Relationship between changes in the characteristics of demographic structure and Korea residential energy consumption

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I. Introductions

- Changes in the demographic structure, such as nuclear family and aging, are common phenomena that occur as urbanization progresses, technology advances, the economy grows, society matures, the fertility rate lowers, and life expectancy increases
- Numerous studies suggest that household structure such as single-person households, gender, and age of household members also influences household energy consumption patterns, and changes the energy consumption structure.
- This study analyzed the effect of single-person households and aging on energy consumption by utilizing household energy consumption in a city

II. Methods and Data

- Temporal range of this study was set to 2017 and 2047
- Household energy panel survey data in 2017(Korea Energy Economics Institute, 2018) was used

$$Energy\ Consumption\ per\ capita$$
$$= \frac{Annual\ Energy\ Consumption\ per\ Household}{Number\ of\ household\ members}$$

Total energy consumption =
$\sum$(Energy consumption per capita by city and province, and household composition $*$
Average number of household members per household composition $*$
Number of households per household composition)

- The content scope was to analyze the factors affecting the consumption of electric power and heating energy in the household sector and the effect of changes in these socioeconomic factors on future household energy consumption.

- The average number of household members according to the status of a single-person household per household composition and the age group of the household head

- Polynomial Nonlinear Regression (mixed-effects model)

