Is there a retirement consumption puzzle in Japan? Evidence based on panel data on households in the agricultural sector †

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Abstract

Taking advantage of annual panel data on part-time farmer households, this paper investigates whether a retirement consumption puzzle is observed in Japan. Our analysis shows that households' expenditure does decline after the retirement of the household head and that changes in family size and in life-style/preferences cannot fully explain this decline. Unanticipated negative income shocks such as health problems appear to provide a partial explanation. However, our analysis also suggests that there are myopic households that lacked the discipline to accumulate sufficient savings for retirement.

Key words: Retirement, Household consumption, Life cycle/Permanent income hypothesis

JEL Classification Codes: D12, E21, J26

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1. Introduction

Many developed countries, and especially Japan, are experiencing rapid population aging. One aspect of considerable interest in this context is the impact on consumption, which accounts for the largest share of GDP in most countries. This means that as a growing share of the population approaches or reaches retirement, how consumers respond to retirement is becoming a topic of increasing importance for economists and policy makers alike.

The canonical life-cycle/permanent income hypothesis (LC/PIH) predicts that households smooth their marginal utility of consumption against anticipated income changes. Forward-looking households are expected to smooth their standard of living in the face of even a large anticipated income drop such as after reaching retirement, since it is assumed that they save enough to make adequate provisions. However, the empirical evidence regarding the ability of households to adequately plan and save for retirement appears to be inconclusive. While studies using simulations to compare optimal savings to actual savings in the United States suggest that savings are adequate (Engen et al., 1999; Scholz et al., 2006), studies using micro-data to examine consumption changes upon retirement tend to find that household expenditures fall precipitously upon retirement (see, e.g., Banks et al., 1998, for the United Kingdom; Bernheim et al., 2001, and Haider and Stephens, 2007, for the United States; Schwerdt, 2005, for Germany; and Miniaci et al., 2003, for Italy) – a result that seems to conflict with the LC/PIH as it implies that households make inadequate savings for retirement and that has consequently been referred to as the "retirement consumption/saving puzzle."

Probably as a consequence of the conflicting findings, more recent studies on this retirement consumption/saving puzzle have become more nuanced and emphasize the heterogeneity in spending changes upon retirement across households and across consumption categories. For example, Smith (2006) finds that a significant fall in food spending is observed only when retirement is involuntary. Her finding is consistent with the results obtained by Hurd and Rohwedder (2008), who show the spending declines they observe are linked to unexpected retirement due to negative health shocks. Meanwhile, Wakabayashi (2008) and Battistin et al. (2009) report that declines in household consumption upon retirement shrank considerably once changes in household composition at retirement are controlled for. Further, Aguiar and Hurst (2005) argue that modifying the LC/PIH to incorporate home production may help understand the fall in consumption upon retirement. Against this background, Hurst (2008), based on a comprehensive review of this literature, concludes that the standard LC/PIH augmented with home production and unexpected health shocks can explain retirement consumption behavior for the majority of households, although further work is necessary to

understand a relatively small subset of households that are ill-prepared to sustain their consumption through retirement.

Given this debate in the literature, this study focuses on households in Japan and investigates whether their consumption declines upon retirement. While there has been extensive research on consumption patterns upon retirement and hence the retirement consumption puzzle in the United States and other western countries, empirical analyses for Japan are relatively scarce and their results have been inconclusive. For example, Wakabayashi (2008), using cross-section data from a retrospective survey (*Survey of the Financial Asset Choice of Households*) to examine whether such a "puzzle" can be observed in Japan, finds that consumption does tend to decline, but this decline is primarily due to a decline in family size after retirement. Meanwhile, Stephens and Unayama (2012), employing monthly panel data from the *Family Income and Expenditure Survey* (FIES), report that no clear fall in consumption at retirement can be observed and argue that this is probably because of the presence of large lump-sum retirement allowances. Therefore, while their views regarding the expenditure decline upon retirement are slightly different, the two studies point in the same direction in that they provide support for consumption smoothing, i.e., the LC/PIH.

However, the datasets used by these earlier studies are less than ideal for examining consumption patterns upon retirement. As highlighted by Blau (2008), in order to identify the effects of retirement on consumption, it is preferable to use a panel dataset which follows households before and after their retirement. Yet, Wakabayashi (2008) uses only cross-section data, while Stephens and Unayama (2012) do employ panel data from the FIES, but the FIES unfortunately follows each household only for a period of six months, which is too short to truly grasp the impact of retirement – a process that usually spans a number of years.[1] Apart from the relatively short period that the FIES follows individual households, another shortcoming is that it does not ask households to report lump-sum retirement allowances – information that is necessary to understand consumption behavior around the time of retirement in Japan.

Against this background, the aim of this study is to examine consumption behavior in Japan around the time of retirement using a true long-run panel dataset. Specifically, we employ the *Statistical Survey on Farm Management and Economy*, which follows the economic transactions of households in Japan's agricultural sector in detail over a period of several years and includes information on lump-sum retirement allowances. A survey on farm households by its very nature is not representative of all households in Japan. However, many farmers in Japan

[1] Shimizutani (2011), who provides "stylized facts" on retirement behavior in Japan, for example argues that retirement is a gradual, lengthy process that is affected by a variety of factors, including economic, health, family, and other circumstances.

are only part-time farmers and also have or had a salaried job, so that the survey allows us to gain insights on households' reaction to a large income decline such as that observed at retirement that do not necessarily apply to farm households only. Specifically, we examine the behavior of part-time farm households whose head retired from his salaried job during the observation period, and investigate whether the consumption of such households falls in the years following retirement (up to around five years). We also examine where the decline in consumption upon retirement that we observe comes from.

Our analysis based on annual panel data shows that households' expenditure does decline after the retirement of the household head. What is more, changes in family size or other demographic factors appear to only marginally account for the expenditure decline upon retirement. Changes in preferences after retirement also do not appear to explain the expenditure decline, since the decline in expenditure is strongly correlated with the magnitude of the decline in income. Further, we find that the expenditure decline is larger for households with fewer net financial assets, which implies that part of the income-expenditure correlation around retirement is probably due to unanticipated negative income shocks. All of these factors are in line with the LC/PIH. However, our analysis also implies that it is difficult to fully account for the consumption decline at retirement in Japan without myopic households or households that lacked the discipline to accumulate sufficient savings – a result which contradicts the assumptions of the LC/PIH.

The remainder of the paper is organized as follows. The next section describes the data used in this paper, which are from the *Statistical Survey on Farm Management and Economy.* Section 3 then outlines our empirical specification and presents the baseline results of our analysis. Next, Section 4 extends our empirical analysis to investigate the causes of the consumption puzzle in Japan. Section 5 concludes the paper.

2. Data

The data we use in this paper are from the *Statistical Survey on Farm Management and Economy* (SSFME), which is a panel survey on Japanese farm households. The survey has been conducted by the Ministry of Agriculture, Forestry and Fisheries (MAFF) since 1995 for the purpose of monitoring the management and economy of farm households and other entities as well as the production cost of farm products and to contribute to agricultural policy making. The survey is a sample survey which covers commercial farm households (full-time as well as part-time) with an operating cultivated land area of 0.3 hectares or more, or with an annual turnover of 500,000 yen or more.

The survey relies on self-reporting and interviews by enumerators conducted by the Statistics Department of the MAFF and the local statistical offices of the ministry. Roughly 10,000 farm households throughout Japan are surveyed. The survey provides annual information on household members, working hours, income, wealth, etc. In addition, micro-data on the monthly income and living expenditures of roughly 4,000 households, compiled from daily expenditures and income receipts recorded in a diary which is collected once a month, are available. For selected households, living expenditures, classified into ten categories, are also available, but unfortunately only for households that entered the survey before 2000. This means that we have annual data on living expenditures from 1995 to 2003, and monthly data from 1996 to 2003, when the MAFF stopped asking about living expenditures. The survey follows the same households for consecutive years (for as many years as the households agree to continue participating), while some are replaced by new households.

The reason that we focus on farm households is that the SSFME allows us to construct a high quality long-run household panel of unrivalled richness, reflecting the fact that, until recently, the Japanese government has spent generously on the collection of statistics for the agricultural sector.[2] As mentioned, the survey covers both households where the household head is a full-time farmer and households where the household head's main source of income is not farming but a salaried job, and we focus on the latter. Although such household heads may continue to work as farmers when they retire from their salaried job, so that they may not be fully retired, they will likely share many features with non-farm households when it comes to retiring from a salaried job, including a large anticipated decline in income and substantial changes in lifestyle. This is particularly the case for those whose employment status is that of a "regular employee," and it is these households that we focus on to construct a panel dataset (spanning several years) that follows the annual expenditure and income flows, including lump-sum retirement allowances, and asset holdings of part-time farm households.[3]

The basic statistics of our dataset are reported in Table 1. Roughly speaking, the levels of income and expenditure of households in the SSFME are higher than those of households in the FIES (Table 1(a)). Therefore, there is a bias in our dataset toward richer households, although the households are also older and consist of more family members on average.

