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# Mizuho Economic Outlook & Analysis

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October 30, 2019

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## *Analysis of Household Consumption Dynamics* *Considerations for the Consumption Stimulus*

### < Summary >

- ◆ This report estimates the four factors, which are (1) family size effect, (2) age effect, (3) time effect and (4) cohort effect, to explain the dynamics of household consumption in Japan from a mid- to long-term perspective, and the possibility of household consumption boosting is considered.
- ◆ The empirical result suggests that age effect has a hump-shaped pattern with the peak coming at the late 40s, time effect is on a declining trend mainly due to the fall in household disposable income, and the younger generation tends to consume less.
- ◆ Most importantly, the result implies that the time effect has been the greatest driver of macroeconomic consumption. Since this time effect can be maximized depending on the future government's policies and new product and service developments, it seems to be possible to stimulate future consumption.

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Mizuho Research Institute Ltd.  
**Shinya Kotera**, Senior Economist,  
Economic Research Department  
Mizuho Research Institute Ltd.  
[shinya.kotera@mizuho-ri.co.jp](mailto:shinya.kotera@mizuho-ri.co.jp)

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## 1. Factors explaining the dynamics of household consumption

This report empirically analyzes the four factors which help explain the dynamics of household consumption from a mid- to long-term perspective to obtain the implications for the consumption boosting in the future.

A simple life cycle model of the classic economics assumes that under the circumstances where there is no uncertainty in the future income level and money can be borrowed freely (= no liquidity restraints), households borrow money when they are young and start drawing down on their savings as they age, making household spending constant throughout their lifetime. In the real world, however, various factors such as uncertainty and liquidity restraints exist, and household consumption is not always constant but may change as households grow older. Then, with what factors can we explain the changes in household consumption over a lifetime?

**Chart 1 (1)** plots monthly consumption and disposable income (average of 2015-2017, consumption and income per month) of two-or-more-person households by age group of householders from the *Family Income and Expenditure Survey* by the Ministry of Internal Affairs and Communications, and we can see that both consumption and income are hump-shaped. The relationship between spending and income is mostly parallel, with both peakings at the age of 50-54. The amount of spending at the peak age of 50-54 is about 350,000 yen (annually about 4.2 million yen), and that of disposable income is around 490,000 yen (annually about 5.86 million yen). In contrast, the amount of consumption and disposable income becomes smaller when households are younger and older; for example, the expenditure of households aged 34 or younger and aged 65 or older amounted to 240,000-250,000 yen (annually about 2.93-3.0 million yen), only accounting for around 70% of the money spent by households aged 50-54. This hump-shaped relationship between age and spending has also been confirmed in the United States and other countries, in addition to Japan.<sup>1</sup>

One of the attributing factors behind this consumption dynamics by householder's age is the changes of the household members (= family size effect). **Chart 1 (2)** plots the number of household members of two-or-more-person households by householder's age group, and we can see that a certain relationship exists between householder age and the number of household members. The number of household members reaches a peak of 3.8 at age 35-44, and as the householder grows older, the number becomes smaller hitting 2.5 for households at 65 or over. The number of household members under age 18 also reaches a peak of 1.7 when the householder is age 35-44, but it gradually decreases thereafter.

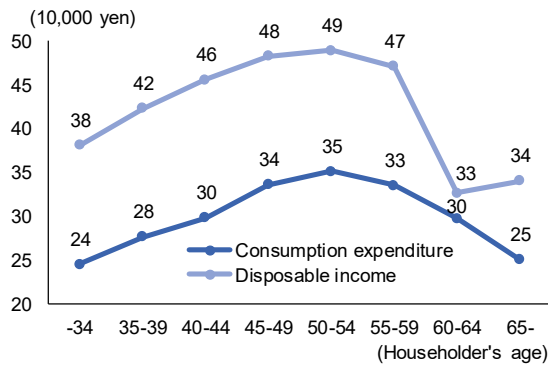
However, the hump-shaped relationship between age and household spending cannot

