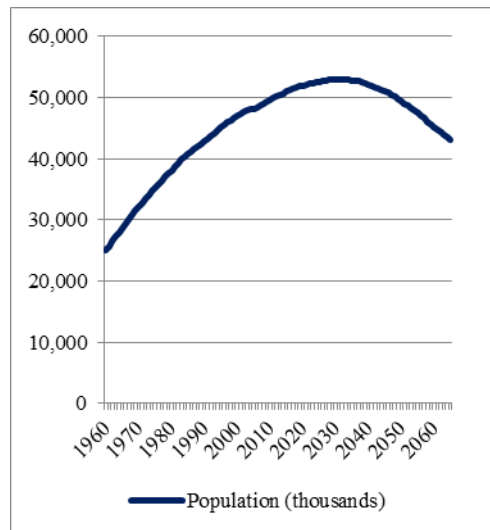


Figure 4. Population projection for Korea

nation in 2015 but is predicted to hit the bottom in 2040, second only to Japan. By 2065, Korea is estimated to have the lowest economically active population ratio in the world (Figure 3). The low birthrate and aging population will lead to a decrease in the overall population. The population was 29 million in 1965 and rose to 51 million by 2015; it is estimated to peak around 2032 at 53 million and decline to 43 million by 2065 (Figure 4). In summation, in just 33 years, 18.8% of the population will vanish. Such a rapid decrease in population will likely cause a variety of social changes, and predictably a low-growth era will arise as demand plummets (KOSIS, 2014). In the case of housing, it is inevitable that a decrease in direct demand will arise because of the decrease in consumers, possibly even affected indirectly by overall low economic growth or recession (Barro, 1991).

2.1 The New Household Paradigm

As society has changed, households have taken different forms. Some recent social phenomena that have influenced contemporary households are the revaluation of marriage, greater age at first marriage, lower birthrates, higher divorce rates, and an increase in single elderly individuals, all of which influence the formation of the households of today (Jacobsen *et al.*, 2012). The influence of this change is not limited to economical areas such as consumption patterns (Wilkes, 1995) and macroeconomics (Deaton and Paxson, 2000); it also affects carbon dioxide emissions (Daltonet *et al.*, 2008), land use (Perz, 2001; Diepen 1995), energy use (O’Neil and Chen, 2002; MacKellar *et al.*, 1995), and water use (Jiang, 1999; Martin, 1999). Since a household is by definition a unit of people that share one home, households hold a direct effect on housing and the policies that govern it (Holmberg, 1987; King, 1999).

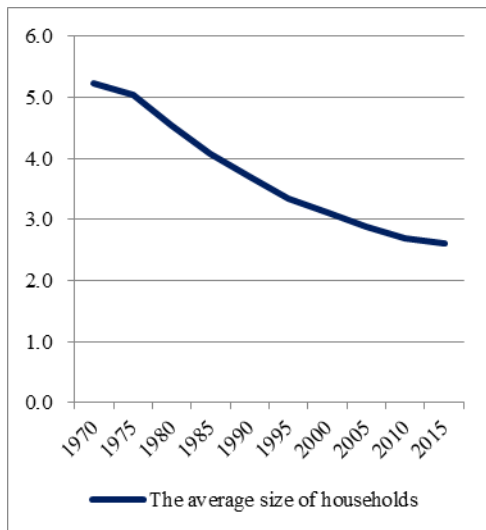


Figure 5. The average size of households in Korea

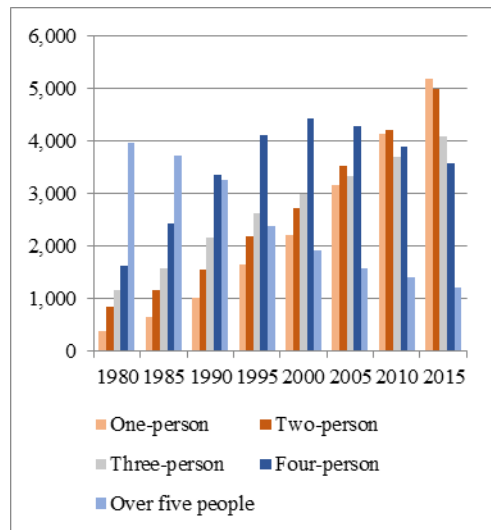


Figure 6. Number of Korean households by size (thousands)