[2] This probably reflects the structural rigidity of the public sector in Japan. While agriculture, the staple economic sector of Japan immediately after World War II, accounted for less than 2 percent of GDP in 2000, government employees in charge of agricultural statistics made up close to 70 percent of the total government employees in charge of statistics in that year.

[3] The number of part-time farmers in Japan increased after World War II due to farm mechanization and structural changes in the economy. Especially in the case of small-scale rice-cropping, farm household heads no longer have to devote themselves full-time to agricultural work and typically work as a regular employee in addition to working as a part-time farmer with their family's assistance.

Agricultural income accounts for roughly 30 percent of the total current income of all households in the SSFME, who, moreover, spend a sizable amount of time on their agricultural activities. However, for part-time farm households, which our analysis focuses on, income from agricultural activities accounts for only 5 percent of the total current income, and household heads spend less than 400 working hours annually on agricultural activities.

To further check the reliability of our dataset, we compared it with data from the *National Survey of Family Income and Expenditure* (NSFIE), which provides information on the average income and living expenditures of part-time farmers. The NSFIE is a nationally representative survey that is conducted every five years and covers around 60,000 households (households randomly selected each time) throughout Japan. We find that the average income and expenditure of part-time farmers in the NSFIE are broadly consistent with those in our dataset.[4]

Next, Table 1(b) compares the sample statistics for the treatment group consisting of households where the household head retired from his/her salaried job at some point during our observation period with those of the control group consisting of households where the household head did not retire. The basic statistics for the control households look broadly similar to those for the treatment households before retirement. After their retirement, the annual income of the treatment households decreased by about 20 percent. Wage income declined drastically after retirement. However, as suggested by Figure 1(a) presenting the average income pattern of households whose head retired at some point, the income in the retirement year is higher for retiring households, as they often receive a large lump-sum retirement allowance. Although increases in pensions and income from agricultural activities partly make up for the loss in wage income, income flows after retirement are substantially lower than those before retirement. Household heads' working hours spent on agricultural activities increase substantially after retirement, although the observed increase in income from agricultural activities looks relatively modest. We also observe a fall in consumption (expenditures) after retirement (see Figure 1(b)).

3. Baseline specification and consumption changes at retirement

To investigate the impact of retirement on consumption, we examine farm households whose heads are part-time farmers and mainly work as regular employees. More precisely, we focus on households with the following characteristics: (i) the household head was a regular employee at the beginning of the panel, retired from his/her regular job, and never returned to regular

[4] According to the 1999 NSFIE, the average annual income of part-time farm households/farmers was 10.4 million yen, while the average expenditure was 5.0 million yen.

employment during the observation period; (ii) the household head was 55 years old or older; (iii) the number of regular employees in the household other than the (working) household head was at most one; and (iv) the household's wage income dropped by more than half upon the head's retirement. We use households whose heads were 55 years old or older and continued to be regular employees throughout the observation period as our control group.

We examine the impact of retirement on consumption expenditures, as well as household income, by exploiting the panel feature of our dataset. Following the strategy taken by Stephens and Unayama (2012), we estimate the following two equations in a fixed effects specification:[5]

$$\ln Y_{i,t} = \sum_{k=0}^{5} \gamma_{Y,k} RetiredDum(k)_{i,t} + \beta_Y X_{i,t} + \phi_Y Z_t + \mu_{Y,i} + \eta_{Y,i,t} \qquad (1)$$

$$\ln C_{i,t} = \sum_{k=0}^{5} \gamma_{C,k} RetiredDum(k)_{i,t} + \beta_C X_{i,t} + \phi_C Z_t + \mu_{C,i} + \eta_{C,i,t} \qquad (2)$$

where $Y_{i,t,}$ is household i's annual disposable income in year t, $C_{i,t,}$ stands for household i's living expenditures in year t, and $RetiredDum(k)_{i,t}$ is a dummy variable that takes one if household i retired in year t-k. Moreover, $X_{i,t}$ is a set of household-specific factors in year t, which can change over time, such as the household head's age, the number of household members, the number of regular employees in the household other than the household head, the number of part-time workers, and dummies indicating whether there is a child/there are children aged 0 to 5, 6 to 12, and/or 13 to 18 living in the household. Further, Z_t is a set of year dummies to control for time-specific characteristics, $\mu_{Y,i}$ and $\mu_{C,i}$ are household-specific time-invariant characteristics, and $\eta_{Y,i,t}$ and $\eta_{C,i,t}$ are well-behaved disturbance terms.

In this specification, the estimated coefficients on $RetiredDum(k)_{i,t}$ represent the cumulative impact of retirement on income and consumption. As retirement typically leads to a sudden decline in income flows, the $\gamma_{Y,k}$ should clearly be negative and be both economically and statistically significant. Therefore, what we are interested in is whether the $\gamma_{C,k}$ are also negative and significant.

Table 2 presents the results from estimating equations (1) and (2). The first four columns report the results using households where the household head retired from his/her salaried job during our observation period. As expected, disposable income declines significantly after retirement ($\gamma_{Y,k}$<0). Consumption also declines ($\gamma_{C,k}$<0) after retirement,

[5] We also tried a first-difference specification to examine the robustness of our findings. See Appendix A for those results.

although the estimated coefficients generally are not statistically significant.

A potential problem in these estimates, however, is that they may suffer from measurement error due to "survey fatigue." Stephens and Unayama (2012) in their analysis of FIES data found that the longer households are in the survey, the less consumption they generally report, regardless of whether they retire or not. In order to control for this potential source of bias, we also tried regressions that include non-retiring households as a control group. The results are reported in columns (*v*) and (*viii*) and show that the pattern of the estimated coefficients on $RetiredDum(k)_{i,t}$ remains broadly unchanged, although the size of the negative coefficients in the consumption regression becomes larger (in absolute terms) and more significant when we include the control households in our regressions. The results therefore suggest that the consumption expenditure of retired households is lower (by around 10 percent, as indicated by the coefficients for years one to five and more after retirement) than that of non-retired households, indicating that the "retirement consumption puzzle" also seems to hold for Japan.

Our finding that there is a retirement consumption puzzle in Japan looks inconsistent with the finding by Stephens and Unayama (2012). This probably results from the difference in time horizon, i.e., our study examines the impact over several years, while Stephens and Unayama focus only on several months.[6] Considering the fact that retirement is one of the largest turning points in someone's life and its impact on a person's lifestyle is probably gradual, spanning a period of years, we believe that it is necessary to carefully monitor changes after retirement over several years to fully grasp the retirement puzzle. Another likely reason for the different findings is that living expenditures in our dataset include expenditures on durables, while most of the earlier studies focus on non-durable consumption. Given that the LC/PIH focuses on consumption smoothing rather than expenditure smoothing and durables are consumed over a long period of time (i.e., there is a "lag" between expenditure on and consumption of such goods), the natural choice for examining the retirement consumption puzzle is indeed to focus on non-durable consumption. However, since data in the SSFME on individual living expenditure categories are available only for a small subset of households in our sample and only up to 1999, we had no choice but to use total living expenditures.[7] However, fortunately, the fact that we are interested in the long-run effects alleviates this

[6] In fact, our own results indicate that no significant effect on consumption in the year of retirement can be observed.

[7] The ratio of households that are asked to report expenditures by categories is only around 10 percent. Besides that, there are some households which voluntarily reported their consumption by categories. Appendix B reports the results of our analysis on food expenditures (including self-production), although the analysis is inevitably based on a smaller sample.

problem, because the discrepancy between expenditure on and consumption of durables decreases over time.

4. What explains the puzzle?

Given that we did find a retirement consumption puzzle, that is, a simultaneous decline in income and expenditure, in our analysis in the preceding section, we next investigate the reasons for the simultaneous decline. Earlier studies mention several factors that could possibly explain this puzzle, some of which are consistent with the LC/PIH, while others are not.[8] One simple explanation could be that consumption declines after retirement because some dependents (children) are forced to be financially independent and live separate from the retired parents. Changes in preferences due to increased non-market time also may account for the decline. For example, working-related expenses decline naturally after retirement, while leisure-related expenses may change because retired households can spend more time on leisure than working households. Unexpected declines in lifetime income (or permanent income) just around retirement, caused by forced retirement earlier than planned or by a reform of the public pension system, would also provide an explanation for the consumption declines that is consistent with the LC/PIH, since households that had been unable to save enough for retirement would have to cut back on their expenditures. In addition to these explanations in line with the LC/PIH, another possible factor – which would be inconsistent with the LC/PIH – is that some or many of the households were myopic and/or lacked the discipline to save sufficiently for retirement. Such households would be forced to respond to the income drop after retirement by cutting back on consumption to make ends meet even without a shock affecting their life-time income. In the following sub-sections, we examine the role that these possible explanations play in our dataset.