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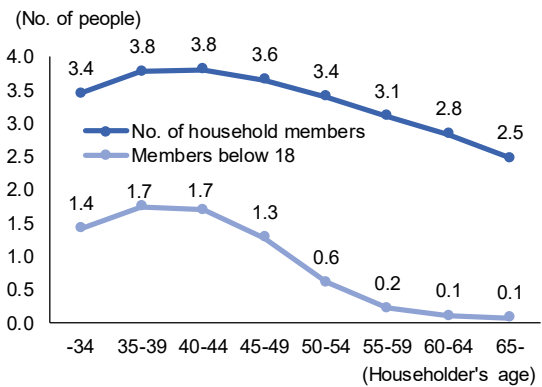
<sup>1</sup> Refer to Attanasio et al. (1999), among others, as an example of the United States.

always be explained by family size effect alone. According to the analysis using data in the United States by Fernandez-Villaverde and Krueger (2007), although about 50% of the hump-shaped relationship between age and consumption expenditure can be explained by changes in household size, the rest requires other attributing factors. Thus, even controlling the size of the household, there seems to be the specific consumption behavior characterized by the age group (= age effect). For example, households at the age of 30s and 50s might have different consumption patterns for travel and leisure costs, housing-related expenditures, education, and medical expenses.

**Chart 1 (1): Expenditure by age group**



**Chart 1 (2): Family structure by age group**



Note: The data above are the average value of 2015-2017 and of two-or-more-person households. The figures of (1) show the amount per month, and the numbers of disposable income are for two-or-more-person households (worker's households).

Source: Made by MHRI based upon the Ministry of Internal Affairs and Communications, *Family Income and Expenditure Survey*.

So far, the explanation on the dynamics of household consumption has assumed a fixed time frame, but if the element of time series is added here, we also need to consider time effect and cohort effect. For example, the household spending pattern will be different in 1990 and 2015 even if we compare households with the same age and family size. One of the factors behind such a difference is the time effect, which says the timing of spending would affect the outcome. The effect includes differences in the macroeconomic environment such as employment and the income situation, as well as differences in goods and services available at the time of the purchase. Cohort effect explains the difference in household spending patterns from the year of birth. For example, generations born after the collapse of the bubble economy might demonstrate a higher propensity to save compared with generations born in earlier times.

Hence, the dynamics of household consumption can be broken down into the four factors of (1) family size effect, (2) age effect, (3) time effect and (4) cohort effect. In the

following sections, this report estimates the magnitude of these four factors on household consumption using time series data from 1985 to capture the characteristics and changes in household spending.

## 2. Estimate of household spending fluctuation factors

### (1) Data

We use consumption data (annual average) of householders belonging to two-or-more-person households by age group (in 5-year increments), taken from the *Family Income and Expenditure Survey* released by the Ministry of Internal Affairs and Communications. Time series data of two-or-more-person households are available only after 2000, but in this report, we make a simple estimate for before 2000 to fulfill our purpose of observing the mid- to long-term trend. More specifically, we apply changes from the previous year of two-or-more-person households (excluding agricultural, forestry and fisheries households) series to the 2000 data to make a retroactive calculation up to 1985. To derive the real-term figures, we use the *Consumer Price Index*, or CPI, from the Ministry of Internal Affairs and Communications. Since CPI weight may vary depending on the age of householders, we use CPI corresponding to the minor classification (or sub-major classification) and sum up the real-term figures calculated by such means to derive the real-term figures of the major and sub-major classifications. It should be noted that although the importance of one-person households has been rising, we use only the data for two-or-more-person households because one-person households present certain restraints in terms of data availability.<sup>2</sup>

### (2) Estimation formula

We make our estimate using the formula below to divide consumption (C) into four factors by referring to Abe (2011).

$$LN(C_{t,age}) = \text{const} + AGE * \alpha + COH * \beta + TIME * \gamma + NUM * \delta + \varepsilon$$

Time (t) represents the seven time points (1985, 1990, 1995, 2000, 2005, 2010 and 2015), and age group refers to the eight groups (34 or under, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64 and 65 or over). The dependent variable is the logarithm of consumption per month (unit before the logarithm is yen), *AGE* is the age dummy with age 34 or under being the base, *TIME* is the time dummy with 1985 as the base, and *NUM* is the number of people in the household of 18 years old or above and under 18 years old. *COH* is the cohort dummy and is organized as described in **Chart 2**. We set people born in the 1920s

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<sup>2</sup> For example, the sample size is quite limited for one-person households, and figures by age group are not available in 5-year increments.

as the base and broke down the groups into 10-year categories up until people born in the 1980s to create the dummy.

