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Time to See a Doctor: Expenditure at Retirement in Japan

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Abstract

Using household panel data, we test whether there exists an immediate decline in consumption at retirement. We find stark evidence of retirement consumption; there is an immediate decline in expenditure of 2.4% even at expected retirement. The negative effect of retirement on expenditure is persistent, and it lasts for at least two years. However, there is no dip in the consumption of higher-educated households, as is the case with lower-educated households. Further, the decline in consumption of healthcare products such as drugs is severe. Indeed, lower-educated households decrease expenditure on drugs by 25% at most. An additional survey for healthcare use reveals that frequent visits to the doctor explain the decline in expenditure on over-the-counter (OTC) drugs. Our results suggest that the reduced opportunity cost of time to see a doctor induces households at retirement to visit a doctor more often than before, and obtain prescribed drugs at more affordable prices than OTC drugs, possibly owing to the universal health insurance system.

JEL Classification: D12; E21

Keywords: buying habits; household consumption; leisure
life cycle/permanent income hypothesis; opportunity cost; retirement

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1 Introduction

A large corpus of literature studies the consumption puzzles at retirement. The life cy-cle/ permanent income hypothesis suggests that households never decrease consumption at retirement, although Banks et al. (1998), Smith (2006), Bernheim et al. (2001), Fisher et al. (2008), and Haider and Stephens (2007) report findings contrary to this assertion.[1] Wakabayashi (2008) and Stephens and Unayama (2012) also show a significant drop in consumption at retirement in Japan. This decline is often attributed to a lack of planning for retirement and knowledge pension benefits, as discussed in Gustman and Steinmeier (1999), Lusardi and Mitchell (2014), Scholz et al. (2006), and Chan and Stevens (2008).[2] van Rooij et al. (2012) show that financial literacy is crucial to retirement planning and households' wealth, whereas Lusardi et al. (2017) present a comprehensive survey on the economic importance of financial literacy.

While the earlier literature suggests a decline in consumption at retirement, recent studies show mixed evidence. For example, Smith (2006) only finds a response for individuals who are involuntarily retired. Battistin et al. (2009) and Aguila et al. (2011) find no evidence when household size is controlled and when consumption is defined as nondurable expenditure. Aguiar and Hurst (2005), Hurd and Rohwedder (2003), and Hurd and Rohwedder (2008) show that extra leisure time can account for its response at retirement. Hurst (2008) argues that the evidence does not imply time-inconsistent behaviour. Luengo-Prado and Sevilla (2013) and Atalay et al. (2020) suggest that home production can explain a decline in consumption at retirement. These mixed findings on the consumption puzzle suggest that more empirical evidence is needed.

Using large-scale monthly panel data collected from more than 50,000 Japanese households in 2010, we test whether there exists an immediate decline in consumption at retirement. The Homescan data we use in this study allow us to study a heterogeneous response to retirement among households. First, we find stark evidence of retirement consumption;

[1] Miniaci et al. (2003), Battistin et al. (2009), Schwerdt (2005), and Allais et al. (2020) also document a decline in consumption at retirement in European countries.

[2] Regarding planning, Blundell et al. (2020) especially discuss how a government should insure consumption fluctuations in old age.

there is a fall in consumption by 25% even at 'expected' retirement. The negative effect of retirement on expenditure is persistent, and it lasts for two years immediately after retirement. However, there is no dip in the consumption of higher-educated households, as in the case of lower-educated households. Our results suggest that the determinants of a decline in expenditure at retirement are not income level, but education level. The results are robust when the disentangling price and quantity decline. Second, we find that the decline in healthcare products at retirement is severe. Those who completed high school decreased healthcare expenditure by approximately -7.2%. For over-the-counter (OTC) drugs, households who completed high school had a maximum expenditure of 25%.

We further investigate whether more frequent visits by households at retirement explain the decrease in expenditure on healthcare products using an additional survey. We conducted a survey for healthcare use and found that the change in the purchasing behaviour of the households can be explained by the frequency of visiting a doctor. Our results suggest that the more frequent the visits to a doctor by less-educated households, the lower the buy volume of healthcare products or OTC drugs after retirement. The evidence supports the view that the reduced opportunity costs of time to see a doctor induce households to take prescribed medication at a cheaper price by visiting a doctor more frequently than before.

The remaining of the paper is organised as follows: Section 2 summarises the literature on healthcare consumption at retirement. Section 3 explains the survey we use and the estimation strategy. Section 4 presents the estimation results. Section 5 disentangles price and quantity declines in consumption at retirement. Section 6 uncovers how often households visit a doctor and their expenditure on healthcare products before and after retirement, and Section 7 concludes the paper.

2 Existing Literature on Healthcare Consumption at Retirement

Our study is related not only to the literature examining consumption puzzles at retirement, but also to healthcare consumption at retirement. The literature presents mixed evidence on the effects of retirement on healthcare consumption. For example, Lucifora and Vigani (2018) and Zhang et al. (2018) find that retirement increases healthcare use, leading to lower opportunity costs of time to visit a doctor after retirement. Gross et al. (2020) and Ophem (2011) indicate heterogeneous effects of retirement on healthcare consumption. Gross et al. (2020) find a significant decline in healthcare consumption of hand-to-mouth households at retirement. Ophem (2011) finds that the elderly visit a doctor more frequently, but those who completed college do less so. On the other hand, studies also point to a decline in healthcare expenditure after retirement. Frimmel and Pruckner (2020) show that retirement reduces subsequent doctor visits and expenditure for medical attendance. Eibich (2015) and Biro and Elek (2018) also show that retirement improves health and reduces healthcare use.

While the literature provides mixed evidence on healthcare consumption after retirement, studies that examine healthcare expenditure at retirement using consumption data, combined with a survey on the frequency of doctor visits, are scant. The linked data on household expenditure with a survey of doctor visits allows us to investigate whether and which type of household decreases healthcare consumption before and after retirement. At the same time, we can examine the relationship between the frequency of doctor visits and healthcare consumption. Our findings contribute to the literature by presenting the causal effects of retirement on healthcare consumption and doctor visits. We discuss the implications for the universal health insurance system in Japan.

3 Data and Estimation Strategy

3.1 Data

We use panel data (SCI-personal) on household consumption in Japan collected by Intage Inc., which examines over 50,000 responses in order to report the items that individuals buy on a daily basis. The data cover consumer goods with barcodes, but not fresh foods or durable goods. This limited coverage is the caveat in SCI-personal; the data include only consumer goods such as food, beverage, miscellaneous daily goods, cosmetics, drugs, and cigarettes that have bar codes, while fresh food, durable goods, and expenses related to clothing, meals, transportation, and entertainment are not covered.

However, SCI-personal is unique and worthy to be analysed. The literature on private consumption using micro-data mainly employs the family income and expenditure survey (FIES) by the Ministry of Internal Affairs and Communications. While FIES, which serves as one of the basic statistics for gross domestic product, is based on a limited number of samples, SCI-personal covers over 50,000 respondents. Furthermore, the survey of periods for each respondent are quite different. The duration of survey in FIES for each household is six months at most. On the other hand, the average duration of SCI was 92 months.[3] Table 1 summarises the comparison between FIES and SCI-personal. The number of respondents and the average duration of survey periods of SCI-personal are more than at least fifteen times larger and longer than those of FIES, respectively. The longer duration of survey periods allows us to further examine the consumption puzzle. For example, we can test whether the decrease in consumption at retirement is permanent, and if the drop disappears when one gains a job after retirement.

Furthermore, a survey on the frequency of doctor visits is available, and can be combined with SCI personnel. Such combined data allow us to examine the relationship between the frequency of doctor visits and healthcare consumption. The details of the survey of doctor visits are shown in Section 6.

[3]The average duration of survey periods in SCI-personal is calculated from April 2010 to December 2019.