4.1 Effects of changes in household demographics

Wakabayashi (2008) argues that the consumption decline at retirement in Japan that she observed is primarily due to the declines in family size. Going back to our results in Table 2, we find that a number of the demographic variables are significant. Specifically, the number of household members as well as the number of regular employees in the household other than the household head have a positive effect on the level of household income and consumption, as expected, while having a child or children aged zero to five appears to have a negative effect.

[8] A leading explanation of the failure of the LC/PIH is liquidity constraints. However, liquidity constraints cannot explain the retirement consumption puzzle, since income decreases at the time of retirement.

While the significant coefficients on these household demographic variables may appear to support the argument by Wakabayashi (2008), we should not ignore the fact that the effect of retirement on consumption is negative and significant even after controlling for household demographics. Therefore, the changes in household demographics explain part of the consumption decline at retirement, but they do not appear to be the primary explanation for the retirement consumption puzzle in Japan.[9]

4.2 Changes in lifestyle/preferences?

The next possible explanation is that the "puzzle" is the result of changes in lifestyle/preferences after retirement. In his comprehensive review of the consumption puzzle, Hurst (2008) argues that the decline in spending during retirement for the average household is limited to food and work-related expenses, reflecting changes in lifestyle/preferences. In their study on Japanese households, Stephens and Unayama (2012) indeed find a retirement consumption decrease in food and work-related expenses, which appears to be in line with this argument. Unfortunately, our dataset, as mentioned, does not provide household expenditure data sufficiently broken down into expenditure categories to analyze changes in particular expenditure categories. In order to assess the importance of changes in lifestyle/preferences, we therefore use an alternative approach, dividing households in our sample into two groups in terms of the size of the income drop, assuming that if the expenditure decline at retirement results from changes in lifestyle/preferences, the decline should be correlated with the event of retirement and not with the size of the income drop.

Table 3 reports the results when dividing retiring households into two groups based on whether the rate of income drop (from the year before retirement to the year after retirement) was smaller or larger than the median. When we confine our sample only to households that retired sometime during our observation period, the income regression coefficients for households with a large income drop (column (*i*)) indicate that their income declined significantly from the first year after retirement onward, while the coefficients for households with a small/no income drop (column (*iii*)) are not significantly different from zero. And more interestingly, only households that saw a large drop in income also reduced their consumption significantly. The correlation between income and consumption can be observed more clearly when we include the control households in our regressions (columns (*v*) to (*viii*)). While the level of consumption of households with a large income drop declines significantly after

[9] When we conduct the same regressions without the household demographic variables, the size of the estimated coefficients on the retirement dummies is not noticeably affected. This suggests that there is something beyond changes in family size that affects households' consumption at their retirement.

retirement, no significant decline is observed for households with a small/no income drop. Therefore, broadly speaking, the consumption drop upon retirement appears to be correlated with the size of the income drop at retirement, which seems to contradict the hypothesis that the consumption drop around retirement reflects changes in lifestyle/preferences.

4.3 Insufficient wealth accumulation?

Another possible explanation is that the puzzle is due to the reaction of households that did not save enough for their retirement. To investigate this hypothesis, we split our sample households in terms of their wealth-consumption ratio (=net financial asset holdings / annual consumption) at the time of their retirement and examine whether the consumption decline is significantly more pronounced for households with a smaller ratio. The results, which are reported in Table 4, indicate that while the income decline for the two groups is similar in size – especially in the first two years after retirement – the drop in consumption appears to be larger and longer-lasting for households with fewer financial assets at their retirement. We find this pattern irrespective of whether we include the control households or not. Therefore, the results indicate that there were households with insufficient savings that responded to the income drop after retirement by cutting back their consumption to make ends meet.

4.4 Disentangling the determinants of the decline in consumption

The finding above indicates that part of the retirement consumption puzzle in Japan is explained by households that do not have sufficient savings for retirement. However, the fact that we find that to some extent consumption falls upon retirement even for households with high savings (column (*viii*) of Table 4) and that income and consumption are correlated (Table 3) suggests that the retirement consumption puzzle is a complex phenomenon that results from several factors. Moreover, in the case of Japan, measuring the effect of retirement on consumption may be more complicated due to the existence of large lump-sum retirement allowances, which, as shown in Figure 1(a), result in a jump in income in the year of retirement.[10] To address the complication arising from the existence of lump-sum retirement allowances, we extend our regression by including interaction dummies. Specifically, we estimate the following specification:

[10] Stephens and Unayama (2012) cite large *teinen* bonuses (paid by private employers when employees reach the mandatory retirement age) as a reason why the consumption puzzle is not clearly observed in Japan. However, the FIES, which they rely on for their empirical analysis, does not provide any information on *teinen* bonuses, so that this appears to be mere conjecture.

$$\ln C_{it} = \sum_{k=0}^{4} \eta_{c}^{(a)}{}_{,k} RD(k)_{i,t} + \sum_{k=0}^{4} \eta_{c}^{(b)}{}_{,k} RD(k)_{i,t} \times CDum1_{i,t} + \sum_{k=0}^{4} \eta_{c}^{(c)}{}_{,k} RD(k)_{i,t} \times CDum2_{i,t} + \ldots + \mu_{c,i} + \eta_{c,i,t} \quad (3)$$

where $RD(k)_{i,t}$ is short for $RetiredDum(k)_{i,t}$, the dummy for households where the head retired in year *t-k* used in the previous sections, *CDum1* is a dummy for households that experienced a relatively small income drop at retirement, and *CDum2* is a dummy for households that received a lump-sum retirement allowance.[11]

The results are reported in Table 5 and indicate that for households with smaller financial assets, the coefficients on the retirement dummies, *RD(k)*, are negative and significant after the year of retirement, as shown in the columns labeled (a_1 *and* a_2) in Tables 5-1A and 5-2A. Turning to the interaction terms, while the coefficients on the dummy for households with a small income drop, $RD(k) \times CDum1$ (columns (b_1, *and* b_2)), are generally positive and significant, the coefficients on the dummy for households that received a lump-sum retirement allowance, $RD(k) \times CDum2$ (columns (c_1, *and* c_2)) are not statistically significant.

The panels labeled with B in the right half of Table 5 report the estimated patterns of consumption decline after retirement by household type, which are derived from the estimated coefficients in the panels labeled with A in the left half of the table. The observed patterns reveal a number of interesting facts about the retirement consumption puzzle in Japan. First, the size of the income drop appears to be a key determinant of the magnitude of the consumption decline. Specifically, while we find a significant consumption decline for households with a relatively large income drop, for households with a relatively small income drop we cannot detect a statistically significant decline in consumption after retirement. Another key determinant of the magnitude of the consumption decline is the wealth-consumption ratio at the time of the household head's retirement. The estimated size of the consumption decline upon retirement is clearly larger for households with a lower wealth-consumption ratio. In contrast, whether a household receives a lump-sum retirement allowance does not appear to noticeably change the pattern of consumption around retirement.

To sum up, the decline in consumption upon retirement in Japan appears to be due to the response of households that were unable to save enough for their retirement to compensate for the decline in income upon retirement. Moreover, lump-sum retirement allowances appear to influence households' consumption response only through their effect on the level of household

[11] We first tried another specification, in which we also included the interaction term $RD(k) \times CDum1 \times CDum2$, but decided to exclude it from the regression, since the coefficients were not significant.

wealth at the time of retirement.

4.5 Was the retirement a "surprise"?

While the finding that the consumption decline upon retirement in Japan is largely due to the response of households that could not save enough for their retirement is a useful piece of information regarding the consumption puzzle, it does not provide conclusive evidence on the validity of the LC/PIH. On the one hand, we can say that the finding is consistent with the LC/PIH if for some of the households the income decline was unexpected. A reduction in consumption to cope with a negative surprise would be entirely consistent with the LC/PIH, since it reflects an unexpected decline in lifetime income. On the other hand, however, insufficient savings at retirement are not necessarily solely the result of such surprises. Some households may not have saved enough, not because their income dropped unexpectedly, but because they were just myopic or lacked sufficient discipline.