Population by age group
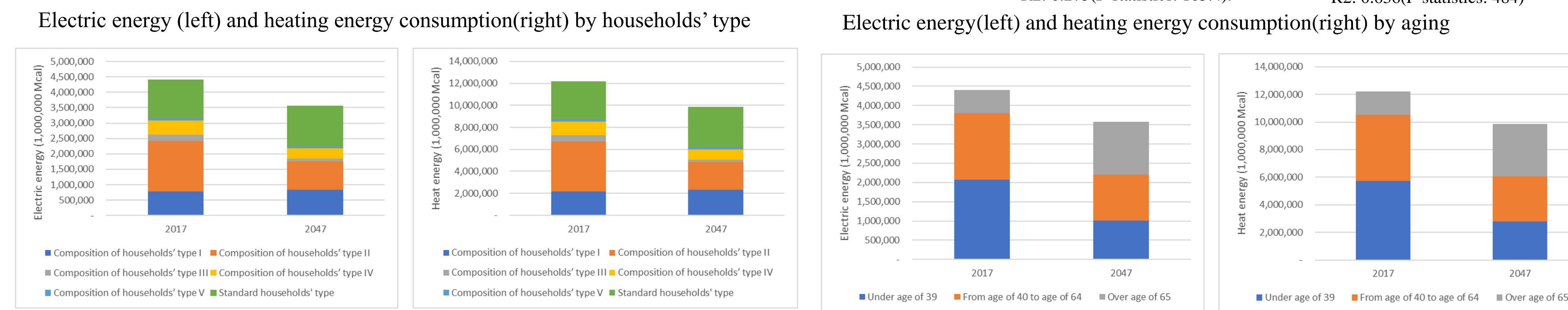

Ratio of population by age group
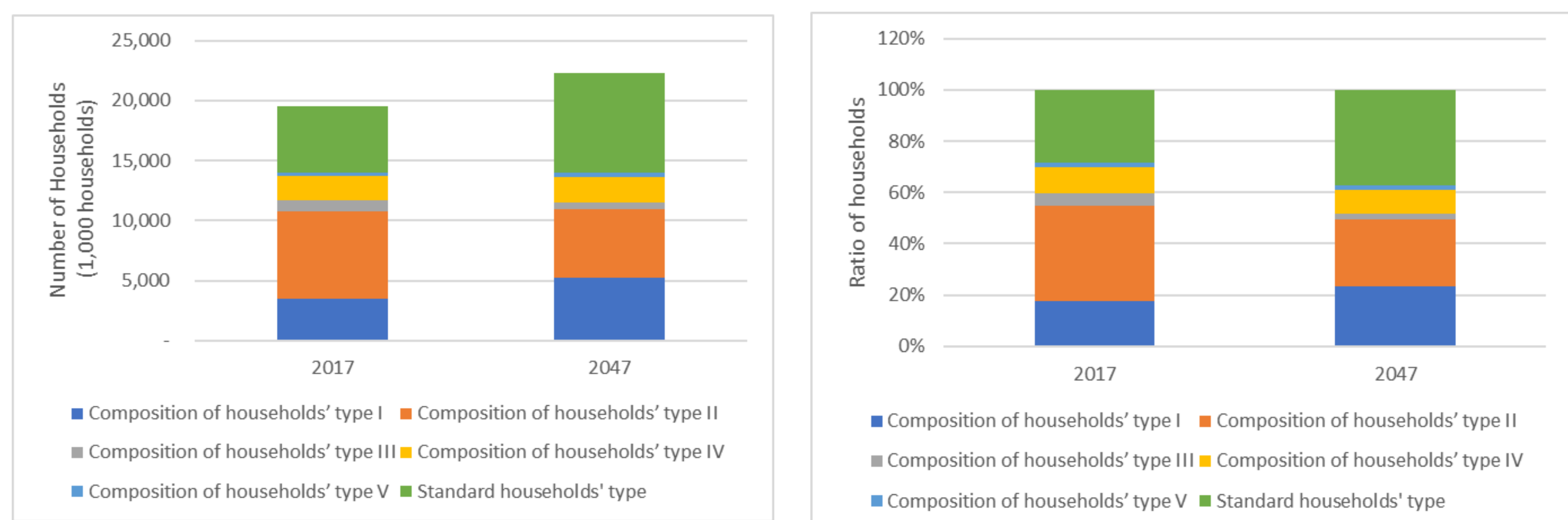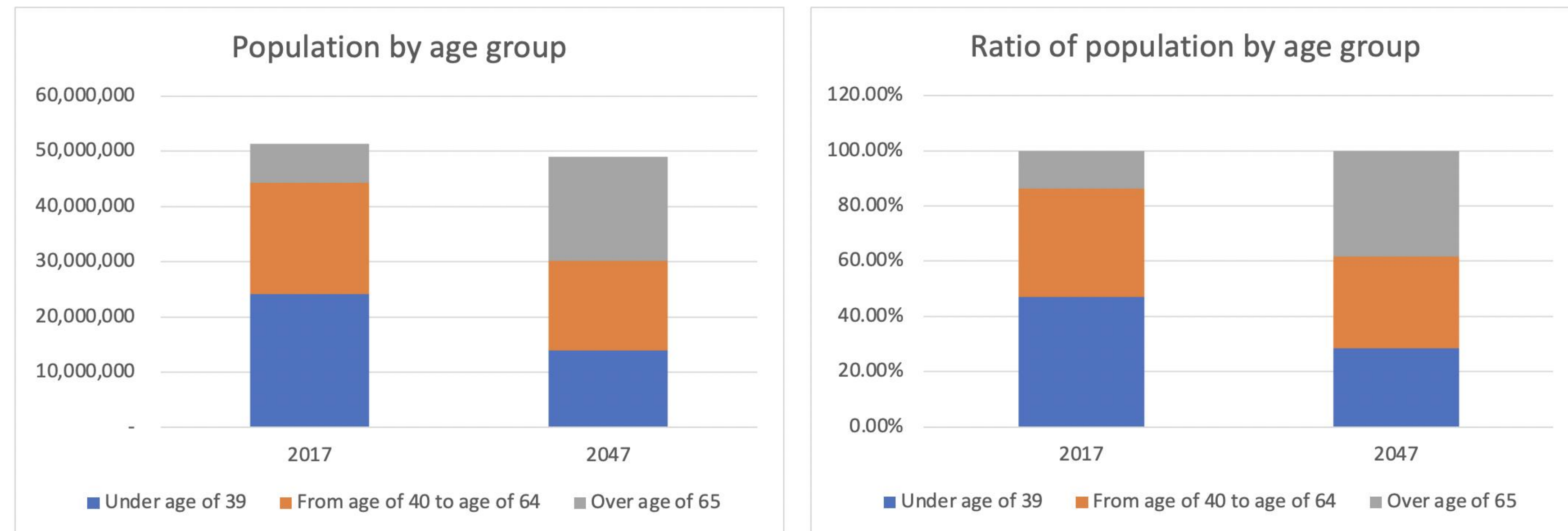
Number of households' type(left) and ratio of households' type(right)