Such changes are presently occurring in many countries. In particular, the average size of households in the United States decreased from 5.8 in 1990 to 2.6 in 2000. The rate of single-person households rose from 7.8% in 1940 to 26.4% in 1980. Concurrently, the rate of households comprising a married couple with children in the United States reduced from 42.9% in 1940 to 30.7% in 1980 and 20.2% in 2010, no longer dominating the household landscape. Dramatic changes occurred in the United States from 1960 to the early 1980s, and those changes have become more gradual since (Bianchi and Casper, 2000). On the other hand, Korea has been experiencing drastic household changes in recent years. The average household size decreased from 5.2 in 1970 to 2.7 in 2010 (Figure 5). In essence, the demographic changes that the United States experienced over the past 200 years took place in South Korea within only 40 years. In Germany, the average household consisted of 2.27 people in 1991 and decreased to 2.11 people in 2005; this was considered a rapid decline and the cause of social issues (Peichl *et al.*, 2012). This shows how radical Korea's household change has been. In addition, single-person households, the rate of which stood at 4.8% in 1980, became the most common form of households in Korean society as of 2015, accounting for 23.3% (Figure 6).

2.3 Medium-to-large Sized Household Centric Supply

In addition to changes in the population and household sizes, the housing inventory and supply patterns are also important considerations. Housing is a low-elasticity product that takes considerable time to supply and dissipate (Blackley, 1999). Therefore, if there is a sudden drop in demand, there is an oversupply, and in severe cases, a large-scale vacancy may occur. These sudden changes are usually caused by shifts in the absolute demand, such as a decrease in the population of the region,

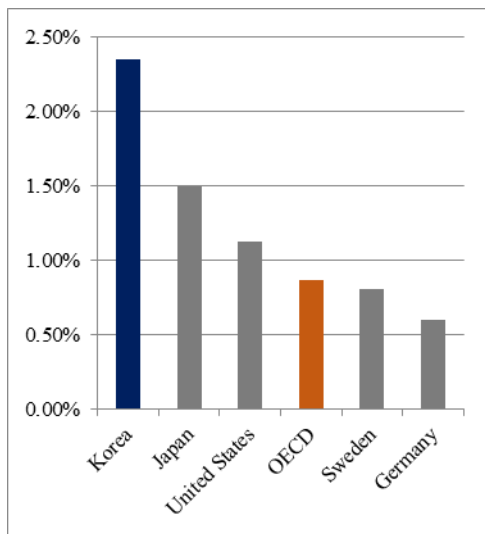


Figure 7. Housing construction by country

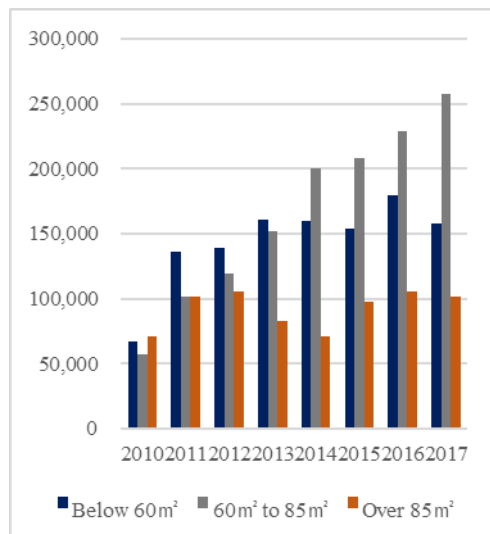


Figure 8. Housing construction by size

rather than by economic factors such as a decrease in purchasing power. Some examples of this are the large vacancies caused by job cuts in Michigan and Detroit in the United States (Alexander, 2005; Gunton 2006) as well as Japan's case of population decrease caused by aging (Sorensen, 2006; Murakami *et al.*, 2009).