A number of preceding studies (e.g., Smith, 2006; Hurd and Rohwedder, 2008; Hurst, 2008) cite forced retirement and health problems as potential reasons for unanticipated early retirement. Unfortunately, the SSFME does not contain information that would allow us to determine directly whether retirement was unexpected due to, for example, health problems. However, we think it is possible to conjecture whether retirement was unexpected by examining proxy variables that are potentially correlated with health problems. As our first proxy, we focus on changes in agricultural working hours of the retiring household head, which are available from the SSFME. As shown in Figure 1(b), retiring household heads typically increase their agricultural working hours after leaving their salaried job as a regular employee outside agriculture. If we can assume that a retiring head will not increase his/her agricultural working hours when he/she has some health problems, then household heads that did not increase their agricultural working hours are more likely to be suffering from health problems. As a second proxy, we also focus on changes in households' medical expenditure, since medical expenditure is likely to increase if the head retired due to health problems. Although information on consumption by category, as explained above, is available only for a subset of households in the SSFME, we can use this information for our analysis, assuming that the heads of households that reported an increase in medical expenditure around the time of the head's retirement are more likely to be suffering from health problems.

To examine the effects of unanticipated retirement due to health problems, we re-estimate equation (3) replacing *CDum2* by one of the following two dummy variables: *CDum3*, a dummy variable for households whose head's agricultural working hours increased

after the head's retirement; and *CDum4*, a dummy for households whose medical and healthcare expenditure did not increase at the retirement of the household head.[12] Given our finding that it is households without sufficient savings whose consumption declines substantially upon retirement, we focus on households whose wealth-consumption ratio is below the median.

The results are reported in Table 6. Starting with the regressions for our first proxy, *CDum3*, we find that the size of the consumption decline upon retirement is larger for households whose heads' agricultural working hours did not increase, which supports the PI/LCH and the "surprise" hypothesis, that is, that at least for some households the consumption decline is explained by an unexpected decline in income. The result using the second proxy, *CDum4*, also appears to endorse the "surprise" hypothesis in that the size of the consumption decline is larger for households whose medical expenditure increased at retirement.

In sum, comparing households whose head appears to be experiencing health problems and those that do not suggests that a surprise decline in income does play some role, which is in line with the PI/LCH. However, a consumption decline, though to a lesser degree, can also be observed for households which are less likely to have experienced health problems. Therefore, in that sense our results suggest that the consumption decline at retirement in Japan cannot fully be explained without myopic households or households that lacked the discipline to accumulate sufficient savings – a result which contradicts the assumptions of the LC/PIH.

5. Conclusion

Taking advantage of panel data on farm households collected by the *Statistical Survey on Farm Management and Economy*, this paper investigated whether a retirement consumption puzzle can be observed in Japan and, given that this is the case, what the reasons are. Our long-run panel data allow us to examine the behavior of households whose head actually retired during the observation period.

Our analysis based on this annual panel dataset showed that the retirement consumption puzzle – that is, the fact that households' expenditure declines after the household head retires – can also be observed in Japan. Contrary to Wakabayashi (2008), we find that changes in family size or other demographic factors only marginally account for the expenditure decline upon retirement. Further, the observed consumption decline can also not fully be explained by changes in lifestyle/preferences, as the consumption decline is strongly correlated with the size of the income decline upon retirement. In addition, we find that households with

[12] To be precise, *CDum4* includes households for which information on medial expenditure is not available, since we set households that reported an increase in medical expenditure as our baseline (without the dummy).

fewer assets experience a larger decline in consumption upon retirement, suggesting that part of the puzzle may be explained by households that do not have sufficient savings for retirement and need to reduce their expenditures to make ends meet. However, the reason why some households have insufficient savings for retirement are not entirely clear and there are at least two, not necessarily mutually exclusive, possibilities, namely, that rational households experienced an unanticipated negative income shock, or that households were myopic or lacked the discipline to accumulate sufficient savings for retirement (i.e., they were irrational). Our analysis suggests that unanticipated negative income shocks including health problems probably explain part of the puzzle; at the same time, though, part of the consumption drop cannot be explained without the existence of households that were myopic or lacked sufficient saving discipline. The presence of large lump-sum retirement allowances appears to complicate the consumption puzzle in Japan; however, the results of our analysis suggest that lump-sum retirement allowances influence consumption around retirement only through their effects on the level of household wealth at the time of retirement.

To sum up, although it may sound like a cliché, the retirement consumption puzzle is a complex phenomenon that cannot be explained by a single factor alone. Instead, many of the factors proposed in earlier studies can each help to explain part of the puzzle. Therefore, we can say that part of the retirement consumption puzzle in Japan can certainly be explained by factors that are not necessarily inconsistent with the LC/PIH; at the same time, however, we cannot rule out the possibility that there are some households that are myopic or lack sufficient saving discipline and thus contradict the assumptions of the LC/PIH.

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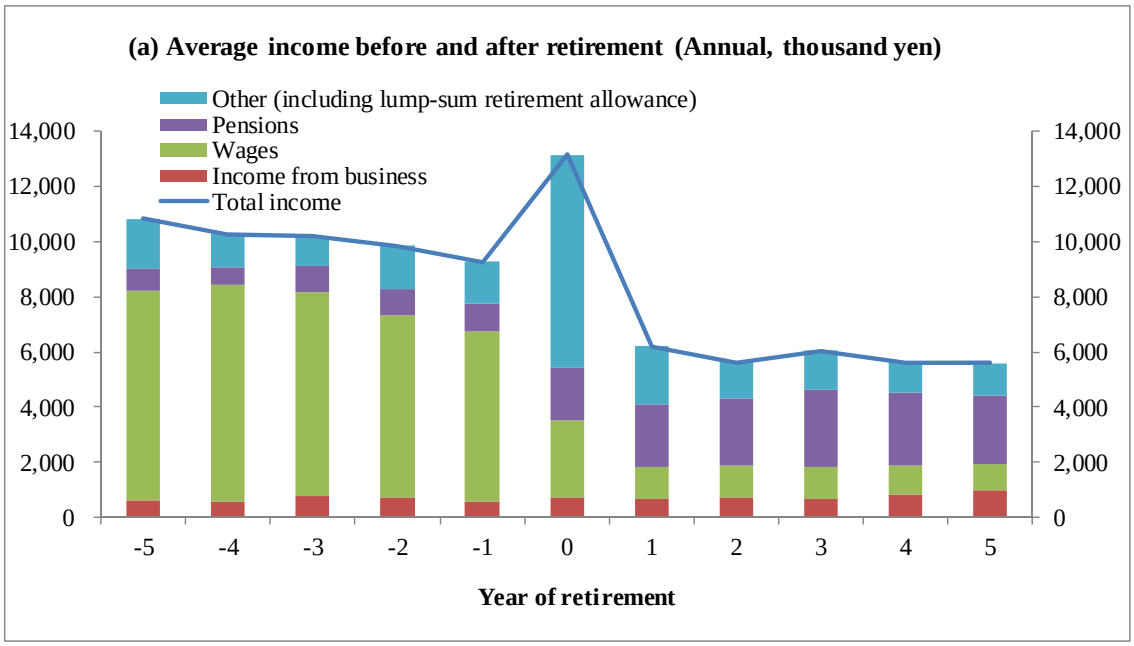
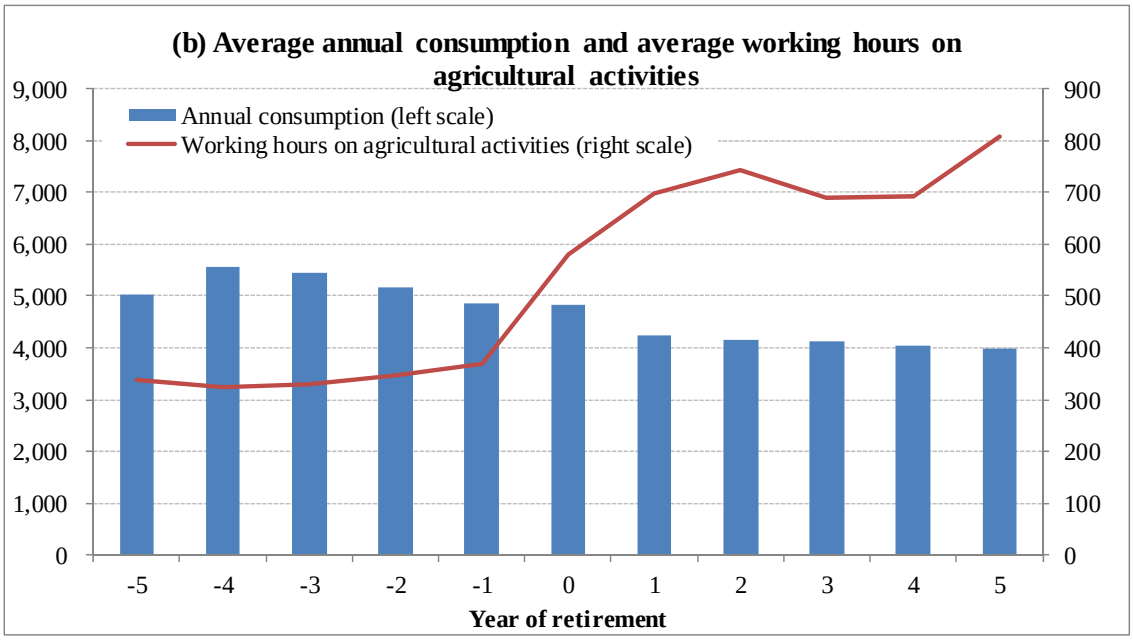
Figure 1. Changing pattern of income, consumption, and working hours of households whose head retired at some point during our observation





Notes: Average figures calculated from an unbalanced panel using 118 households whose heads retired during the observation period. Household heads are 55 years old or older.