**Chart 2: Organization table of cohorts**

	1985	1990	1995	2000	2005	2010	2015
Born in 1920s	60 years old-	65 years old-					
Born in 1930s	50-59 years old	55-64 years old	60 years old-	65 years old-			
Born in 1940s	40-49 years old	45-54 years old	50-59 years old	55-64 years old	60 years old-	65 years old-	
Born in 1950s	-39 years old	35-44 years old	40-49 years old	45-54 years old	50-59 years old	55-64 years old	60 years old-
Born in 1960s		-34 years old	-39 years old	35-44 years old	40-49 years old	45-54 years old	50-59 years old
Born in 1970s				-34 years old	30-39 years old	35-44 years old	40-49 years old
Born in 1980s						-34 years old	-39 years old

Source: Made by MHRI.

The data employed in our analysis is rather small with 56 samples as the only aggregated data is available to the public. Meanwhile, as the number of explained variables (or dummies) is large, a small fluctuation or noise in the data would affect the estimation results to a great extent (= the problem of overfitting). Since the *Family Income and Expenditure Survey* is particularly known for wider fluctuations due to the limited number of samples, it increases the possibility that dummies may pick up noises. Hence, we used the average figures of the three-year period succeeding to each of the seven time points in order to capture the core movement of that period.

### (3) Estimation results

We made estimates using the above formula and plotted the coefficients in **Chart 3**. **Chart 3 (1) and (2)** have the different dependent variables<sup>3</sup>: **(1)** shows the outcome using the entire consumption expenditure, and **(2)** uses expenditure that excludes highly volatile items such as housing to capture the trend<sup>4</sup>. Since the dependent variable is with the logarithm, the coefficients of the dummies indicate that by what percentage the subject item came higher (or lower) compared to the base of dummies. For example, the coefficient of the expenditure of the age group 50-54 was 25%, suggesting that by controlling the other three factors, expenditure of the age group 50-54 can be about 25% higher than the base household (households of 34 years old or under). Furthermore, as family variables are continuous variables, their coefficients represent by what percentage consumption expenditure grows when the number of household members increases by one.

In the following, we examine the estimated four effects of our analysis in detail. In terms of the cohort, the coefficients are on a slightly increasing trend through the cohort

<sup>3</sup> Please refer to the appendix of the original Japanese report for details of the estimated results.

<sup>4</sup> Consumption expenditures excluding “Housing”, “Purchase of vehicles”, “Money gifts” and “Remittance”.

of the 1920s to 1960s, but they show a decline for cohorts born in the 1970s and 1980s (they are not statistically significant at the 10% level). Young generations who faced deflation when starting families might be more inclined to reduce consumption than older generations. Coefficients of cohort dummies, however, produce relatively small value compared with the coefficients of other effects.

For age effect, consistent with the previous literature, it shows a hump-shaped curve even after controlling the other effects. The estimated result of consumption expenditure excluding housing etc. shows that spending peaked at age 45-49 in both nominal and real terms. The reason why the timing of the peak is different from that in **Chart 1**, could be the presence of family size effect. Since the age and consumption have a hump-shaped relationship even after controlling for the other factors, it suggests that consumption carries an inherent age factor. It is worth mentioning that in **Chart 3**, although the coefficient of age 65 or above was around 5%, if we conduct the same estimate by limiting the data to working households, the coefficient of age 65 or above rises to slightly below 20%. This is probably due to an increase in disposable income concomitant with work. Recently, as more senior people have started participating in the labor market, and this trend seems to be exerting a positive effect on consumption.