III. Results and Discussion

Energy consumption per capita (Polynomial Nonlinear Regression Results)

Independent variable	Heat energy		Electricity	
	Coefficient	p-value	Coefficient	p-value
Households age	48.7708	0.001	10.9222	0.000
Households age square	-0.3565	0.008	-0.0745	0.000
One generation households (Dummy)	1084.89	0.000	579.2255	0.000
Two generation households (Dummy)	-98.5663	0.727	94.2424	0.028
Three generation households (Dummy)	-777.285	0.011	-70.1656	0.130
Single parent family (Dummy)	541.0491	0.074	372.7901	0.000
Other type of households (Dummy)	-269.546	0.385	273.0854	0.000
Monthly average gross income	120.8762	0.000	17.2624	0.000
Number of economically active household members	-197.794	0.000	-51.6631	0.000
Non-single household (31-64 years old) (Dummy)	-40.7332	0.713	19.671	0.243
Non-single household (Less than 30 years old) (Dummy)	390.1729	0.174	120.4828	0.006
Single household (Less than 30 years old) (Dummy)	2020.608	0.000	1121.983	0.000
Single household (31 – 64 years old) (Dummy)	2574.361	0.000	1325.477	0.000
Single household (More than 65 years old) (Dummy)	3414.698	0.000	1365.31	0.000
Seoul (Dummy)	239.8681	0.078	262.9464	0.000
Busan (Dummy)	-948.233	0.000	335.5815	0.000
Daegu (Dummy)	16.755	0.918	280.8581	0.000
Incheon (Dummy)	-551.835	0.001	283.8727	0.000
Gwangju (Dummy)	1228.341	0.000	391.7838	0.000
Daejeon (Dummy)	1338.091	0.000	336.9808	0.000
Ulsan (Dummy)	-371.022	0.056	258.5942	0.000
Sejong (Dummy)	-43.9732	0.863	295.5512	0.000
Gyunggi (Dummy)	444.4845	0.001	266.3002	0.000
Gangwon (Dummy)	1516.953	0.000	362.0907	0.000
Chungbuk (Dummy)	1587.002	0.000	315.0959	0.000
Chungnam (Dummy)	942.1173	0.000	226.9515	0.000
Jeonbuk (Dummy)	1464.202	0.000	202.3319	0.000
Jeonnam (Dummy)	2014.732	0.000	256.3632	0.000
Gyungbuk (Dummy)	914.554	0.000	343.1467	0.000
Gyungnam (Dummy)	-470.842	0.003	317.6466	0.000
Jeju (Dummy)	-830.987	0.000	325.8522	0.000

R2: 0.275(F-statistics: 105.4).   R2: 0.636(F-statistics: 484)

Electric energy (left) and heating energy consumption(right) by households' type

Electric energy(left) and heating energy consumption(right) by aging

- Energy consumption was also found to be related to household income. The consumption by age varied with age, but both electric power energy and heating energy increased and then decreased. The consumption of electric power energy decreased after the age of 73.3, and the consumption of heating energy decreased after the age of 68.4. This can only be considered as a change in energy consumption according to age because the differences in line with household type, household income, and region were fixed. Meanwhile, it is estimated that lifestyle habits, which could not be reflected in this study among various factors affecting energy consumption, mainly contributed to this difference in energy consumption per age

- An increase in single-person and two-person households (one-generation households) has begun to affect household energy consumption. The result of this research also found that the research on the energy consumption of single-person households or one-generation households in the future than at the present. The current household energy consumption is mostly dominated by two or three-generation households, but in the future, single-person or one-generation households were found to be the main contributors in the household sector.
- Energy consumption was also found to be related to household income. It can be assumed that the income of the future generation would be higher than the income of the present generation due to technological development, the higher GDP, and the development of the social security system