Table 1. Sample statistics (Based on data from 1995 to 2003)

(a) Basic statistics and comparison with the Family Income and Expenditure Survey

	Statistical Survey on Farm Management and Economy				*Family Income and Expenditure Survey*			
	All households		Households used in our analysis		All households with head working as an employee		Households with head working as an employee and aged 55 and over	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Income	9,102	5,623	9,869	5,654	6,868	3,397	6,722	3,813
Income from business	3,164	4,764	570	1,188	45	313	67	392
Wages	3,274	3,954	6,407	4,440	6,559	3,454	5,883	3,994
Pensions	1,254	1,123	1,192	1,295	246	755	744	1,258
Other (including lump-sum retirement allowance)	1,411	2,474	1,700	3,823	19	161	29	199
Consumption	4,980	2,562	5,173	2,619	4,194	2,178	4,223	2,455
Consumption (including self-production)	5,115	2,582	5,304	2,632	na	na	na	na
Net financial assets	25,035	31,664	28,648	22,597	6,882	20,046	17,860	25,166
Lump-sum retirement allowance	116	1,440	270	2,399	na	na	na	na
Dummy for households who received lump-sum retirement allowance	0.01	0.10	0.13	0.34	na	na	na	na
Lump-sum retirement allowance for those who received	5,885	8,423	11,580	10,875	na	na	na	na
Working hours of household head in agriculture	1,225	983	396	346	na	na	na	na
Age of household head	58.5	10.8	60.3	4.3	45.9	10.8	60.3	4.5
Number of household members	4.7	1.9	3.9	1.7	3.5	1.2	2.9	1.0
Number of workers (including farmers)	3.3	1.3	2.9	1.3	1.6	0.7	1.8	0.9
Number of observations	37,105		2,578		70,399		16,497	
Number of households	9,466		765		70,399		16,497	

Notes: Income, consumption and assets are in thousand yen. Net financial assets, gross financial assets, and debts in the FIES are available from 2001. The number of observations for all households in the FIES is 13,936, while that for households with a head aged 55 and over is 3,263.

Table 1. Sample statistics (continued)

(b) Regular employee households whose head has not retired vs. households whose head retired at some point during the observation period

	Treatment group: Households whose head retired (from a regular job) at some point during the observation period						*Control group: Regular employee households whose head has not retired*	
	All observations		Before retirement		After retirement			
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Income	8,724	6,273	9,628	4,462	8,013	7,320	10,293	5,347
Income from business	731	1,260	662	1,244	785	1,272	510	1,155
Wages	3,909	3,939	6,795	3,551	1,637	2,467	7,333	4,255
Pensions	1,677	1,536	873	1,424	2,311	1,310	1,012	1,142
Other (including lump-sum retirement allowance)	2,407	5,222	1,297	2,420	3,280	6,515	1,439	3,112
Consumption	4,557	2,208	4,961	2,377	4,240	2,013	5,402	2,721
Consumption (including self-production)	4,684	2,220	5,094	2,392	4,361	2,020	5,534	2,734
Net financial assets	30,963	22,281	29,479	21,855	32,130	22,570	27,790	22,659
Lump-sum retirement allowance	997	4,538	282	2,225	1,733	5,924	389	2,900
Dummy for households who received lump-sum retirement allowance	0.48	0.50	0.11	0.31	0.47	0.50	0.04	0.02
Lump-sum retirement allowance for those who received	12,066	11,013	1,593	3,931	10,725	11,054	9,371	10,957
Working hours of household head in agriculture	538	454	354	258	683	518	343	277
Age of household head	61.3	4.2	59.2	3.5	63.0	3.9	59.9	4.3
Number of household members	3.4	1.5	3.6	1.6	3.2	1.5	4.1	1.7
Number of workers (including farmers)	2.4	1.2	2.8	1.1	2.2	1.3	3.1	1.2
Number of observations	697		307		390		1,881	
Number of households	118		118		118		647	

Note: Income, consumption, and assets are in thousand yen.

Table 2. Do households' income and consumption decline at retirement in Japan?

	Only households whose head retired at some point during the observation period				Including control households			
	Income		Consumption		Income		Consumption	
	Fixed effect	Random effect	Fixed effect	Random effect	Fixed effect	Random effect	Fixed effect	Random effect
	(i)	*(ii)*	*(iii)*	*(iv)*	*(v)*	*(vi)*	*(vii)*	*(viii)*
RetiredDum(*k*)								
k =0: Year of retirement	0.11	0.15 **	0.01	0.04	0.13 ***	0.19 ***	-0.03	0.01
	(0.08)	(0.07)	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)
k =1: 1st year	-0.52 ***	-0.48 ***	-0.11 *	-0.07	-0.52 ***	-0.46 ***	-0.14 ***	-0.10 ***
	(0.08)	(0.07)	(0.06)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)
k =2: 2nd year	-0.53 ***	-0.47 ***	-0.08	-0.03	-0.52 ***	-0.45 ***	-0.12 ***	-0.07 *
	(0.10)	(0.08)	(0.07)	(0.06)	(0.05)	(0.04)	(0.04)	(0.04)
k =3: 3rd year	-0.41 ***	-0.33 ***	-0.05	0.02	-0.44 ***	-0.36 ***	-0.14 ***	-0.08 *
	(0.12)	(0.10)	(0.08)	(0.07)	(0.06)	(0.05)	(0.05)	(0.05)
k =4: 4th year	-0.43 ***	-0.34 ***	-0.02	0.05	-0.48 ***	-0.41 ***	-0.14 **	-0.08
	(0.14)	(0.11)	(0.10)	(0.09)	(0.07)	(0.06)	(0.06)	(0.06)
k =5: 5th year or more	-0.39 **	-0.26 **	-0.00	0.10	-0.43 ***	-0.35 ***	-0.12 *	-0.06
	(0.17)	(0.13)	(0.12)	(0.10)	(0.07)	(0.06)	(0.07)	(0.06)
Number of HH members	0.06	0.10 ***	0.07 **	0.08 ***	0.06 ***	0.10 ***	0.08 ***	0.12 ***
	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)
Number of regular employees	0.26 ***	0.24 ***	0.10 ***	0.09 ***	0.17 ***	-0.15 ***	0.05 **	-0.17 ***
other than household head	(0.05)	(0.04)	(0.04)	(0.03)	(0.02)	(0.04)	(0.02)	(0.04)
Number of non-regular	0.03	0.02	0.04 *	0.01	0.02	0.00	0.06 ***	-0.08 **
employees	(0.03)	(0.02)	(0.02)	(0.02)	(0.01)	(0.04)	(0.01)	(0.04)
Dummy for child(ren) aged 0-5	-0.21	-0.17	-0.13	-0.08	-0.22 ***	-0.05	-0.24 ***	0.05
	(0.18)	(0.11)	(0.13)	(0.09)	(0.06)	(0.04)	(0.05)	(0.04)
Dummy for child(ren) aged 6-12	0.21	0.14	0.10	0.08	0.02	0.17 ***	-0.03	0.07 ***
	(0.15)	(0.11)	(0.11)	(0.08)	(0.05)	(0.02)	(0.05)	(0.02)
Dummy for child(ren) aged 13-18	-0.22	-0.25 *	0.01	-0.09	-0.10 *	0.00	0.05	0.02
	(0.16)	(0.13)	(0.11)	(0.10)	(0.05)	(0.01)	(0.05)	(0.01)
Number of obs.	697		697		2578	2578	2578	2578
(Obs. for retiring HHs)	697		697		697	697	697	697
Number of HHs	118		118		765	765	765	765
Hausman test	42.0		38.1		44.0		73.1***	
R^2: Within	0.45	0.45	0.27	0.27	0.32	0.32	0.16	0.15
Between	0.03	0.39	0.16	0.24	0.27	0.4	0.24	0.32
Overall	0.00	0.43	0.24	0.28	0.33	0.4	0.23	0.29

Notes: Dependent variables are in log form. Standard errors are shown in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively. Dummies for the age of the household head and year dummies are included in all regressions.