3.2 Estimation Strategy

Using monthly data from April 2010 to December 2019, we examine the effect of retirement on expenditure. Following Stephens and Unayama (2012), we use Equation (1) as follows:

$$\ln c_{i,t} = \alpha_i + \boldsymbol{X}\beta + \sum \gamma_\tau Retire_{i,\tau} + \varepsilon_{i,t}, \tag{1}$$

where $c_{i,t}$ is the equivalence scale-adjusted expenditure in month t by woman i whose husband retires. $Retire_{i,\tau}$ is a set of months relative to the retirement indicators. $\boldsymbol{X}$ is defined as a vector of household-specific factors in t, which include the number of adults and children, marital status, age, and a vector of month dummy.[4] α_i and $\varepsilon_{i,t}$ are the fixed effect and residuals, respectively.

The main regressors of interest are the set of indicators, $Retire_{i,\tau}$, for the months before or after the month retirement, t^*. Owing to data limitations, we cannot identify the precise date when respondents retire. Because the job status that our data indicates changes at the end of every fiscal year, we assume that t^* is March; most workers who reach mandatory retirement age are expected to retire at the end of March.[5] Equation (1) includes three retirement indicators in $Retire_{i\tau}$: an indicator for a half year before retirement (months $t^* - 6$ and $t^* - 1$), an indicator for the month of retirement and the year immediately after retirement (months t^* and $t^* + 11$), and an indicator for 12 to 23 months after retirement (months $t^* + 12$ and $t^* + 23$). Because the average duration of the survey is 7.7 years (92 months), the data allow us to examine the effect of retirement on expenditure over a long period of time. To the best of our knowledge, this is the first study to analyse the longer-run effect of retirement on expenditure which is captured by the coefficients γ of $Retire_{i,\tau}$.

There are two reasons why we use women's expenditure in estimating Equation (1).

The first reason is representativeness. Women's expenditure accounts for a large part of

[4]Stephens and Unayama (2012) document that the longer a respondent is in the survey, the less consumption they generally report regardless of whether they retire. They call this phenomenon 'survey fatigue'. While citetStephens control the effect of survey fatigue on expenditure, Equation (1) does not consider this effect, because we do not observe clear evidence of this phenomenon in our sample.

[5]According to Figure 1, Google Trend suggests that mandatory retirement is concentrated in March. Furthermore, public sector employees retire in March, in line with the Public Service Act.

household consumption. The basic statistics of SCI-personal show that the expenditure level of women is double that of men when it is measured by median. That is, women bear most of the living cost in each household, and hence we use women's expenditure.

The second reason is that focus on women's expenditure can mitigate the influence of a possible dip in work-related expenditure. Studies document that a decline in expenditure at retirement is not found if the decrease in work-related expenditure is controlled[6]. Hurst (2008) suggests that the decline at retirement found in the literature occurs within work-related expenditure.

As shown above, we use data on expenditure by women i with retired husbands. While the cost for commuting and business suit, which accounts for a large portion of work-related expenditure, is not originally covered in SCI-personal expenditure, most work-related expenditures are considered not to be included in women's expenditure. We believe that the possible problem in identification arising from work-related expenditure can be mitigated if we focus on women's expenditure.

4 Expenditure at Retirement: Estimation Results

Table 3 presents the results from Equation (1), using the full sample of retiring households for ages 55 or above. First, the coefficients of the retirement dummies (γ) are generally negative, which suggests that expenditure significantly decreases at retirement. Panel (A) in Table 3 shows that households decrease expenditures by 2.1% in a year immediately after retirement. This decrease is persistent: the coefficient of $Retire$ for 12 to 23 months before retirement (months t^*+12 and t^*+23). The decline is found in every good category: Despite food and non-food categories, expenditure drops at retirement even over the two years after retirement.[7] This is the case when we use an indicator for the successive 24 months immediately after retirement (months t^* and t^*+23). Panel (B) in Table 3 shows

[6]Hurst (2008) also shows that overall expenditure declines by a fall in not only work-related consumption, but also food expenditure, mainly because of a decrease in opportunities for eating out. However, the cost of food consumption away from home is not covered in our database. Therefore, we can ignore the effect of the cost of food away from home on overall expenditure at retirement.

[7]The only exception is beverage. The coefficients γs are generally negative, while they are not significant.

that households decrease expenditure by approximately 2.4% in two years immediately after retirement for all categories except for beverage. The evidence suggests that our benchmark results are robust.

Second, those who completed university never decrease expenditure at retirement. Our motivation to split the sample by education level is to check whether the households who completed college prepare for retirement by saving or through pension benefits.[8] Tables 4 and 5 show the results from Equation (1), using the subsample of retiring households who completed four-year university and high school, respectively. Panels (A) and (B) in Table 4 show that the coefficients of $Retire$ are generally insignificant, suggesting that retiring households who completed four-year university do not decrease expenditure at re-tirement. On the other hand, retiring households who completed high school decreased expenditure at retirement. Table 5 shows a negative effect of retirement on expenditure by retiring households who completed high school. Table 6 supports the view that education is crucial to the determinants of the decline of expenditure at retirement. Table 6 represents the results from Equation (1), using the four subsamples from retiring: (A) low-income group, (B) high-income group, (C) low-education and high-income group, and (D) high-education and low-income group.[9] In Panel (A) in Table 6, using the subsample from (A), high-education and low-income groups show that the coefficients of $Retire$ are very small and insignificant. On the other hand, in Panel (B) in Table 6, using the subsample from (A), the low-education and high-income group shows that the coefficients of $Retire$ are gen-erally negative and significant. The results suggest that education is crucial to explaining a drop in consumption at retirement; even 'rich' people are likely to decrease expenditure at retirement if they are in the low-education group. Panel (C) in Table 6 further supports the education view; the panel shows that, even when retiring households earn higher family incomes, they decrease expenditure after retirement by 3%.[10] Further, education is crucial for uncovering the retirement consumption puzzle.

[8]Gustman and Steinmeier (1999), Lusardi and Mitchell (2014), Scholz et al. (2006), and Chan and Stevens (2008) suggest this may be because of a lack of planning for retirement and knowledge pension benefits.

[9]Low- and high-income households are those that earn less than 7 million yen and 7 million yen or over as annual income of family, respectively. The income levels are measured just before retirement.

[10]Panel (D) in Table 6 shows that households with lower family incomes decrease expenditure after retirement.

Third, those who completed high school sharply decreased expenditure on healthcare goods at retirement. The seventh columns from Tables 3 to 6 represent the effect of retirement on healthcare product expenditure, which covers drugs and health-related products. While Table 4 and Panel (A) in Table 6 show no decline in healthcare product expendi-ture by those who completed university, Table 5 and Panel (B) in 6 show a significant by those who completed high school. Table 5 shows that the negative effect of retirement on expenditure of healthcare products amounts to -7.2%. For those who are in the low-and high-income groups, the decline becomes severe; Panel (B) in Table 6 shows that the negative effect of retirement on healthcare products reaches -12.4%.

Our results cannot be fully explained by home production, as documented in Luengo-Prado and Sevilla (2013) and Atalay et al. (2020) because not only food expenditure but also non-food expenditure declines at retirement. Table 3 shows that expenditure on food significantly drops by 2%. This may be explained by home production because expenditure on processed food also declines by approximately 2%. The typical example in the category of processed food is frozen meals. Because frozen meals are easily replaced by homemade meals through home production, the decline in processed food may be associated with an increase in expenditure on fresh food, which is not covered by the data we use. However, the decline in the non-food category, which includes daily necessities and healthcare goods, is difficult to replace by home production. The decline in expenditure on wide-ranging goods suggests that households significantly decrease consumption at retirement.

In sum, we find a drop in expenditure at retirement. First, expenditure at retirement significantly decreases by 2.4%. The negative effect of retirement on expenditure is persistent, and it lasts for two years immediately after retirement. Second, the determinants of a decline in expenditure at retirement are not income level, but education level. In fact, the decline is severe for those who completed high school, while there is no significant dip for those who completed university. Third, the decline in healthcare products at retirement is severe. Those who completed high school decrease expenditure of healthcare by approximately -7.2%.