Regarding time effect, although the level of coefficients is different between nominal and real terms, both nominal and real consumption are on a declining trend after peaking in around the 1990s, mainly due to the sluggish growth of disposable income in the household sector.<sup>5</sup> The fact that real consumption is in the negative territory in 2010 and 2015 (statistically significant at the 10% level) indicates that the recent real consumption was lower even compared with the base year of 1985. In 2015, nominal consumption seems to have stopped declining, but on a real basis it continued shrinking, partly because of the consumption tax hike in 2014. While total nominal expenditure by households seems to be constant, households might be reducing the volume of items they purchase, as the prices are rising. Time effect is a factor that affects all households evenly and we believe this is the most influential factor affecting the consumption trend on a macroeconomic level (described later in detail).

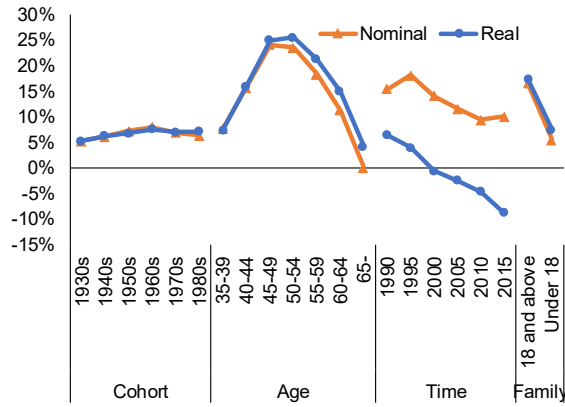
As for family size effect, the outcome naturally reveals a strong correlation between the number of household members and consumption expenditure. Consumption expenditure excluding housing etc. on a real basis increases by about 13% when adding one person of age 18 or above to a household and by around 7% when adding a person under 18 years old. Since the number of household members of two-or-more-person households is on a declining trend both for people of age 18 or above and people under 18,

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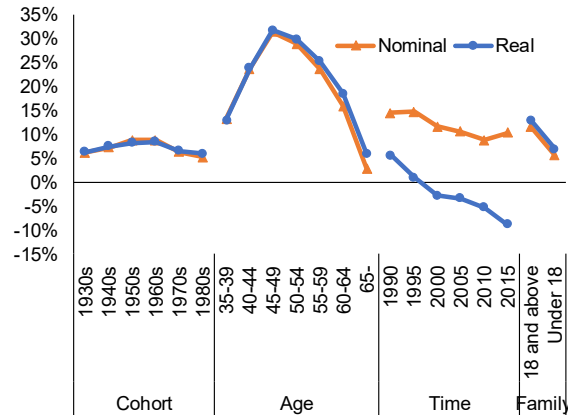
<sup>5</sup> See Cabinet Office (Director General for Economic Research) (2019).

it may be exerting a negative impact on households' consumption.

**Chart 3 (1): Consumption expenditure**



**Chart 3 (2): Consumption expenditure (excluding housing etc.)**



Source: Made by MHRI based upon the Ministry of Internal Affairs and Communications, *Family Income and Expenditure Survey* and *Consumer Price Index*.

#### (4) Estimation results—by use classification group

In the section above, we used the entire consumption expenditure for the dependent variable, but to grasp more detailed consumption trends we changed the dependent variable to the expenditure of each use classification group and conducted the same regression. There are 10 groups in the major classification of the *Family Income and Expenditure Survey*, but we used sub-major classification for some classification, and in total, an analysis of 15 classification groups was conducted. Note that for highly volatile items such as housing and private transportation, there is a high probability that the coefficients might pick up noises. We plotted the estimated coefficients excluding the family size effect in **Chart 4**.

Here, we mention some classification groups which have distinct movements by each effect. First, for cohort effect, many groups are on a declining trend among younger generations just as in the entire consumption expenditure, and these groups include food, fuel, light and water charges, medical care, culture and recreation, social expenses and other consumption expenditures (pocket money and remittances). On the other hand, groups on an increasing trend among the younger generations (narrower minus range) include communication, education and miscellaneous. The cohort effect is not evident for classifications such as meals outside the home, housing, and private transportation. In sum, younger generations seem to be paying necessary expenses such as communication and education while saving on food costs and pocket money.