Table 3. How was the consumption decline correlated with the income decline at retirement?

(Households that experienced a large income drop at retirement vs. households that experienced a small/no income drop)

	Only households whose head retired at some point during the observation period				Including control households			
Income drop	Large		Small/None		Large		Small/None	
	Income (i)	Consumption (ii)	Income (iii)	Consumption (iv)	Income (v)	Consumption (vi)	Income (vii)	Consumption (viii)
RetiredDum(*k*)								
k =0: Year of retirement	-0.05	0.03	0.30 **	-0.02	0.11	-0.09	0.23 ***	-0.06
	(0.14)	(0.10)	(0.12)	(0.10)	(0.07)	(0.07)	(0.06)	(0.07)
k =1: 1st year	-1.00 ***	-0.12	0.06	-0.02	-0.86 ***	-0.24 ***	-0.10 **	-0.06
	(0.13)	(0.09)	(0.12)	(0.09)	(0.05)	(0.05)	(0.05)	(0.05)
k =2: 2nd year	-0.94 ***	-0.10	-0.12	-0.02	-0.69 ***	-0.20 ***	-0.27 ***	-0.05
	(0.16)	(0.12)	(0.15)	(0.12)	(0.06)	(0.06)	(0.06)	(0.06)
k =3: 3rd year	-0.87 ***	-0.03	-0.07	-0.06	-0.61 ***	-0.24 ***	-0.23 ***	-0.07
	(0.20)	(0.15)	(0.17)	(0.13)	(0.07)	(0.07)	(0.07)	(0.07)
k =4: 4th year	-0.96 ***	0.00	0.04	0.06	-0.68 ***	-0.24 ***	-0.23 **	-0.07
	(0.24)	(0.17)	(0.22)	(0.18)	(0.08)	(0.08)	(0.09)	(0.10)
k =5: 5th year or more	-1.02 ***	0.04	0.04	0.14	-0.59 ***	-0.25 ***	-0.26 ***	-0.02
	(0.30)	(0.21)	(0.27)	(0.21)	(0.08)	(0.08)	(0.09)	(0.10)
Number of obs.	315	315	269	269	2,196	2,196	2,150	2,150
(Obs. for retiring HHs)	315	315	269	269	315	315	269	269
Number of HHs	44	44	43	43	691	691	690	690
Hausman test	112.3 ***	42.0 **	24.7	21.5	48.9	66.4 ***	46.8	72.8 ***
R^2: Within	0.64	0.44	0.37	0.21	0.38	0.19	0.18	0.13
Between	0.12	0.00	0.41	0.25	0.31	0.24	0.35	0.23
Overall	0.02	0.05	0.42	0.24	0.35	0.23	0.36	0.22

Notes: This table presents the results using fixed effects regressions. Dependent variables are in log form. Standard errors of coefficients are shown in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively. Dummies for the age of the household head, the number of household members, children aged 5 or younger, children aged 6 to 12, and children aged 13 to 18, as well as the number of regular employees other than the household head, the number of non-regular employees, and year dummies are included in all regressions.

Table 4. How did the impact of retirement on income and consumption differ between households with high savings and households with low savings?

(Households with a high wealth-consumption ratio vs. households with a low wealth-consumption ratio)

	Only households whose head retired at some point during the observation period				Including control households			
Wealth-consumption ratio	Below median		Above median		Below median		Above median	
	Income (i)	Consumption (ii)	Income (iii)	Consumption (iv)	Income (v)	Consumption (vi)	Income (vii)	Consumption (viii)
RetiredDum(*k*)								
k =0: Year of retirement	-0.06	-0.06	0.24 **	0.06	0.06	-0.04	0.21 ***	-0.02
	(0.13)	(0.09)	(0.11)	(0.08)	(0.06)	(0.06)	(0.06)	(0.06)
k =1: 1st year	-0.58 ***	-0.24 **	-0.52 ***	-0.03	-0.44 ***	-0.19 ***	-0.58 ***	-0.11 **
	(0.13)	(0.09)	(0.11)	(0.08)	(0.05)	(0.05)	(0.05)	(0.05)
k =2: 2nd year	-0.63 ***	-0.19	-0.53 ***	-0.03	-0.44 ***	-0.13 **	-0.59 ***	-0.11 *
	(0.17)	(0.12)	(0.13)	(0.10)	(0.06)	(0.06)	(0.06)	(0.06)
k =3: 3rd year	-0.59 ***	-0.21	-0.38 **	0.01	-0.40 ***	-0.17 **	-0.47 ***	-0.13 *
	(0.21)	(0.15)	(0.16)	(0.12)	(0.07)	(0.07)	(0.07)	(0.07)
k =4: 4th year	-0.67 ***	-0.21	-0.30	-0.01	-0.48 ***	-0.18 **	-0.48 ***	-0.15 *
	(0.25)	(0.18)	(0.19)	(0.14)	(0.08)	(0.08)	(0.09)	(0.09)
k =5: 5th year or more	-0.62 **	-0.22	-0.41 *	0.02	-0.34 ***	-0.15 *	-0.57 ***	-0.15
	(0.31)	(0.22)	(0.23)	(0.17)	(0.08)	(0.08)	(0.09)	(0.09)
Number of obs.	334	334	354	354	2,215	2,215	2,235	2,235
(Obs. for retiring HHs)	334	334	354	354	334	334	354	354
Number of HHs	57	57	57	57	704	704	704	704
Hausman test	41.1	53.3 **	17.6	18.7	50.1	76.9 ***	48.4	67.3 ***
R^2: Within	0.41	0.31	0.55	0.33	0.22	0.15	0.32	0.16
Between	0.06	0.07	0.00	0.20	0.30	0.22	0.30	0.25
Overall	0.00	0.12	0.19	0.24	0.33	0.21	0.33	0.24

Notes: See notes for Table 3.

Table 5. How did the impact of retirement on consumption differ among households? With low/high savings, a large/small income drop, and with/without a lump-sum retirement allowance

5-1. Only households whose head retired at some point during the observation period

A. Estimated coefficients

Retirement Dummies (*RD(k)*)	< 1 > Wealth-consumption ratio < median			< 2 > Wealth-consumption ratio > median		
	RD(k)	*RD(k)* × *CDum1*	*RD(k)* × *CDum2*	*RD(k)*	*RD(k)* × *CDum1*	*RD(k)* × *CDum2*
	(a_1)	(b_1)	(c_1)	(a_2)	(b_2)	(c_2)
k =0: Year of retirement	-0.00	-0.07	-0.23	-0.12	0.13	0.25 **
	(0.11)	(0.13)	(0.14)	(0.12)	(0.13)	(0.13)
k =1: 1st year	-0.38 ***	0.18 *	-0.02	-0.30 **	0.24 **	0.26 **
	(0.12)	(0.11)	(0.11)	(0.12)	(0.11)	(0.12)
k =2: 2nd year	-0.31 **	0.18	-0.06	-0.20	0.15	0.15
	(0.15)	(0.12)	(0.12)	(0.17)	(0.15)	(0.16)
k =3: 3rd year	-0.27	0.20	-0.19	-0.07	0.05	0.08
	(0.19)	(0.14)	(0.14)	(0.18)	(0.17)	(0.17)
k =4: 4th year	-0.35	0.47 **	-0.27	-0.02	-0.36	0.05
	(0.23)	(0.18)	(0.18)	(0.21)	(0.23)	(0.20)
F test: Coeff. on retirement dummies = 0 for all *k*	2.83 **	2.16 *	1.02	1.42	1.90 *	1.45
Number of obs. (of which for retiring HHs)	310 (310)			339 (339)		
Number of HHs	57			57		
Hausman test	35.8			38.5		
R^2: Within	0.36			0.36		
Between	0.07			0.00		
Overall	0.14			0.00		