Regarding housing ratio, Korea currently provides the largest amount of housing in the Organization for Economic Cooperation and Development (OECD) (Figure 7). Although it has been known that the number of single-person households has been increasing for a considerable period of time, the size of houses being supplied indicates that Korea is still targeting four-person households. Houses under 60 m² in size accounted for only 40.1% of the supply in 2011, and this actually declined to 30.6% in 2017. However, the ratio of 60–85 m² homes increased from 30.0% to 49.8% over the same period (Figure 8). This is in line with the decreasing size of households we saw above, where both the shortage of small-to-medium-sized dwellings and the oversupply of larger homes occur simultaneously.

3. Empirical Studies

Since population and housing are closely related, studies continue to analyze the relationship between housing demand and population structure. A representative study is that of Mankiw and Weil (1989), who estimated the demand for long-term housing as the population age structure changed. Later, Mankiw and Weil's model was applied in numerous cases, such as that of Canada (Engelhardt and Poterba, 1991) and Korea (Kim, 1999).

Mankiw and Weil's model was criticized for not incorporating other important factors when estimating housing demand in addition to demographic variables. For example, Swan (1995) proposed that real income, relative prices, interest rates, and so on should be accounted for. Green and Hendershott (1996) suggested including education and income levels in the model. In Korea, a variety of studies that use models based on the effects of housing costs and income has been conducted (Chung and Cho, 2005; Kim *et al.*, 2008; Shin and Nam, 2011). However, the use of economic factors is based on an approach that regards housing as a commodity rather than a necessity; thus, some think it is more appropriate to consider only demographic factors when it comes to basic housing supply and demand (Pattillo, 2013).

Since housing is consumed by households rather than individuals, there are many studies that use households as the unit of measurement for housing demand. These studies took interest in the characteristics of housing demand for a particular generation (Chiuri and Jappelli, 2010) or cohort (Holland, 1991; Ohtake and Shintani, 1996) and incorporated them to improve the Mankiw-Weil model (Lee and Park, 2009). On the other hand, Korean research tended to focus on the aspects of households (Park *et al.*, 2009; Lee and Yang, 2013; Lee and Kim, 2013). This seems

to be due to cultural factors that value households and major social indicators, such as the housing supply ratio, that are centered upon households.

4. Research Questions

This study aims to project the social issues that may occur if the current patterns of population, household, and housing supply continue. It therefore differs from the empirical studies that were presented before, as they are more concerned with housing prices or demand. While economic factors such as income are the main variables used to analyze housing prices and demand, absolute values such as population, households, and the number of dwellings are more significant in matters of absolute housing supply and demand. Therefore, this study aims to analyze future estimates that are based on the advancement of present trends and formulated using figures such as the housing supply ratio, housing units per thousand, etc. In this context, this study proposes two hypotheses based on the aforementioned population and household changes. Hypothesis 1 is based on the fact that, while the population decreases, current housing still exists, and that the continuing supply of additional housing will cause a surplus. Hypothesis 2 is based on the assumption that the surplus that was suggested in Hypothesis 1 will unbalance the ratio of dwelling sizes. The growth of small households will prevent a surplus of small housing; however as larger households become scarcer, the demand for larger homes will plummet and create a huge surplus of the same.

5. Methods

5.1 Overview

This study seeks to verify the above two hypotheses. The elements required in this process are estimates of the population and household sizes, estimates of the number of housing units, and the household-housing size distribution. Hypothesis 1 will be verified by comparing estimates of demand, population, households, supply, and the number of dwellings. For Hypothesis 2, this study focuses on the size of dwellings, classifying them by said size, creating estimates of their numbers, estimating the number of households per class, and comparing them. For this estimation process, this study uses both the ARIMA and the quantile regression models.

Hypothesis 1. Housing will be oversupplied.