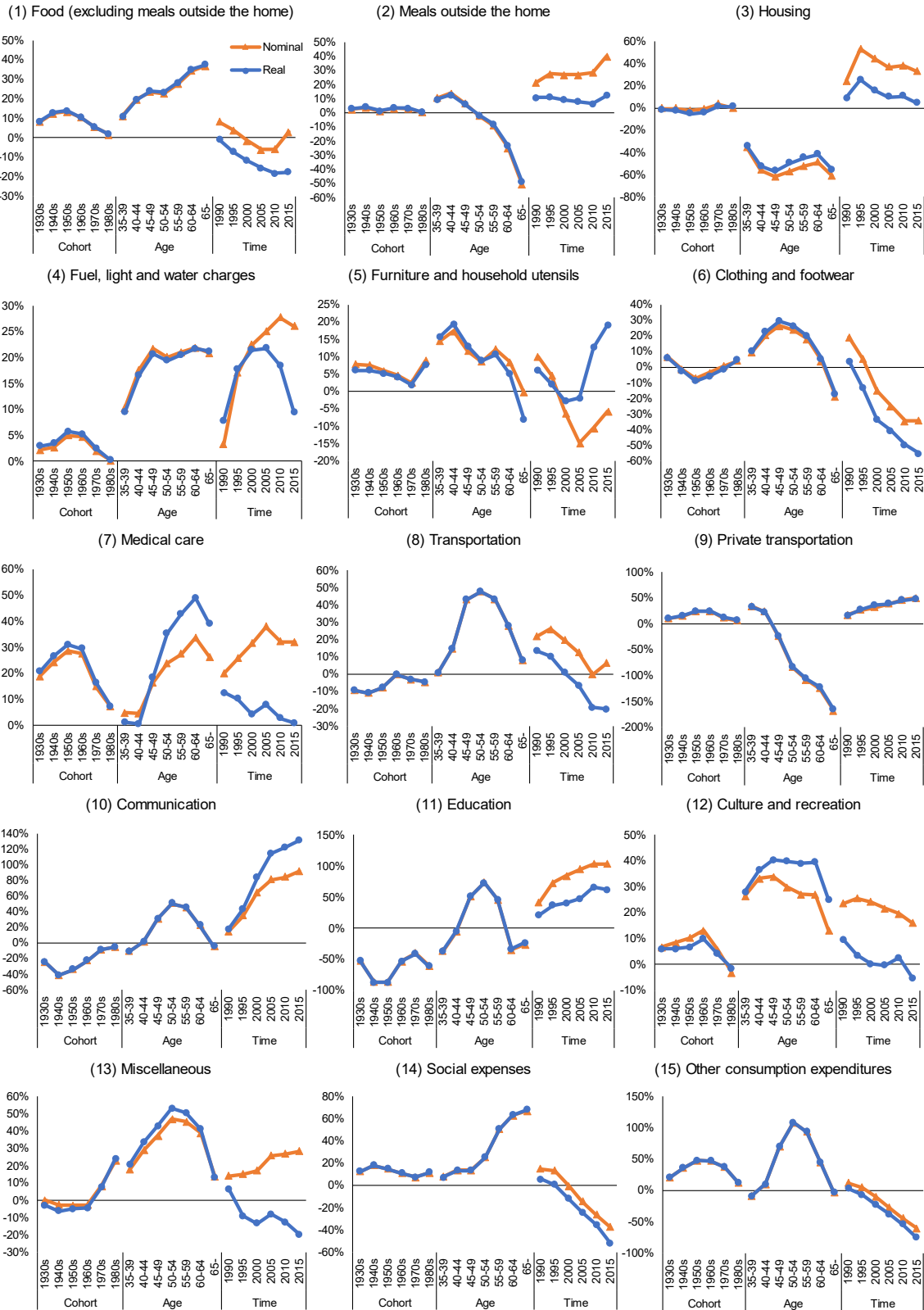
Concerning age effect, consumption expenditure shows a hump-shaped pattern for



groups such as clothing and footwear, transportation, communication, education, miscellaneous and other consumption expenditures, with a peak from the late 40s to early the 50s. It seems that these items are contributing to the formation of a hump-shaped age effect of the overall consumption as seen in **Chart 3**. Groups that increase as people grow older are food, medical care, and social expenses, while meals outside the home, furniture and household utensils, and private transportation decrease. This result suggests that as people become older, they refrain from eating outside and eat at home, and try to increase their exchanges with other people after they retire from work. Other distinctive trends are that fuel, light and water charges flatten after age 45, and cultural and recreational activities rise and remain at a high level from age 45 to 64.