The above evidence is consistent with the finding in the literature that education is

crucial for the retirement consumption puzzle. Studies also suggest that this may be due to a lack of planning for retirement and knowledge pension benefits of low-educated households [see, e.g. Gustman and Steinmeier (1999), Lusardi and Mitchell (2014), Scholz et al.(2006), and Chan and Stevens (2008)]. There is evidence that low-educated households lack retirement planning. Figure 2 shows the results from an opinion survey for elderly people by the Cabinet Office, Government of Japan. The survey asks respondents who are 60 years or older to answer how they prepare for retirement. The figure shows that 42.7% of respondents in Japan answered 'Nothing in particular', while 20.9%, 26.1%, and 25.4% did so in the United States, Germany, and Sweden, respectively. The survey suggests that a lack of planning and preparing for retirement may explain the consumption path at retirement.

5 Disentangling Price and Quantity Declines

Dong and Yang (2017) find that food expenditure declines at retirement, particularly among the less-educated group. They further show that this decline is driven by a reduction in prices than quantities. While we find that consumption at retirement significantly decreases by 2%, especially for those who completed high school, it may reflect that households at retirement purchase goods at cheaper prices more than before.

To examine whether the decline in expenditure at retirement reflects a decline in the average price of goods purchased, we disentangle price changes from quantity changes at retirement. We estimate Equation (1) by replacing (the logarithm of) consumption into quantity and price. Here, $q_{i,t}^{j}$ and $\bar{p}_{i,t}^{j}$ are denoted as the number of (equivalence scale-adjusted) units purchased from category j by individual i and the average price of goods purchased from category j by individual i in month t.[11] More specifically, the average price of goods purchased among category j by individual i in month t is computed by the

[11]The middle and bottom panels in Table 2 show the descriptive statistics of quantities purchased and the average prices. We compute the average price by dividing the total expenditure by the number of units purchased. Table 7 shows the basic statistics of the average prices of each category. Because the average prices of each category varies, 'aggregated' average prices are less informative for capturing the purchasing behaviour at retirement. While Table 9 omits the results using the 'aggregated' average prices to save space, the average price of goods purchased from all categories does not significantly change for low- and high-educated households at a significance level of 5%.

following equation:

$$\bar{p}^j_{i,t} \equiv \frac{c^j_{i,t}}{q^j_{i,t}},$$

where $c^j_{i,t}$ is denoted as the nominal expenditure on category j by individual i in month t. Suppose that individual i's nominal expenditure and units purchased on food amounts to 10,000 yen and 50 units in month t, respectively. Then, the average price of foods $\bar{p}^{food}_{i,t}$ is 200 yen. We estimate the following equations:

$$\ln q^j_{i,t} = \alpha_i + \boldsymbol{X}\beta + \sum \gamma_\tau Retire_{i,\tau} + \varepsilon_{i,t}, \tag{2}$$

and

$$\ln \bar{p}^j_{i,t} = \alpha_i + \boldsymbol{X}\beta + \sum \gamma_\tau Retire_{i,\tau} + \varepsilon_{i,t}. \tag{3}$$

The dependent variables in Equations (2) and (3) are (the logarithm of) quantity demanded and average prices, respectively.

Tables 8 and 9 show the results from Equations (2) and (3), respectively, using the full sample of retiring households aged 55 or over. Table 8 shows that, as for low-educated households, the coefficients of the retirement dummies (γ) are generally negative with significance. This suggests that consumption measured by the number of units purchased significantly decreases at retirement. The effect of retirement on the number of units purchased is approximately -2%. This effect is similar to that on expenditure, as reported in Table 5, that is, -2.7%. The result suggests that the decline in the number of units purchased accounts for a large fraction of the decline in total expenditure for low-educated households. However, this decline for high-educated households is not observable. While the number of units of daily necessities drops significantly, the coefficients γ are positive for food.

On the other hand, Table 9 shows that average prices do not change at retirement, even for low-educated households. For both low- and high-educated households, the coefficients γ are very small and insignificant. The effect of retirement on average prices are at most

-0.5%. Even for low-educated households, a significant decline in average prices is found only in processed food and healthcare.

The evidence suggests that retirement influences the number of units purchased only for low-educated households, without changing the average prices of goods purchased. Thus, the decline in nominal expenditure by low-educated households at retirement reflects a decline in quantities, and not prices purchased.

6 Cause of Falling Expenditure on Healthcare Products at Retirement

The previous section raises a new question, that is, why does consumption of healthcare products fall sharply at retirement? Our estimation results show that the decline in healthcare products at retirement is severe. Particularly, those who completed high school with high income decreased the consumption of healthcare by more than 12%. One possible explanation is that those who completed high school visit a doctor more often than before retirement, likely because prescription drugs are affordable under Japan's universal health insurance system. A consumer can save more by purchasing prescribed drugs at a hospital for an illness than by purchasing OTC drugs, which are expensive, at a drug store.

In Japan, the proportion of medical expenses is 30%, 20%, and 10% for insured employees, people aged 70 or more, and people aged 75 or more, respectively.[12] Table 10 shows the comparison of prices for prescribed and OTC drugs. For example, poultice costs only 32 yen for people aged 75 or over, while it costs 2,551 yen when purchasing OTC, which is approximately eighty times more expensive. Another example is Chinese herbal medication, which costs only 101 yen for people aged 75 or over, while it costs 4,644 yen when purchasing OTC, that is, 46 times more expensive.

The opportunity cost of time is the key to answer our research question. In the literature,Ophem (2011), Lucifora and Vigani (2018), and Zhang et al. (2018) investigate the number of doctor visits in order to show that the opportunity cost of time that retiring house-

[12]The portion of medical expenses depends on income level as well as age.

holds face determines how often they visit a doctor after retirement. For example, Ophem (2011) finds that the elderly have a higher probability of visiting a doctor, while more highly educated individuals show lower frequency of visits. Lucifora and Vigani (2018) find that the number of doctor's visits and the probability of visiting a doctor more than four times a year increase after retirement; this increase in healthcare use is consistent with the de-crease in the opportunity cost of time faced by individuals when they retire. Zhang et al.(2018) also indicate the association of healthcare use with the reduced opportunity cost of time after retirement. The above literature confirms that retirement reduces the opportunity cost of time that retiring individuals often confront. The reduced opportunity cost of time and the universal health insurance system in Japan motivate retiring individuals to take pre-scribed medication by visiting a doctor rather than purchasing OTC drugs, which are more expensive.

6.1 Doctor Visits and Expenditure on Healthcare Products

To formally examine the above intuitions, we further investigate whether more frequent visits by less-educated retiring households explain the decrease in expenditure on health-care products using an additional survey. We conducted a survey of the same respondents with panel data (SCI-personal) used in the previous section, for healthcare use in March 2017 and February 2018.

We ask respondents how often they visit a doctor.[13] More specifically, respondents were asked the following question: 'How often do you visit a hospital in a year, excluding visiting someone at a hospital or going to the hospital as an attendant?' The respondents chose the most appropriate answer from the following choices: (1) six or seven times a week, (2) four or five times a week, (3) two or three times a week, (4) once a week, (5) two or three times a month, (6) once a month, (7) four or five times in six months, (8) two or three times in six months, (9) once in six months, (10) once a year, and (11) do not visit.[14] The question directly reveals the number of visiting a doctor.

[13] In our survey, 89,004 respondents were asked the question in the first and second waves, respectively; the response rate is 84.5% on average.

[14] Table 11 represents the basic statistics of the survey.