Hypothesis 2. The oversupply will vary according to dwelling size

5.2 Time-Series Analysis: ARIMA Modelling

Estimates of population, households, and housing are by definition all predictions about the future, and in this research, these estimates are done using time-series analysis. Estimates of population and households were performed by the Korean

Statistical Information Service (KOSIS). The estimate predicts future births, deaths, migrations, and other demographic changes, and it applies the demographic balancing equation, further analyzed by calculating and recalculating repeatedly using the cohort components method (KOSIS, 2014). These data are used for both domestic and international policymaking and evaluation, indicating that the data are a credible source for use in this research.

$$\text{Dwellings} = \text{Previous Year's Dwellings} - \text{Demolished Dwellings} + \text{New Dwellings} \quad (1)$$

A “dwelling estimate” is calculated using the factors “Previous Year’s Dwellings,” “New Dwellings,” and “Demolished Dwellings,” shown in Formula 1. Here, the factors of “New Dwellings” and “Demolished Dwellings” are estimated by time-series analysis: the ARIMA modelling. The ARIMA modelling proposed by Box-Jenkins, is used to extend the values of a single variable on a historical basis (Naylor *et al.*, 1972). The housing count data are based on the data from the official census. Data for the estimate of new dwellings are based on the Housing Construction Performance Statistics announced by the Ministry of Land, Infrastructure and Transport. The number of dwellings to be demolished is an estimate based on the collective data that the Ministry of Land, Infrastructure and Transport gathered from local governments. The data are from January 2013 to December 2017, and are recorded monthly. The estimate ranges up to the year 2045.

5.3 Quantile Regression Model

One of the main goals of this study is to distinguish the different supply surplus amounts that would emerge by dwelling-size classifications. A major obstacle to this goal is determining how to distribute the dwellings by classification. The determination of dwelling size classification is not completely dependent on demographic factors such as population and households. The size dwelling a person chooses to reside within is usually influenced by many different factors in the person’s life, which are difficult to estimate. Accordingly, existing studies have used the average area per person or the average size of dwelling by household type (Mankiw and Weil, 1989; Lee and Park, 2009). However, since this study concerns the future dispersion of dwellings and households, data based on the average does not suffice. Rather, it is necessary to extend the range by types of households. For this, use of the quantile regression model is necessary.

The quantile regression model was first introduced by Koenker and Bassett (1978). OLS analysis provides estimates for the conditional mean of the variable; to analyze by classification, one must artificially divide the data, causing trouble creating samples (Heckman, 2013). However, the quantile regression model gives different weights by quantile rank, using the whole sample and making the samples unbiased.

Consequently, it is suitable for determining preferred area segments for each type of household.

In this study, the quantile regression model was implemented with dwelling size as a dependent variable for each type of household. It also included “year” among its variables to extend preferences for household types chronologically. Although it is based on dwelling size preference determined by past data, extending it chronologically enables the reflection of changes in dwelling size preferences over time. In other words, it calculates the conditional distribution function for dwelling size preferences by household type, and with this it allows us to estimate the distribution of dwellings by year. For example, if household types like “household of one young person” is set as household classification h , and dwelling types like “dwellings smaller than 60 square meters” is set as dwelling size a , it is possible to compare the estimates identified by the functions for each quantile for households h with value a to estimate the percentile of households h that also classify as dwelling size a , which would be $n_a^h\%$.

At this point, multiplying N^h (the estimated number of households h at a given point) and $n_a^h\%$ provides an estimated number of dwellings that are value a and occupied by households h , the number N_a^h . This means that adding all a values of all h household classifications will provide the estimated number all households of value a (Lee and Kim, 2013). With this method, this research calculated dwelling classifications as “60 square meters or less,” “60 to 85 square meters,” and “85 square meters or more.” These classifications were used to analyze and compare the estimated number of dwellings by year.

This research sorted households into the following classifications: “households of one young member,” “households of one middle-aged member,” “households of one senior member,” “households of two young members,” “households of two middle-aged members,” “households of two senior members,” “households of three or four members,” and “households of five members or more.” The number of households of each classification and the demand for dwellings by classification were calculated and estimated using the quantile regression model. This analysis also reflects the characteristics of generations, as indicated by the fact that the demand for small-sized households differs greatly by generation.

The data were created by the “Actual Dwelling Research.” The “Actual Dwelling Research” is conducted by the Ministry of Land, Infrastructure and Transport. In odd years, the research targets special households such as disabled individuals or newlyweds; in even years, it targets general households. This study uses the data collected by the “Actual Dwelling Research” carried out in the even years between 2006 and 2012.