B. Derived patterns of consumption decline after retirement by household type

Retirement allowance	< 1 > Wealth-consumption ratio < median				< 2 > Wealth-consumption ratio > median			
	No		Yes		No		Yes	
Income drop	Large	Small	Large	Small	Large	Small	Large	Small
	(a_1)	$(a_1)+(b_1)$	$(a_1)+(c_1)$	$(a_1)+(b_1)+(c_1)$	(a_2)	$(a_2)+(b_2)$	$(a_2)+(c_2)$	$(a_2)+(b_2)+(c_2)$
k =0: Year of retirement	-0.00	-0.07	-0.23	-0.30 *	-0.12	0.01	0.13	0.26 *
	(0.11)	(0.13)	(0.16)	(0.16)	(0.12)	(0.14)	(0.11)	(0.15)
k =1: 1st year	-0.38 ***	-0.20	-0.40 ***	-0.22 *	-0.30 **	-0.06	-0.04	0.20 *
	(0.12)	(0.12)	(0.13)	(0.13)	(0.12)	(0.12)	(0.10)	(0.12)
k =2: 2nd year	-0.31 **	-0.13	-0.37 **	-0.19	-0.20	-0.05	-0.05	0.10
	(0.15)	(0.16)	(0.15)	(0.16)	(0.17)	(0.14)	(0.12)	(0.17)
k =3: 3rd year	-0.27	-0.07	-0.46 **	-0.26	-0.07	-0.02	0.01	0.06
	(0.19)	(0.20)	(0.19)	(0.19)	(0.18)	(0.17)	(0.15)	(0.19)
k =4: 4th year	-0.35	0.12	-0.62 ***	-0.15	-0.02	-0.38	0.03	-0.33
	(0.23)	(0.24)	(0.23)	(0.26)	(0.21)	(0.23)	(0.16)	(0.26)

5-2. Including control households

A. Estimated coefficients

Retirement Dummies (*RD(k)*)	< 1 > Wealth-consumption ratio < median			< 2 > Wealth-consumption ratio > median		
	RD(k)	*RD(k)* × *CDum1*	*RD(k)* × *CDum2*	*RD(k)*	*RD(k)* × *CDum1*	*RD(k)* × *CDum2*
	(a_1)	(b_1)	(c_1)	(a_2)	(b_2)	(c_2)
k =0: Year of retirement	0.07	-0.08	-0.22 *	-0.12	0.03	0.17
	(0.09)	(0.12)	(0.13)	(0.09)	(0.12)	(0.11)
k =1: 1st year	-0.30 ***	0.23 **	-0.05	-0.29 ***	0.17 *	0.19 *
	(0.08)	(0.09)	(0.10)	(0.09)	(0.10)	(0.10)
k =2: 2nd year	-0.17 *	0.16	-0.11	-0.33 **	0.18	0.24
	(0.09)	(0.10)	(0.10)	(0.13)	(0.13)	(0.13)
k =3: 3rd year	-0.22 **	0.23 *	-0.15	-0.31 **	0.15	0.22 **
	(0.10)	(0.12)	(0.12)	(0.13)	(0.14)	(0.14)
k =4: 4th year	-0.23 *	0.36 **	-0.25	-0.11	-0.24	0.03
	(0.12)	(0.15)	(0.16)	(0.16)	(0.19)	(0.18)
F test: Coeff. on retirement dummies = 0 for all *k*	4.23 ***	2.82 **	1.06	3.23 ***	1.53	1.56
Number of obs. (of which for retiring HHs)	2191 (310)			2220 (339)		
Number of HHs	704			704		
Hausman test	83.1***			81.2***		
R^2: Within	0.17			0.16		
Between	0.22			0.26		
Overall	0.21			0.25		

B. Derived patterns of consumption decline after retirement by household type

Retirement allowance	< 1 > Wealth-consumption ratio < median				< 2 > Wealth-consumption ratio > median			
	No		Yes		No		Yes	
Income drop	Large	Small	Large	Small	Large	Small	Large	Small
	(a_1)	$(a_1)+(b_1)$	$(a_1)+(c_1)$	$(a_1)+(b_1)+(c_1)$	(a_2)	$(a_2)+(b_2)$	$(a_2)+(c_2)$	$(a_2)+(b_2)+(c_2)$
k =0: Year of retirement	0.07	-0.01	-0.15	-0.23 *	-0.12	-0.09	0.05	0.08
	(0.09)	(0.10)	(0.12)	(0.12)	(0.12)	(0.11)	(0.08)	(0.12)
k =1: 1st year	-0.30 ***	-0.07	-0.35 ***	-0.12	-0.29 ***	-0.12	-0.10	0.07
	(0.08)	(0.08)	(0.09)	(0.09)	(0.10)	(0.09)	(0.07)	(0.09)
k =2: 2nd year	-0.17 *	-0.01	-0.28 ***	-0.12	-0.33 **	-0.15	-0.09	0.09
	(0.09)	(0.09)	(0.09)	(0.10)	(0.13)	(0.11)	(0.08)	(0.12)
k =3: 3rd year	-0.22 **	0.01	-0.37 ***	-0.14	-0.31 **	-0.16	-0.09	0.06
	(0.10)	(0.10)	(0.12)	(0.11)	(0.14)	(0.12)	(0.10)	(0.14)
k =4: 4th year	-0.23 *	0.13	-0.48 ***	-0.12	-0.11	-0.35 **	-0.08	-0.32
	(0.12)	(0.13)	(0.13)	(0.18)	(0.19)	(0.16)	(0.12)	(0.20)

Notes: See notes for Table 3. *CDum1*: Dummy for households that experienced a small income drop at retirement. *CDum2*: Dummy for households that received a lump-sum retirement allowance.

Table 6. How did the impact of retirement on consumption differ among households? With low savings, a large/small income drop, expected/unexpected retirement

6-1. Only households whose head retired at some point during the observation period

A. Estimated coefficients

Retirement Dummies (*RD(k)*)	< 1 >			< 2 >		
	RD(k)	*RD(k)* × *CDum1*	*RD(k)* × *CDum3*	*RD(k)*	*RD(k)* × *CDum1*	*RD(k)* × *CDum 4*
	(a_1)	(b_1)	(c_1)	(a_2)	(b_2)	(c_2)
k =0: Year of retirement	-0.05	-0.09	-0.03	-0.29 *	0.12	0.25
	(0.14)	(0.14)	(0.15)	(0.17)	(0.17)	(0.17)
k =1: 1st year	-0.55 ***	0.16	0.17	-0.43 **	0.22	0.21 *
	(0.19)	(0.11)	(0.18)	(0.17)	(0.14)	(0.13)
k =2: 2nd year	-0.50 **	0.15	0.16	-0.36 *	0.13	0.14
	(0.21)	(0.12)	(0.19)	(0.20)	(0.15)	(0.14)
k =3: 3rd year	-0.72 ***	0.15	0.38 **	-0.47 *	0.15	0.19
	(0.25)	(0.15)	(0.20)	(0.27)	(0.19)	(0.20)
F test: Coeff. on retirement dummies = 0 for all *k*	3.44 ***	1.23	1.04	1.68	0.73	1.04
Number of obs. (of which for retiring HHs)		292 (292)			185 (185)	
Number of HHs		57			34	
Hausman test		37.5			76.2***	
R^2: Within		0.36			0.47	
Between		0.04			0.17	
Overall		0.09			0.28	

B. Derived patterns of consumption decline after retirement by household type

Income drop	< 1 > Agricultural working hours				< 2 > Medical expenditure			
	Did not increase		Increased		Increased		Did not increase	
	Large	Small	Large	Small	Large	Small	Large	Small
	(a_1)	$(a_1)+(b_1)$	$(a_1)+(c_1)$	$(a_1)+(b_1)+(c_1)$	(a_2)	$(a_2)+(b_2)$	$(a_2)+(c_2)$	$(a_1)+(b_1)+(c_1)$
k =0: Year of retirement	-0.05	-0.14	-0.08	-0.17	-0.29 *	-0.17	-0.04	0.08
	(0.14)	(0.18)	(0.13)	(0.13)	(0.17)	(0.18)	(0.18)	(0.18)
k =1: 1st year	-0.55 ***	-0.39 *	-0.38 ***	-0.22 *	-0.43 **	-0.21	-0.22	0.00
	(0.19)	(0.20)	(0.12)	(0.12)	(0.17)	(0.16)	(0.16)	(0.16)
k =2: 2nd year	-0.50 **	-0.35	-0.34 **	-0.19	-0.36 *	-0.23	-0.22	-0.09
	(0.21)	(0.22)	(0.15)	(0.15)	(0.20)	(0.21)	(0.19)	(0.19)
k =3: 3rd year	-0.72 ***	-0.57 **	-0.34 *	-0.19	-0.47 *	-0.32	-0.28	-0.13
	(0.25)	(0.27)	(0.19)	(0.19)	(0.27)	(0.28)	(0.24)	(0.23)