We connect the survey with panel data on the same respondents' expenditure on healthcare products, which includes expenditure on OTC drugs. Our focus is on whether more frequent visits by lower-educated retiring households predict the decrease in consumption of healthcare products owing to the reduced opportunity cost of time faced by retiring households. The estimating equation is the following:

$$\ln(c_{i,t}^{HC}) = \alpha_i + \boldsymbol{X}\beta + \gamma_1 Retire + \gamma_2 \ln(Hospital_{i,t}) + \gamma_3 Retire \times \ln(Hospital_{i,t}) + \varepsilon_{i,t}, \tag{4}$$

where $c_{i,t}^{HC}$ and $Hospital$ are denoted as individual i's (equivalence scale-adjusted) expenditure per a (fiscal) year t on healthcare products (or drugs) and how often respondent i visits a doctor per month in t, respectively. Here, $Retire$ takes the value of one if the respondents retire; otherwise, it is zero.[15] The sample covers a period from FY2016 (April 2016 to March 2017) to FY2017 (April 2017 to March 2018), which corresponds to the period of the hospital visit survey. $\boldsymbol{X}$ is defined as a vector of household-specific factors in t, which include income level, gender, marital status, and a year dummy. α_i and $\varepsilon_{i,t}$ are the fixed effect and residuals, respectively.

Table 12 shows the result from Equation (4) using the subsample from those who completed high school. Our interest is in γ_3, that is, the coefficient of the interaction term between $Retire \times \ln(Hospital_{i,t})$. If the coefficient is negative, less-educated people decrease expenditure on healthcare products after retirement, and we find that that is the case. Table 12 reports that γ_3 is negative and significant. Using Full samples from those who completed high school, the coefficients suggest that they significantly decrease expenditure on healthcare products or OTC drugs by 16% after retirement. Even when we exclude 'Do not visit', the result is similar: The coefficients suggest a significant decrease in expenditure on healthcare products or OTC drugs by approximately 25% after retirement. This suggests that the more frequent the visits to a doctor by less-educated households, the lower the buy volume of healthcare products or OTC drugs after retirement.

[15] The dummy variable of $Retire$ is the same as that defined in Section 3.

6.2 Do Doctor Visits Predict Explain a Decline in Expenditure on Healthcare Products?

Table 12 shows a sharp decline in expenditure that is attributable to the decline in average price or quantity demanded. To identify which factors determine the decline in expenditure on healthcare goods, we further estimate the following equations:

$$\ln(q_{i,t}^{HC}) = \alpha_i + \boldsymbol{X}\beta + \gamma_1 Retire + \gamma_2 \ln(Hospital_{i,t}) + \gamma_3 Retire \times \ln(Hospital_{i,t}) + \varepsilon_{i,t}, \tag{5}$$

and

$$\ln(\bar{p}_{i,t}^{HC}) = \alpha_i + \boldsymbol{X}\beta + \gamma_1 Retire + \gamma_2 \ln(Hospital_{i,t}) + \gamma_3 Retire \times \ln(Hospital_{i,t}) + \varepsilon_{i,t}, \tag{6}$$

where $q_{i,t}^{HC}$ and $\bar{p}_{i,t}^{HC}$ are denoted as individual i's (equivalence scale-adjusted) quantity demanded in a fiscal year t on healthcare products (or drugs) and average price of healthcare goods (or drugs) purchased by individual i in a (fiscal) year t, respectively. Here, $Retire$ takes the value of one if respondents retire; otherwise, it is zero.[16] The sample covers a period from FY2016 (April 2016 to March 2017) to FY2017 (April 2017 to March 2018), which corresponds to the period of the hospital visit survey. $\boldsymbol{X}$ is defined as a vector of household-specific factors in t, which include income level, sex, marital status, and a year dummy. α_i and $\varepsilon_{i,t}$ are the fixed effect and residuals, respectively.

Table 13 shows the result from Equation (5) using the subsample from those who completed high school. Our interest is also in γ_3, that is, the coefficient of the interaction term between $Retire \times \ln(Hospital_{i,t})$. Table 13 reports that γ_3 is negative and significant. Using Full samples from those who completed high school, the coefficients suggest that these households significantly decrease the quantity demanded for healthcare products or OTC drugs by more than 10% after retirement. Even when we exclude 'Do not visit', the result is similar: The coefficients suggest a significant decrease in the quantity demanded for healthcare products by approximately 18%. The decline is severe for OTC drugs: The

[16]The dummy variable of $Retire$ is the same as that defined in Section 3.

negative effect of retirement amounts to 23%.

The quantitative effect of retirement on expenditure and quantity demanded on OTC drugs are very similar, suggesting that the decline in expenditure on OTC drugs is accounted for mostly by the decline in quantity demanded. In fact, the estimation results suggest the weak effect of retirement on the average prices of healthcare goods. Table 14 presents the result from Equation (6). It shows that γ_3 is negative and the estimated coefficients vary from -1% to -6%. While the effects are not so small, they are insignificant. This might suggest that those who completed high school seem to prefer drugs that are cheaper at retirement than before.

In sum, our estimation results show that households who completed high school significantly decrease consumption of OTC drugs at retirement. The effect of retirement on expenditure on OTC drugs is at most 25%. The change in the purchasing behaviour of the households can be explained by the frequency of visiting a doctor. The estimation results suggest that the more frequent the visits to a doctor by less-educated households, the lower the buy volume of healthcare products or OTC drugs after retirement. The evidence supports the view that the reduced opportunity costs of time to see a doctor induce households to take prescribed medication at a cheaper price. More frequent visits help them save money, since prescribed drugs are cheaper than OTC drugs under the universal health insurance system.

7 Conclusion

Using large-scale monthly panel data collected from more than 50,000 Japanese households in 2010, we tested whether there is an immediate decline in consumption at retirement. Homescan data allowed us to study a heterogeneous response to retirement among households. First, we found stark evidence of retirement consumption. There is a fall in consumption by 2.4% even at 'expected' retirement. The negative effect of retirement on expenditure is persistent, and it lasts for two years immediately after retirement. However, there is no dip in the consumption of higher-educated households, as it is the case with the

lower-educated households. Our results suggest that education, and not income, determines the decline in consumption at retirement. These results are robust when the disentangling price and quantity decline. Second, the decline in consumption of healthcare products such as drugs at retirement is severe. Those who completed high school decreased healthcare expenditure by approximately -7.2%. Households who completed high school had a maximum expenditure of 25% for OTC drugs. We further examined whether frequent visits explain the level of expenditure on healthcare goods. We found that those who completed high school visited a doctor more frequently *after* retirement than before, while the expenditure on healthcare goods significantly decreased after retirement. We conclude that this is because more-educated households visit a doctor more often after than before retirement in order to save money, since OTC purchases are more expensive in Japan.

References

Aguiar, Mark, and Hurst, Erik, (2005) "Consumption versus expenditure." *Journal of Political Economy* 133(5), 919–948.

Aguila, Emma, Attanasio, Orazio, and Meghir, Costas, (2020) "Changes in consumption at retirement: evidence from panel data." *Review of Economics and Statistics* 93(3), 1094–1099.

Allais, Olivier, Leroy, Pascal, and Mink, Julia, (2020) "Changes in food purchases at retirement in France." *Food Policy* 90(101806), 1–10.

Atalay, Kadir, Barrett, Garry F., and Staneva, Anita, (2020) "The effect of retirement on home production: evidence from Australia." *Review of Economics of the Household* 18, 117–139.

Banks, James, Blundell, Richard, and Tanner, Sarah, (1998) "Is there a retirement-savings puzzle?" *Amerrican Economic Review* 88(4), 769–788.

Battistin, Erich, Brugiavini, Agar, Rettore, Enrico, and Weber, Guglielmo, (2009) "The retirement consumption puzzle: evidence from a regression discontinuity approach." *American Economic Review* 99(5), 2209–2226.

Bernheim, B. Douglas, Skinner, Jonathan, and Weinberg, Steven, (2001) "What accounts for the variation in retirement wealth among US households?" *American Economic Review* 91(4), 832–857.