6. Results

6.1 Will Excessive Supply Occur?

This study analyzed the aspects of the question: Will excessive supply occur if demographic changes continue along with the current supply flow? For this purpose, estimates of population, households, and dwellings were analyzed up to the year

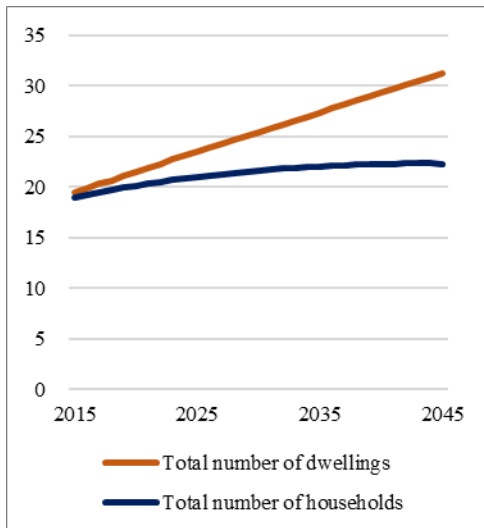


Figure 9. Trends in the number of dwellings per thousand people in Korea (millions)

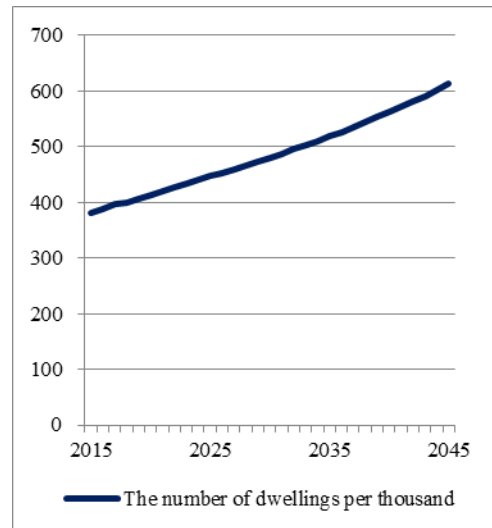


Figure 10. Trends of number of dwellings per thousand in Korea

2045. First, it is estimated that the population will rise from 51.0 million in 2015 to 53.0 million in 2031, peak at this point, and then decline to 51.1 million in 2045. Second, the number of households would continue to rise from 19.0 million households in 2015 to 22.3 million in 2043, and then it would decline. Thus, the population peaks in the year 2031 and households in 2043. This is due to the decline in the average number of members per household. Finally, the estimates for the number of dwellings are 19.5 million in 2015, and 31.3 million in the year 2045, a constant rise (Figure 9).

To ascertain whether excessive supply would occur, this study analyzed the relation between population and housing as well as that between household and housing separately. First, in the case of population and housing, this study used a common statistic: dwellings per 1,000 inhabitants. The number of dwellings per 1,000 inhabitants in 2015 is 381.5, and it is estimated to continuously rise, reaching 612.7 dwellings per 1,000 inhabitants in 2045 (Figure 10). This is a significant number considering that the OECD average was 460 dwellings per 1,000 inhabitants in 2015, with Germany at 510, the United States at 419, and Sweden at 476 (OECD).

In addition, when comparing the estimates for households and dwellings, dwellings surpassed households by only 0.4 million in 2015; however, in 2045, the number of dwellings are estimated to surpass that of households by 9 million. To clarify, the housing supply ratio, the index used regularly in Korea and Japan, is estimated to jump from 102.4% in 2015 to 140.2% in 2045. Oversupply is therefore predicted, which could lead to high vacancy rates that could cause socio-economic problems. However, the current housing indexes of 2015 are favorable, and awareness and control of current tides can prevent such predictions from passing into reality.

6.2 How Will Oversupply Occur by Dwelling Size?

Considering the Korean trend of households growing smaller while the supply remains focused on medium-to-large household sizes, one could predict that the oversupply listed above will affect household size classifications in different ways. To ascertain the truth of this, this study used dwelling sizes by household types with the quantile regression model to calculate the number of households by dwelling size. Further, this is then compared to the number of dwellings estimated by the ARIMA analysis.