Lastly, time effect is examined. While the effect shows a falling trend for many groups, the trend is particularly evident for clothing and footwear, social expenses and other consumption. These three items show a significant degree of decline relative to the base year of 1985, with social expenses marking -52%, clothing and footwear -55%, and other consumption expenditures -75% in 2015 in the real term. This may be attributable to lifestyles that place less emphasis on tradition and customs, a decrease in associating with other people, including eating outside the home, and a reduction in the family income, which may have led to the cutting down of clothing expenditure and reduction of the pocket money that can be spent freely. Meanwhile, with the spread of smartphones and internet use, time effect of communication is substantially high, with consumption in 2015 reaching 131% of the level (real term) compared with the base year. In addition, groups showing positive growth recently include meals outside the home, furniture and household utensils and private transportation, and the reason behind this trend seems to be factors such as the increase in dual-income households, the spread of energy-saving electronic appliances, and the rise in car insurance premiums and parking costs. Further, in **Chart 4**, both nominal and real term estimates are plotted, and we can see that for the classification other than communication and furniture and household utensils, time effect tends to be greater in nominal term than in real terms, with the deviation range widening for items such as education, miscellaneous, medical care and housing.

### Chart 4: Use classification



Source: Made by MHRJ based upon the Ministry of Internal Affairs and Communications, *Family Income and Expenditure Survey* and *Consumer Price Index*.

### 3. Implications for macroeconomic consumption based on the estimation

Based on the above results, we consider their implications about how consumption expenditure can be stimulated on a macroeconomic level. Here, we adopt a simplified method of multiplying the number of households to derive macroeconomic consumption. More specifically, we used the estimated outcome of consumption expenditure excluding housing etc. (real term) as shown in **Chart 3 (2)**, and took into account of the number of two-or-more-person households by age group in the *Population Census* compiled by the Ministry of Internal Affairs and Communications to calculate the macro movement. However, as our analysis does not cover single-person households, the values of change rates derived by this calculation may not necessarily be consistent with the overall movement of macroeconomic consumption. But by examining the degree of contribution of each four effects on the overall change rates, we can grasp which effects are more influential on overall consumption. Furthermore, since our estimate uses dummy variables, the three effects other than family size effect are computed by changes from the reference household or time point. For this reason, the changes in the total number of households generate the element of changes in “constant term (consumption expenditure of the base household) × total number of households”. To eliminate this constant term, we also calculated by fixing the total number of households and using the ratio of household number by age group for each year.

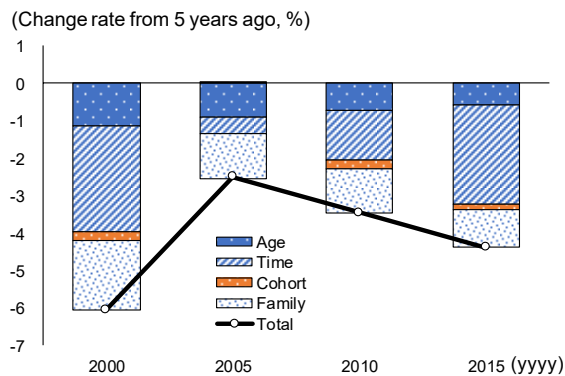
**Chart 5** depicts the outcomes of this calculation, plotting the growth rate of consumption from five years ago after 2000. **Chart 5 (1)** shows the calculation result by fixing the total number of households, and **Chart 5 (2)** allows changes in the total number of households. It should be noted that the change rate (from five years ago) of the total number of two-or-more-person households was +3.7% in 2000, +2.2% in 2005, +1.1% in 2010, and -0.6% in 2015, showing that the growth rate turned to be negative in the most recent year. We can see from **Chart 5** that the most influential factor affecting macroeconomic consumption is time effect. Since time effect affects all households regardless of age and cohort, its impact is very significant. The second influential factor, excluding a contribution of the change in the base household, is the family effect and age effect, reflecting a declining trend of household members and the aging of society. The contribution of the cohort effect was very small compared with the other effects.