Biro, Aniko, and Elek, Peter, (2018) "How does retirement affect healthcare expenditures? Evidence from a change in the retirement age." *Health Economics* 27(5), 803–818.

Blundell, Richard, Borella, Margherita, Commault, Jeanne, and Nardi, De, Mariacristina, (2020) "Why does consumption fluctuate in old age and how should the government insure it?" *NBER Working Paper Series* No.27348.

Cabinet Office, Government of Japan (2015) Annual Report on the Aging Society.

Chan, Sewin, and Stevens, Ann Huff, (2008) "What you don't know can't help you: pension knowledge and retirement decision making." *Review of Economics and Statistics* 90(2), 253–266.

Dong, Yingying, and Yang, Dennis Tao, (2017) "Mandatory retirement and the consumption puzzle: disentangling price and quantity declines." *Economic Inquiry* 55(4), 1738–1758.

Eibich, Peter, (2015) "Understanding the effect of retirement on health:Mechanisms and heterogeneity." *Journal of Health Economics* 43, 1–12.

Fisher, Jonathan, Johnson, David S., Marchand, Joseph, Smeeding, Timothy M., and Torrey, Barbara Boyle, (2008) "The retirement consumption conundrum: evidence from a consumption survey." *Economics Letters* 99(3), 482–485.

Frimell, Wolfgang, Pruckner, Gerald, (2020) "Retirement and healthcare utilization." *Journal of Public Economics* 184, 104146.

Gross, Tal, Layton, Timothy, and Prinz, Daniel, (2020) "The liquidity sensitivity of healthcare consumption: evidence from social security payments." *NBER Working Paper Series* No.27977.

Gustman, Alan L., and Steinmeier, Thomas L., (1999) "What people don't know about their pensions and social security: an analysis using linked data from the health and retirement study." National Bureau of Economic Research Working Paper No. 7368.

Haider, Steven J., and Stephens Jr., Melvin, (2007) "Is there a retirement-consumption puzzle? Evidence using subject retirement expectations." *Review of Economics and Statistics* 89(2), 247–264.

Hurd, Michael D., and Rohwedder, Susann, (2003) "The retirement-consumption puzzle: anticipated and actual declines in spending and retirement." National Bureau of Economic Research Working Paper No. 9586.

Hurd, Michael D., and Rohwedder, Susann, (2008) "The retirement-consumption puzzle: actual spending change in panel data." National Bureau of Economic Research Working Paper No. 13929.

Hurst, Erik, (2008) "The retirement of a Consumption Puzzle." National Bureau of Economic Research Working Paper No. 13789.

Lucifora, Claudio, and Vigani, Daria, (2018) "Health care utilization at retirement: The role of the opportunity cost of time" *Health Economics* 27(12), 2030–2050.

Luengo-Prado, Maria Jose, and Sevilla, Almudena, (2013) "Time to cook: expenditure at retirement in Spain." *Economic Journal* 123, 764–789.

Lusardi, Annamaria, and Mitchell, Olivia S., (2014) "The economic importance of financial literacy: Theory and evidence." *Journal of Economic Literature* 52(1), 5–44.

Lusardi, Annamaria, Michaud, Pierre-Carl, and Mitchell, Olivia S., (2017) "Optimal financial knowledge and wealth inequality" *Journal of Political Economy* 125(2), 431–477.

Miniaci, Raffaele, Monfardini, Chiara, and Weber, Guglielmo, (2003) "Is there a retirement consumption puzzle in Italy? *Institute for Fiscal Studies Working Paper* No. W03/14.

van Ophem, Hans, (2011) "The frequency of visiting a doctor: Is the decision to go independent of the frequency?" *Journal of Applied Econometrics* 26, 872–879.

Scholz, John Karl, Seshadri, Ananth, and Khitatrakun, Surachai, (2006) "Are Americans saving "optimally" for retirement?" *Journal of Political Economy* 114(4), 607–643.

Schwerdt, Guido, (2005) "Why does consumption fall at retirement? Evidence from Germany." *Economics Letters* 89(3), 300–305.

Smith, Sarah, (2006) "The retirement-consumption puzzle and involuntary early retirement: evidence from the British household panel survey." *Economic Journal* 116(510), C130–C148.

Stephens Jr., Melvin, and Unayama, Takashi, (2012) "The impact of retirement on household consumption in Japan." *Journal of The Japanese and International Economies* 26, 62–83.

van Rooij, Maarten C.J., Lusardi, Annamaria, and Alessie, Rob J.M. (2012) "Financial literacy, retirement planning and household wealth." *Economic Journal* 122(550), 449–478.

Wakabayashi, Midori, (2008) "The retirement consumption puzzle in Japan." *Journal of Population Economics* 21(4), 983–1005.

Zhang, Yi, Salm, Martin, and Soest, Van, Arthur, (2018) "The effect of retirement on healthcare utilization:Evidence from China" *Journal of Health Economics* 62, 165–177.

Table 1: Family Income and Expenditure Survey (FIES) and SCI-personal

	Number of respondents
FIES	9,000
SCI-personal	50,000

	Survey of periods
FIES	6 months (at most)
SCI-personal	32 months (average)

	Coverage
FIES	All goods and services
SCI-personal	Commodities with a bar code

Table 2: Descriptive statistics: Monthly basis

(A) Expenditure

April 2010 to December 2019	Mean	Median	S.D.	Observations
All	20,341	16,762	16,176	5,376,766
Men	14,322	11,029	12,386	2,152,246
Women	24,358	21,424	17,135	3,224,520
55 years old or over	25,126	21,371	17,254	1,205,660
Under 55 years old	18,958	15,728	15,580	4,171,106
High-income households	22,265	18,291	17,928	1,804,430
Low-income households	19,369	16,099	15,122	3,572,336
Households who completed high school	21,611	18,382	16,677	3,219,664
Households who completed university	18,445	14,664	15,200	2,157,102

(B) Quantities purchased

April 2010 to December 2019	Mean	Median	S.D.	Observations
All	105.84	91	72.0312	4,902,399
Men	80.12	65	58.4201	1,888,235
Women	122.98	112	74.9736	2,928,190
55 years old or over	140.92	133	70.9662	121,102
Under 55 years old	104.99	90	71.8358	4,781,297
High-income households	123.16	113	74.2607	72,958
Low-income households	126.40	118	71.6327	107,651
Households who completed high school	118.02	106	74.3062	2,673,193
Households who completed university	94.60	80	66.4236	1,919,963

(C) Average prices

April 2010 to December 2019	Mean	Median	S.D.	Observations
All	211.62	186.36	113.83	4,749,312
Men	203.04	173.48	116.70	1,839,230
Women	217.05	192.88	111.64	2,910,082
55 years old or over	234.67	208.46	119.72	1,136,749
Under 55 years old	204.37	180.11	110.93	3,612,563
High-income households	224.19	195.96	127.17	1,566,051
Low-income households	205.54	182.04	106.13	3,154,916
Households who completed high school	211.75	188.20	108.89	2,682,822
Households who completed university	214.16	186.30	121.16	1,920,545

Note: High- and low-income households are those who earn 7 million yen or over and less than 7 million yen as annual income of family, respectively.