Table 1. Results of the Quantile Regression Model

Category		10%	20%	30%	40%	50%	60%	70%	80%	90%
Households of one young member	C	16.50***	23.50***	26.40***	34.07***	37.37***	42.90***	51.67***	59.40***	74.25***
	Y	0.33*	-0.05*	0.00	-0.53***	-0.53***	-0.65***	-1.08***	-0.81***	-0.83***
Households of one middle aged member	C	19.80***	29.70***	37.13***	45.27***	50.40***	61.05***	70.40***	85.30***	105.6***
	Y	0.41**	0.01	-0.41*	-0.57***	-0.10	-0.83***	-1.10***	-1.58***	-2.31***
Households of one senior member	C	30.00***	40.10***	49.50***	56.47***	66.00***	66.00***	82.00***	89.10***	110.7***
	Y	0.00	-0.05***	0.00	-0.37***	-0.66***	0.00	-0.75***	-0.66***	-1.17***
Households of two young members	C	33.00***	39.28***	49.50***	56.07***	62.70***	72.60***	79.20***	86.63***	105.6***
	Y	0.00	0.36***	0.01	0.02	0.00	0.00	0.00	-0.41**	0.03
Households of two middle-aged members	C	39.60***	50.33***	64.05***	72.60***	82.50***	89.10***	105.0***	112.2***	151.1***
	Y	0.07	-0.08	-0.68***	-0.90***	1.23***	-0.99***	-2.25***	-1.32***	-4.55***
Households of two senior members	C	49.50***	59.40***	66.00***	77.55***	82.50***	93.50***	104.4***	118.8***	165.0***
	Y	0.00	-0.20	0.00	-0.83***	-0.33***	-1.10***	-1.20***	-1.98***	-5.28***
Households of three or four members	C	49.50***	66.00***	73.67***	79.20***	83.75***	99.00***	106.9***	112.2***	141.9***
	Y	0.25**	-0.66***	-0.53***	-0.03***	-0.13***	-1.32***	-0.65***	-0.53***	-2.64***
Households of five members or more	C	59.40***	72.60***	79.20***	85.80***	102.2***	105.6***	111.3***	129.2***	165.0***
	Y	-0.07	-0.81***	-0.03	-0.40***	-1.62***	-0.66***	-0.57***	-1.70***	-2.64***

Note: C: constant Y: year

The quantile regression model for dwelling size by household type is shown in Table 1. Overall analysis, the larger and older the household, the larger the dwelling. However, households with two middle-aged members and those with two senior members showed similar dispersion to those with three or four members; the top 90 percentile even show these two household types living in larger dwellings than households with three or four members. This reflects the characteristics of households maintaining existing housing after the number of members decrease for certain reasons, such as grown children leaving. Additionally, households of one senior member tend to use larger dwellings than those of two young members, but households of two young members tend to have a smaller deviation. At certain percentiles, households of two young members live in larger dwellings than the former. The results show that there are large deviations even within the same household type, a result that concurs with the need to use the quantile regression model. Furthermore, as most “year” variables are negative figures, this shows dwelling sizes decreasing over time.

Next, the distribution of households by dwelling sizes is addressed. For dwellings smaller than 60 m², the count will continue to rise from 7,458 thousand in 2015, reaching 10,829 thousand in 2045. The number of households residing in such dwellings will rise from 6,703 thousand in 2015 to 12,979 thousand by 2038, and then decline to 12,167 thousand in 2045 (Figure 11). This is because the number of households of one young member, who prefer dwellings under 60 m², will decrease, and the number of older households who prefer larger dwellings will also increase. The housing supply ratio for this classification was relatively high in 2015 at 111.3%, but the estimate of increasing demand causes the ratio to reach a low of 74.7% in 2030, and the gap weakens from that point onward.