What implications can we obtain based on the above results? With time effect being the biggest contributor to fluctuations in overall consumption, we can interpret that there are chances to stimulate consumption in the future. Our framework of analysis assumes that age and cohort effects remain constant, but as time effect captures the factors such as the economic situation at that time and the introduction of new products and services, we believe that it is a changeable factor through efforts of the government and companies. As

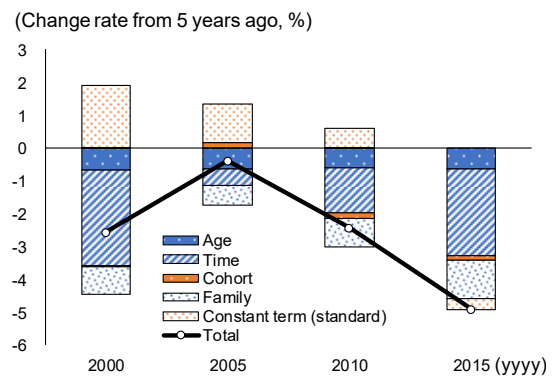
was seen with communication in **Chart 4**, there were items that had time effect with a positive trend, thanks to the development of new products and services such as smartphones and the internet. It is important to boost the consumption regardless of age and cohort factors by, for example, enhancing the potential economic growth and accelerating wage increases by advancing structural reforms, promoting self-development to prepare the age of 100-year life, and encouraging companies' efforts to develop new and more attractive products and services.

Although the increase in senior households is having a negative impact on consumption, as explained earlier, consumption decline by age effect can be mitigated when senior households are working, so giving seniors more incentive to work would be an effective initiative. Furthermore, since tackling the declining birth rate could stop the fall in the number of household members, it is also a good option for stimulating household consumption. On the other hand, some people point out that younger generations (cohort) do not spend much money, and although we cannot deny this underlying trend, given its slight impact on overall consumption, it is not appropriate to attribute sluggish consumption growth to the cohort factor.

**Chart 5 (1): Macro consumption change (number of households fixed)**



**Chart 5 (2): Macro consumption change (number of households changed)**



Note: Values are on real term. The calculation is based on the consumption expenditure of two-or-more-person households excluding housing costs.

Source: Made by MHRI based upon the Ministry of Internal Affairs and Communications, *Family Income and Expenditure Survey, Consumer Price Index and Population Census*.

#### 4. Conclusion

This report analyzes the four factors which help explain the household consumption dynamics from a mid- to long-term perspective. The four effects, which are (1) family size effect, (2) age effect, (3) time effect and (4) cohort effect, are examined, to consider how the consumption can be stimulated. Our estimated results reveal that age effect has a hump-shaped relationship with consumption with the peak arriving in the late 40s, time effect is

on a downward trend mainly due to the decline in disposable income, and the younger cohort has a tendency to spend less money. Among all factors, however, time effect exerts the greatest impact on macroeconomic consumption. While we cannot deny the influence of the aging society and cohort effects on the slowdown in consumption, they are not considered as the main factors. As time effect can be maximized depending on future initiatives, there are possibilities to boost private consumption. We should not let age and cohort effects bear the responsibility for the slow consumption trend; it is more important to proceed with structural reforms that can contribute to raising Japan's potential growth rate and wages, promote self-development activities to prepare for the age of 100-year life, and encourage firms' efforts to develop new products and services that will stimulate people's appetite to consume.

## Reference

**Refer to the original Japanese report by clicking the URL below for the reference material**

<https://www.mizuho-ri.co.jp/publication/research/pdf/insight/jp191030.pdf>