Table 3: Effect of retirement on expenditure: Households ages 55 or over

	$\ln c_{i,t} = \alpha_i + \boldsymbol{X}\beta + \sum \gamma_\tau Retire_{i,\tau} + \varepsilon_{i,t}$						
	All						
		Food	Without food				
			Beverage	Processed food		Daily necessaries	Healthcare
Panel A							
$t^* - 6 \to t^* - 1$	-0.0110	-0.0110	0.00187	-0.00950	-0.0261^{*}	-0.0213	-0.0403^{**}
	(0.00779)	(0.00824)	(0.0126)	(0.0114)	(0.0146)	(0.0133)	(0.0201)
$t^* \to t^* + 11$	-0.0210^{***}	-0.0204^{**}	-0.00356	-0.0301^{**}	-0.0377^{***}	-0.0525^{***}	-0.0543^{***}
	(0.00788)	(0.00845)	(0.0119)	(0.0117)	(0.0141)	(0.0136)	(0.0206)
$t^* + 12 \to t^* + 23$	-0.0270^{***}	-0.0222^{***}	-0.0191	-0.0233^{**}	-0.0485^{***}	-0.0299^{**}	-0.0728^{***}
	(0.00767)	(0.00809)	(0.0119)	(0.0105)	(0.0133)	(0.0126)	(0.0187)
Observations	91,101	91,115	90,362	90,893	88,386	86,912	34,390
# of individuals	1,014	1,014	1,014	1,014	1,013	1,013	1,003
Panel B	.						
$t^* \to t^* + 23$	-0.0238^{***}	-0.0204^{***}	-0.0141	-0.0245^{***}	-0.0421^{***}	-0.0351^{***}	-0.0622^{***}
	(0.00651)	(0.00696)	(0.0100)	(0.00922)	(0.0112)	(0.0105)	(0.0156)
Observations	91,101	91,115	90,362	90,893	88,386	86,912	34,390
# of individuals	1,014	1,014	1,014	1,014	1,013	1,013	1,003

Note: We report the estimated coefficients, γ. Clustered (individual) standard errors are in parentheses. Individual i retires at the end of the month $t^* - 1$, and ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 4: Effect of retirement on expenditure: Those who completed university (Higher-education group)

	$\ln c_{i,t} = \alpha_i + \boldsymbol{X}\beta + \sum \gamma_\tau Retire_{i,\tau} + \varepsilon_{i,t}$						
	All						
		Food	Without food				
			Beverage	Processed food		Daily necessaries	Healthcare
Panel A							
$t^* - 6 \to t^* - 1$	−0.00236	0.00448	−0.0111	0.00667	−0.0351	−0.0480*	−0.0384
	(0.0152)	(0.0157)	(0.0268)	(0.0232)	(0.0286)	(0.0276)	(0.0446)
$t^* \to t^* + 11$	0.00218	0.00809	0.0233	0.0124	−0.0143	−0.0391	−0.0252
	(0.0160)	(0.0160)	(0.0254)	(0.0232)	(0.0277)	(0.0283)	(0.0380)
$t^* + 12 \to t^* + 23$	−0.0184	−0.00634	0.00671	0.00136	−0.0655**	−0.0517*	−0.0396
	(0.0160)	(0.0165)	(0.0239)	(0.0225)	(0.0274)	(0.0267)	(0.0336)
Observations	22,165	22,165	21,976	22,081	21,365	20,809	8,024
# of individuals	248	248	248	248	248	248	243
Panel B							
$t^* \to t^* + 23$	−0.0113	−0.00203	0.0135	0.00430	−0.0444*	−0.0421*	−0.0302
	(0.0135)	(0.0140)	(0.0204)	(0.0190)	(0.0230)	(0.0223)	(0.0285)
Observations	22,165	22,165	21,976	22,081	21,365	20,809	8,024
# of individuals	248	248	248	248	248	248	243

Note: We report the estimated coefficients, γ. Clustered (individual) standard errors are in parentheses. Individual i who are 55 years old or over retires at the end of the month $t^* - 1$ and ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 5: Effect of retirement on expenditure: Those who completed high-school (Lower-education group)

	$\ln c_{i,t} = \alpha_i + \boldsymbol{X}\beta + \sum \gamma_\tau Retire_{i,\tau} + \varepsilon_{i,t}$						
	All						
		Food	Without food				
			Beverage	Processed food		Daily necessaries	Healthcare
Panel A							
$t^* - 6 \to t^* - 1$	-0.0131	-0.0160^{*}	0.00443	-0.0144	-0.0202	-0.0101	-0.0419^{*}
	(0.00901)	(0.00955)	(0.0143)	(0.0129)	(0.0169)	(0.0152)	(0.0225)
$t^* \to t^* + 11$	-0.0279^{***}	-0.0294^{***}	-0.0130	-0.0432^{***}	-0.0430^{***}	-0.0546^{***}	-0.0642^{***}
	(0.00908)	(0.00984)	(0.0135)	(0.0134)	(0.0165)	(0.0156)	(0.0242)
$t^* + 12 \to t^* + 23$	-0.0284^{***}	-0.0265^{***}	-0.0278^{**}	-0.0301^{**}	-0.0396^{***}	-0.0202	-0.0827^{***}
	(0.00867)	(0.00916)	(0.0138)	(0.0119)	(0.0152)	(0.0142)	(6.878)
Observations	68,906	68,920	68,357	68,782	66,992	66,074	26,358
# of individuals	771	771	771	771	770	770	763
Panel B							
$t^* \to t^* + 23$	-0.0268^{***}	-0.0258^{***}	-0.0233^{**}	-0.0329^{***}	-0.0386^{***}	-0.0306^{**}	-0.0721^{***}
	(0.00741)	(0.00792)	(0.0116)	(0.0105)	(0.0129)	(0.0119)	(0.0183)
Observations	68,906	68,920	68,357	68,782	66,992	66,074	26,358
# of individuals	771	771	771	771	770	770	763

Note: We report the estimated coefficients, γ. Clustered (individual) standard errors are in parentheses. Individual i who are 55 years old or over retires at the end of the month $t^* - 1$ and ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 6: Effect of retirement on expenditure by each group

$$\ln c_{i,t} = \alpha_i + \boldsymbol{X}\beta + \sum \gamma_\tau Retire_{i,\tau} + \varepsilon_{i,t}$$

	All	Food	Without food				
			Beverage	Processed food		Daily necessaries	Healthcare
Panel (A): Higher-education and lower-income group							
$t^* \to t^* + 23$	-0.00698	0.00824	0.0231	0.0243	-0.0481	-0.0317	-0.0119
	(0.0166)	(0.0172)	(0.0296)	(0.0246)	(0.0336)	(0.0330)	(0.0400)
Observations	10,527	10,529	10,463	10,464	10,232	10,068	4,083
# of individuals	117	117	117	117	117	117	113
Panel (B): Lower-education and higher-income group							
$t^* \to t^* + 23$	-0.0332^{**}	-0.0298^{**}	-0.0542^{***}	-0.0270	-0.0548^{**}	-0.0426^{*}	-0.124^{***}
	(0.0129)	(0.0133)	(0.0190)	(0.0176)	(0.0231)	(0.0231)	(0.0336)
Observations	24,338	24,338	24,149	24,306	23,751	23,412	9,197
# of individuals	282	282	282	282	281	281	279
Panel (C): Higher-income group							
$t^* \to t^* + 23$	-0.0288^{***}	-0.0251^{**}	-0.0370^{**}	-0.0255^{*}	-0.0521^{***}	-0.0465^{**}	-0.105^{***}
	(0.0110)	(0.0114)	(0.0159)	(0.0150)	(0.0186)	(0.0186)	(0.0279)
Observations	35,919	35,917	35,605	35,866	34,831	34,100	13,117
# of individuals	409	409	409	409	408	408	406
Panel (D): Lower-income group							
$t^* \to t^* + 23$	-0.0216^{***}	-0.0182^{**}	-0.00188	-0.0250^{**}	-0.0373^{***}	-0.0290^{**}	-0.0365^{**}
	(0.00793)	(0.00863)	(0.0130)	(0.0116)	(0.0142)	(0.0127)	(0.0185)
Observations	55,116	55,132	54,691	54,961	53,493	52,750	21,252
# of individuals	604	604	604	604	604	604	596

Note: We report the estimated coefficients, γ. Clustered (individual) standard errors are in parentheses. Individual i who are 55 years old or over retires at the end of the month $t^* - 1$ and ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 7: Basic statistics of average prices

	All						
		Food			Without food		
			Beverage	Processed food		Daily necessaries	Healthcare
Average price	211.62	518.70	159.22	152.92	161.45	354.27	896.91
Observations	4,749,312	4,300,482	4,744,289	4,775,145	3,967,768	4,305,955	1,407,649

Note: Average price is computed by dividing total expenditure by the number of units purchased by individual i at month t.