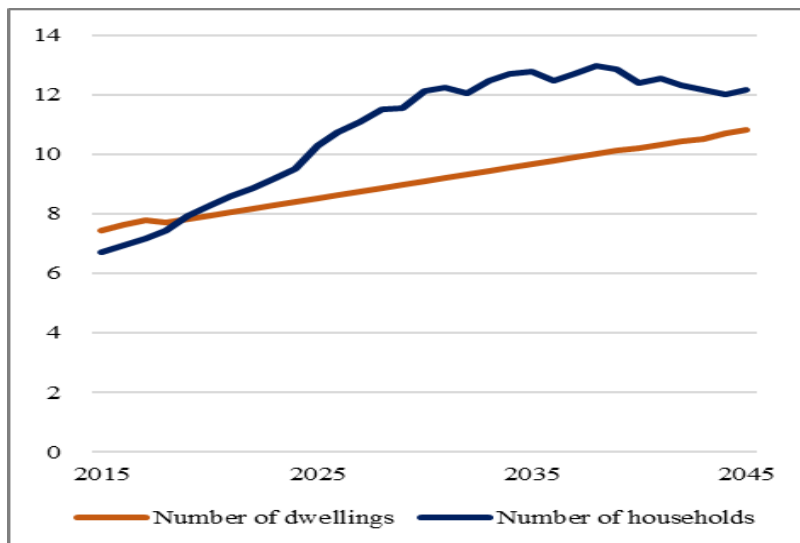


Figure 11. The number of households and dwellings below 60 m² (millions)

For the classification of dwellings that are 60–85 m² in size, their count continues to rise from 5,505 thousand in 2015 to 12,049 thousand in 2045. On the other hand, the number of households residing in them rises from 6,384 thousand in 2015 to 7,165 thousand in 2018, then drops to 3,098 thousand by 2038, and then recovers back to 4,195 thousand by 2045 (Figure 12). The decrease in households of three or more members could be identified as the cause of this phenomenon, and then the number of households with senior members also increases, causing the late boost. The housing supply ratio was 89.5% in 2015 and then rises to 103.5% in 2020, creating a short equilibrium. It peaks at 343.8% in 2038 and is at 287.2% by 2045.

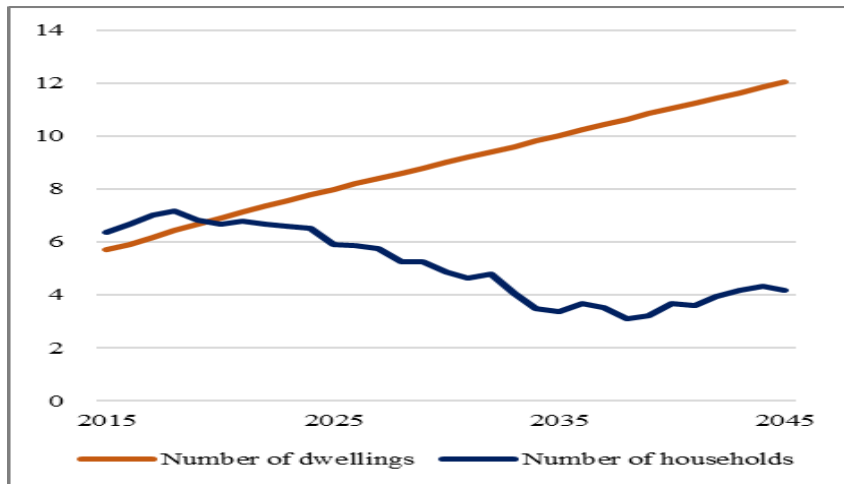


Figure 12. The number of households and dwellings of 60 ~ 85 m² (millions)