Table 8: Effect of retirement on quantities purchased

	$\ln q_{i,t} = \alpha_i + \boldsymbol{X}\beta + \sum \gamma_\tau Retire_{i,\tau} + \varepsilon_{i,t}$						
	All						
		Food			Without food		
			Beverage	Processed food		Daily necessaries	Healthcare
Panel (A): Full sample							
$t^* \to t^* + 23$	-0.0146^{**}	-0.0112^{*}	-0.00524	-0.0120	-0.0302^{***}	-0.0276^{***}	-0.0337^{***}
	(0.00614)	(0.00645)	(0.0103)	(0.00822)	(0.00850)	(0.00858)	(0.0101)
Observations	99,171	91,135	97,770	98,838	96,259	94,628	37,596
# of individuals	1,143	1,143	1,143	1,143	1,142	1,142	1,130
Panel (B): Lower education							
$t^* \to t^* + 23$	-0.0192^{***}	-0.0162^{***}	-0.0144	-0.0184^{**}	-0.0246^{***}	-0.0202^{**}	-0.0383^{***}
	(0.00703)	(0.00737)	(0.0122)	(0.00936)	(0.00963)	(0.00967)	(0.0114)
Observations	75,265	75,227	74,205	75,011	73,154	72,072	28,834
# of individuals	870	870	870	870	869	869	862
Panel (C): Higher education							
$t^* \to t^* + 23$	0.00240	0.00751	0.0255	0.0103	-0.0473^{***}	-0.0505^{***}	-0.0156
	(0.0124)	(0.0129)	(0.0190)	(0.0172)	(0.0182)	(0.0186)	(0.0206)
Observations	23,876	23,878	23,536	23,797	23,076	22,527	8,754
# of individuals	279	279	279	279	279	279	272

Note: We report the estimated coefficients, γ. Clustered (individual) standard errors are in parentheses. Individuals i who are 55 years or older retire at the end of the month $t^* - 1$ and ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 9: Effect of retirement on average prices

	$\ln \bar{p}^j_{i,t} = \alpha_i + \boldsymbol{X}\beta + \sum \gamma_\tau Retire_{i,\tau} + \varepsilon_{i,t}$					
	Food	Without food				
		Beverage	Processed food		Daily necessaries	Healthcare
Panel (A): Full sample						
$t^* \to t^* + 23$	-0.00434^*	-0.00271	-0.0124^{***}	-0.00499	-0.00325	-0.0170
	(0.00300)	(0.00557)	(0.00370)	(0.00665)	(0.00561)	(0.0104)
Observations	99,103	97,698	98,811	96,178	94,506	37,161
# of individuals	1,143	1,143	1,143	1,142	1,142	1,130
Panel (B): Lower education						
$t^* \to t^* + 23$	-0.00535	0.0000	-0.0137^{***}	-0.0455	-0.00180	-0.0208^*
	(0.00338)	(0.00654)	(0.00408)	(0.00776)	(0.00629)	(0.0125)
Observations	75,188	74,138	74,979	73,078	71,970	28,494
# of individuals	869	869	869	868	868	862
Panel (C): Higher education						
$t^* \to t^* + 23$	-0.00276	-0.0124	-0.00837	-0.00819	-0.00915	-0.00771
	(0.00649)	(0.0103)	(0.00834)	(0.0128)	(0.0122)	(0.0169)
Observations	23,894	23,540	23,811	23,080	22,516	8,661
# of individuals	279	279	279	279	279	273

Note: We report the estimated coefficients, γ. Clustered (individual) standard errors are in parentheses. Individuals i who are 55 years or older retire at the end of the month $t^* - 1$ and ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 10: Prices of prescribed medication and OTC drugs.

	Prescribed medication			OTC drugs
	Official price (yen)	Patient's burden (yen)		Price (yen)
		Below age 70: 30%	Age 75 or over: 10%	
Poultice	320	96	32	2,551
Vitamin preparation	520	156	52	3,974
Chinese herbal medicine	1,010	303	101	4,644
Skin poultice	1,100	330	110	2,448

Note: Patient's burden depends on income level as well as age. Those aged between 70 and 74 pay 20% of their medical expenses. Source: Minister of Finance.

Table 11: How often do households visit a doctor? Descriptive statistics of a survey for the frequency of visiting a doctor.

	Mean	Median	S. D.	Observations
All	1.00	0.42	2.34	89,004
Men	0.98	0.42	2.37	35,942
Women	1.01	0.42	2.32	53,062
55 years old or over	1.29	0.75	2.68	23,477
Under 55 years old	0.90	0.42	2.20	65,527
High-income households	1.01	0.42	2.37	29,915
Low-income households	1.00	0.42	2.33	59,089
Households who completed high school	0.97	0.42	2.39	51,777
Households who completed university	1.04	0.42	2.39	37,227

Table 12: Determinants of expenditure on healthcare goods by high school-educated households

$\ln(c_{i,t}^{HC}) = \alpha_i + \boldsymbol{X}\beta + \gamma_1 Retire + \gamma_2 \ln(Hospital_{i,t}) + \gamma_3 Retire \times \ln(Hospital_{i,t}) + \varepsilon_{i,t}$

	Those who completed high school			
	Full sample		$\#\ of\ hospital\ \geq 1$	
	Healthcare	Drug	Healthcare	Drug
β_1: age	0.160^{**}	0.245^{***}	0.196^{***}	0.263^{***}
	(0.0642)	(0.0648)	(0.0755)	(0.0757)
β_2: age^2	-0.00775^{*}	-0.0128^{***}	-0.0101^{*}	-0.0146^{***}
	(0.00468)	(0.00475)	(0.00550)	(0.00554)
γ_1: $Retire$	-0.0173	-0.0870	0.0137	-0.0293
	(0.0847)	(0.0848)	(0.0913)	(0.0890)
γ_2: $\ln(Hospital)$	-0.00321	-0.00986	0.00274	-0.00587
	(0.00756)	(0.00750)	(0.0105)	(0.0102)
γ_3: $Retire \times \ln(Hospital)$	-0.158^{**}	-0.156^{**}	-0.231^{**}	-0.254^{***}
	(0.0631)	(0.0611)	(0.0956)	(0.0904)
Fixed effect	YES	YES	YES	YES
Observations	31,878	29,728	25,819	24,087
# of individuals	18,917	18,125	16,566	15,787

Note: Clustered (individual) standard errors are in parentheses. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. The data span April 2016 to March 2018.

Table 13: Determinants of quantities purchased of healthcare goods by high-school educated households

$$\ln(q_{i,t}^{HC}) = \alpha_i + \boldsymbol{X}\beta + \gamma_1 Retire + \gamma_2 \ln(Hospital_{i,t}) + \gamma_3 Retire \times \ln(Hospital_{i,t}) + \varepsilon_{i,t}$$

	Those who completed high school			
	Full sample		$\#\ of\ hospital\ \geq 1$	
	Healthcare	Drug	Healthcare	Drug
β_1: age	0.0186	0.207***	0.0511	0.207***
	(0.0622)	(0.0568)	(0.0754)	(0.0678)
β_2: age^2	−0.000939	−0.0117***	−0.00304	−0.0120**
	(0.00431)	(0.00412)	(0.00517)	(0.00492)
γ_1: $Retire$	−0.0138	−0.104	0.0153	−0.0374
	(0.0674)	(0.0748)	(0.0734)	(0.0749)
γ_2: $\ln(Hospital)$	−0.00988	−0.00853	−0.0114	−0.00216
	(0.00678)	(0.00634)	(0.00922)	(0.00860)
γ_3: $Retire \times \ln(Hospital)$	−0.134***	−0.107*	−0.177**	−0.230***
	(0.0508)	(0.0562)	(0.0751)	(0.0775)
Fixed effect	YES	YES	YES	YES
Observations	30,970	28,600	25,078	23,180
# of individuals	17,924	17,098	15,769	14,942

Note: Clustered (individual) standard errors are in parentheses. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. The data span April 2016 to March 2018.

Table 14: Determinants of average price of healthcare goods by high-school educated households

$$\ln(\bar{p}_{i,t}^{HC}) = \alpha_i + \boldsymbol{X}\beta + \gamma_1 Retire + \gamma_2 \ln(Hospital_{i,t}) + \gamma_3 Retire \times \ln(Hospital_{i,t}) + \varepsilon_{i,t}$$

	Those who completed high school			
	Full sample		$\#\ of\ hospital\ \geq 1$	
	Healthcare	Drug	Healthcare	Drug
β_1: age	0.157^{***}	0.0411	0.161^{**}	0.0553
	(0.0551)	(0.0325)	(0.0674)	(0.0380)
β_2: age^2	-0.00768^{**}	-0.00120	-0.00807^{*}	-0.00246
	(0.00380)	(0.00236)	(0.00460)	(0.00276)
γ_1: $Retire$	-0.0233	0.00944	-0.0226	-0.00006
	(0.0676)	(0.0374)	(0.0738)	(0.0404)
γ_2: $\ln(Hospital)$	0.00746	-0.000321	0.0152^{*}	-0.00173
	(0.00627)	(0.00367)	(0.00903)	(0.00507)
γ_3: $Retire \times \ln(Hospital)$	-0.0335	-0.0440	-0.0604	-0.0146
	(0.0493)	(0.0274)	(0.0695)	(0.0372)
Fixed effect	YES	YES	YES	YES
Observations	30,644	28,600	24,827	23,180
# of individuals	17,825	17,098	15,664	14,942

Note: Clustered (individual) standard errors are in parentheses. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. The data span April 2016 to March 2018.

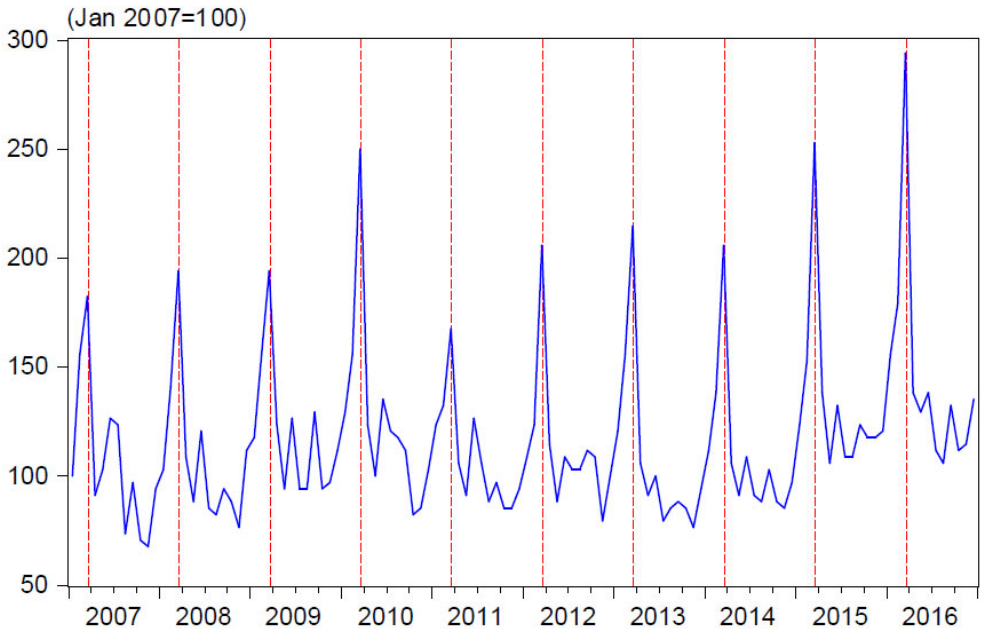

Figure 1: The number of Google searches for “Teinen” retirement (mandatory retirement)

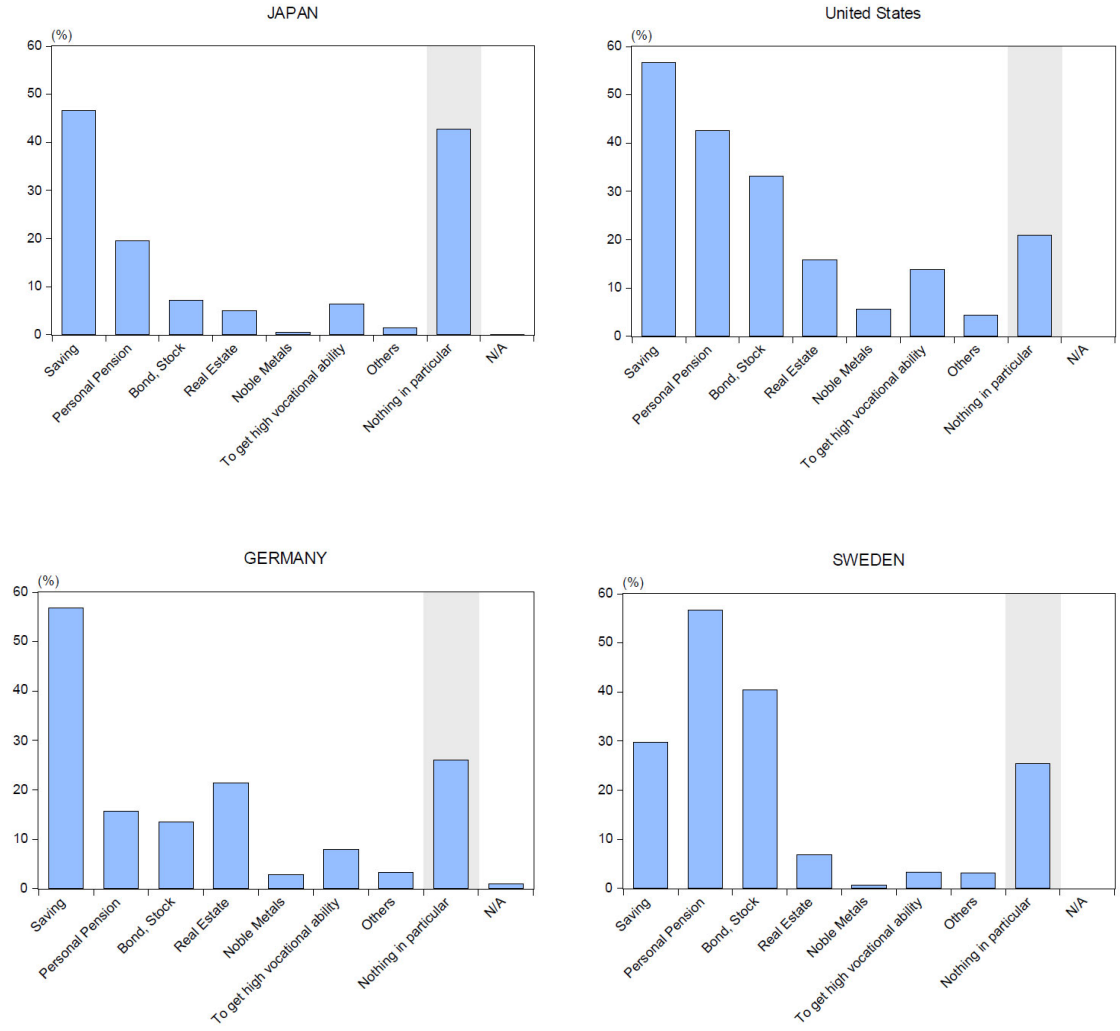

Figure 2: Planning for retirement: Survey for those who are sixty years old or over by Cabinet Office, Government of Japan. Source: Cabinet Office, Government of Japan (2015).