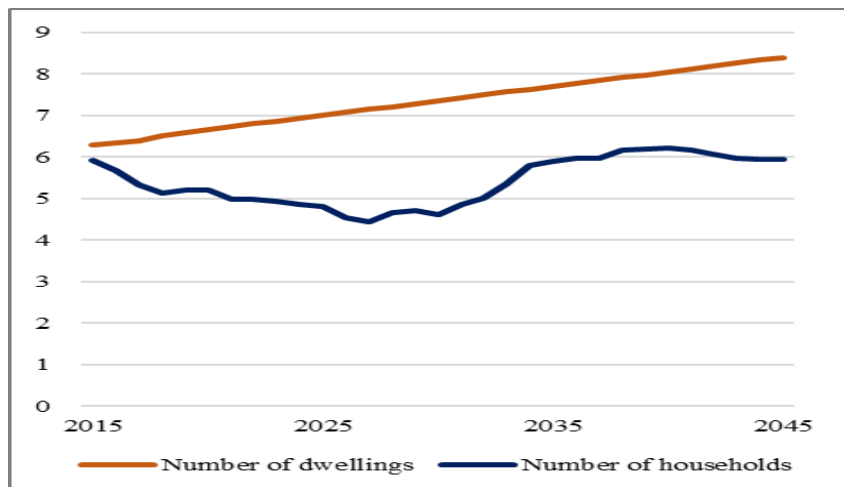


Figure 13. The number of households and dwellings over 85 m² (millions)

For dwellings 85 m² and larger, the count continues to rise from 6,285 thousand to 8,401 thousand from 2015 to 2045. However, households residing in this classification decrease from 5,927 in 2015 to 4,435 thousand in 2027; later years show a twist, as these households peak at 6,209 thousand in 2040 and then continue to maintain similar numbers until the end of the timeframe researched (Figure 13). Again, one can observe similar decreases in households of three members or more as well as an increase in older households. The housing supply ratio was at 106% in 2015 and shows its biggest gap at 161.2% in 2027. In 2038, the ratio drops to 128.5% and shows continuous rises from that point onward.

In summation, these results indicate that there will be a shortage of dwellings classified as smaller than 60 m² and an oversupply of dwellings classified as 60–85 m² and larger than 85 m². Homes 60–85 m² especially showed an extreme amount of oversupply. However, since this is an extension of the current dwelling preferences of each household type, it may vary by situation. If there is a shortage of smaller dwellings and a surplus mid-size homes, it is easy to predict a shift in demand, counterbalancing the shortage and surplus. However, the phenomenon of falling housing prices in the course of this shift is inevitable, and if this happens on a large scale the effect on society may not be limited to falling housing prices. In particular, it is difficult to expect the shortage of smaller homes to be counterbalanced by the oversupply of larger ones. Therefore, the classification of dwellings of 85 m² and larger should be addressed by Hypothesis 1 the most.

7. Conclusion

This study looked at Korea's rapidly changing population and housing supply patterns and conducted an empirical analysis of what would occur should these changes continue. The results showed a housing oversupply overall and particularly in larger dwellings. This study urges awareness about the present shifts in population and household size and suggests that resultant changes in housing supply patterns are inevitable. Moreover, by presenting empirical figures, these findings could also lead to the implementation of concrete policies.

However, these analyses have limitations in terms of methodology. First, they are based on existing patterns, limiting their accuracy should conditions change. This is due to the subjects of the study, namely changes in population and housing preferences, which are influenced by a variety of circumstances and therefore difficult to control. There are also problems caused by the limitations of the available data. A variety of classifications makes it easier to understand housing supply changes according to dwelling sizes. However, the Ministry of Land, Infrastructure and Transport has provided data for future construction and demolition using only three classifications (smaller than 60 m², 60–85 m², and greater than 85 m²), making it impossible to utilize more specific classifications for this study. Even the demolition estimates are based on current trends; if the housing supply were to change over time, the demolition plans would most likely adjust to

these changes. This study could have calculated more accurate estimates if additional data, such as the past supply of dwellings by size or the lifespan of current dwellings, were available. However, because of the insufficient aggregation of historical data and the limitation of access to current building statistics, this research has been restricted. If these problems were to be resolved in the future, more accurate research may be possible.

Nevertheless, this study has raised an alarm about the direction in which the existing society is heading. It is significant in that it suggests that the continuation of current patterns may lead to serious problems, especially considering the fact that these population changes not only affect Korea but all countries that underwent rapid industrialization. Therefore, this study provides a good source of insight for developing countries that are experiencing similar phenomena in Korea's wake, and it may help prepare them to address these issues. A characteristic of population and housing is that it takes a great deal of time for both to rise or fall, making it logical for policy actions to be considered proactively. It is hoped that this research is well-noted and considered as the world continues to work towards a better society.

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