6-2. Including control households

A. Estimated coefficients

Retirement Dummies (*RD(k)*)	< 1 >			< 2 >		
	RD(k)	*RD(k)* × *CDum1*	*RD(k)* × *CDum3*	*RD(k)*	*RD(k)* × *CDum1*	*RD(k)* × *CDum 4*
	(a_1)	(b_1)	(c_1)	(a_2)	(b_2)	(c_2)
k =0: Year of retirement	0.11	-0.05	-0.16	-0.09	-0.06	0.16
	(0.11)	(0.12)	(0.13)	(0.13)	(0.15)	(0.15)
k =1: 1st year	-0.42 ***	0.23 **	0.11	-0.36 ***	0.22 *	0.17
	(0.16)	(0.09)	(0.16)	(0.11)	(0.12)	(0.12)
k =2: 2nd year	-0.30 *	0.17	0.08	-0.18	0.14	0.04
	(0.16)	(0.10)	(0.16)	(0.12)	(0.13)	(0.13)
k =3: 3rd year	-0.59 ***	0.20	0.35 **	-0.18	0.17	-0.01
	(0.18)	(0.12)	(0.18)	(0.15)	(0.15)	(0.15)
F test: Coeff. on retirement dummies = 0 for all *k*	4.44 ***	2.46 **		2.65 **	1.41	0.75
Number of obs. (of which for retiring HHs)		2173 (292)			2066 (185)	
Number of HHs		704			681	
Hausman test		78.4***			74.5***	
R^2: Within		0.16			0.15	
Between		0.22			0.24	
Overall		0.21			0.22	

B. Derived patterns of consumption decline after retirement by household type

Income drop	< 1 > Agricultural working hours				< 2 > Medical expenditure			
	Did not increase		Increased		Increased		Did not increase	
	Large	Small	Large	Small	Large	Small	Large	Small
	(a_1)	$(a_1)+(b_1)$	$(a_1)+(c_1)$	$(a_1)+(b_1)+(c_1)$	(a_2)	$(a_2)+(b_2)$	$(a_2)+(c_2)$	$(a_1)+(b_1)+(c_1)$
k =0: Year of retirement	0.11	0.06	-0.05	-0.10	-0.09	-0.15	0.07	0.01
	(0.11)	(0.15)	(0.10)	(0.09)	(0.13)	(0.13)	(0.13)	(0.13)
k =1: 1st year	-0.42 ***	-0.19	-0.31 ***	-0.08	-0.36 ***	-0.14	-0.19 *	0.03
	(0.16)	(0.16)	(0.07)	(0.07)	(0.11)	(0.10)	(0.10)	(0.09)
k =2: 2nd year	-0.30	-0.13	-0.22 ***	-0.05	-0.18	-0.04	-0.14	0.00
	(0.16)	(0.16)	(0.08)	(0.08)	(0.12)	(0.12)	(0.11)	(0.11)
k =3: 3rd year	-0.59 ***	-0.39 **	-0.24 **	-0.04	-0.18	-0.01	-0.19	-0.02
	(0.18)	(0.19)	(0.10)	(0.09)	(0.15)	(0.13)	(0.13)	(0.13)

Notes: See notes for Table 3. *CDum1*: Dummy for households that experienced a small income drop at retirement. *CDum3*: Dummy for households whose head's working hours in agriculture increased after retirement. *CDum4*: Dummies for households whose medical and healthcare expenditure did not increase at retirement.

Appendix A. Estimates for the growth rates of income and consumption

Table A1. Do households' income and consumption decline at retirement in Japan?

	Only households whose head retired at some point during the observation period		Including control households	
	Income	Consumption	Income	Consumption
	(i)	*(ii)*	*(iii)*	*(iv)*
RetiredDum(k)				
k =0: Year of retirement	0.08	0.04	0.15***	0.01
	(0.09)	(0.06)	(0.05)	(0.05)
k =1: 1st year	-0.64***	-0.07	-0.57***	-0.09*
	(0.11)	(0.08)	(0.06)	(0.05)
k =2: 2nd year	-0.71***	-0.05	-0.57***	-0.06
	(0.16)	(0.12)	(0.08)	(0.07)
k =3: 3rd year	-0.62***	-0.04	-0.49***	-0.08
	(0.22)	(0.16)	(0.10)	(0.09)
k =4: 4th year	-0.64**	-0.01	-0.50***	-0.04
	(0.28)	(0.20)	(0.12)	(0.12)
k =5: 5th year or more	-0.70**	-0.06	-0.50***	-0.06
	(0.35)	(0.25)	(0.15)	(0.15)
Number of HH members	0.06	0.04	0.07***	0.08***
	(0.05)	(0.03)	(0.02)	(0.02)
Dummy for child(ren) aged 0-5	-0.20	-0.20	-0.11*	-0.23***
	(0.29)	(0.21)	(0.06)	(0.06)
Dummy for child(ren) aged 6-12	-0.11	0.04	-0.05	-0.02
	(0.22)	(0.16)	(0.07)	(0.06)
Dummy for child(ren) aged 13-18	-0.39**	-0.02	-0.13**	-0.03
	(0.18)	(0.13)	(0.05)	(0.05)
Number of regular employees	0.14*	0.03	0.09***	0.03
other than household head	(0.08)	(0.06)	(0.03)	(0.02)
Number of non-regular	0.00	0.06**	0.01	0.07***
employees	(0.04)	(0.03)	(0.02)	(0.01)
Number of obs.	592	592	1986	1986
(Obs. for retiring HHs)	592	592	592	592
Number of HHs	117	117	632	632
Adj. R^2	0.228	0.032	0.161	0.054

Notes: Dependent variables are the growth rates. Standard errors are shown in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively. Dummies for the age of the household head and year dummies are included in all regressions.

Table A2. How was the consumption decline correlated with the income decline at retirement?

(Households that experienced a large income drop at retirement vs. households that experienced a small/no income drop)

	Only households whose head retired at some point during the observation period				Including control households			
Income drop	Large		Small/None		Large		Small/None	
	Income	Cons.	Income	Cons.	Income	Cons.	Income	Cons.
	(i)	*(ii)*	*(iii)*	*(iv)*	*(v)*	*(vi)*	*(vii)*	*(viii)*
RetiredDum(*k*)								
k =0: Year of retirement	-0.05	0.06	0.20	-0.01	0.05	0.01	0.28***	-0.06
	(0.15)	(0.10)	(0.13)	(0.10)	(0.07)	(0.07)	(0.06)	(0.07)
k =1: 1st year	-1.10***	-0.12	-0.06	0.00	-0.97***	-0.17**	-0.09	-0.05
	(0.19)	(0.13)	(0.17)	(0.13)	(0.07)	(0.07)	(0.07)	(0.07)
k =2: 2nd year	-1.11***	-0.13	-0.28	-0.01	-0.81***	-0.13	-0.26***	-0.02
	(0.27)	(0.19)	(0.24)	(0.19)	(0.09)	(0.10)	(0.09)	(0.10)
k =3: 3rd year	-1.07***	-0.09	-0.19	-0.05	-0.73***	-0.17	-0.21*	-0.03
	(0.37)	(0.25)	(0.32)	(0.24)	(0.12)	(0.12)	(0.12)	(0.13)
k =4: 4th year	-1.16**	-0.05	-0.08	0.10	-0.76***	-0.15	-0.18	0.06
	(0.47)	(0.32)	(0.42)	(0.33)	(0.15)	(0.15)	(0.16)	(0.17)
k =5: 5th year or more	-1.35**	-0.06	-0.09	-0.01	-0.79***	-0.16	-0.15	0.03
	(0.58)	(0.40)	(0.53)	(0.41)	(0.18)	(0.19)	(0.19)	(0.21)
Number of obs.	276	276	232	232	1670	1670	1626	1626
(Obs. for retiring HHs)	276	276	232	232	276	276	232	232
Number of HHs	44	44	43	43	559	559	558	558
Adj. R^2	0.355	0.094	0.136	-0.007	0.212	0.06	0.074	0.054

Notes: Dependent variables are the growth rates. Standard errors of coefficients are shown in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively. Dummies for the age of the household head, the number of household members, children aged 5 or younger, children aged 6 to 12, and children aged 13 to 18, as well as the number of regular employees other than the household head, the number of non-regular employees, and year dummies are included in all regressions.

Table A3. How did the impact of retirement on income and consumption differ between households with high savings and households with low savings?

(Households with a high wealth-consumption ratio vs. households with a low wealth-consumption ratio)

	Only households whose head retired at some point during the observation period				Including control households			
Wealth-consumption ratio	Below median		Above median		Below median		Above median	
	Income	Cons.	Income	Cons.	Income	Cons.	Income	Cons.
	(i)	*(ii)*	*(iii)*	*(iv)*	*(v)*	*(vi)*	*(vii)*	*(viii)*
RetiredDum(*k*)								
k =0: Year of retirement	-0.05	-0.03	0.28**	0.12	0.07	-0.05	0.25***	0.06
	(0.13)	(0.10)	(0.13)	(0.09)	(0.06)	(0.06)	(0.06)	(0.06)
k =1: 1st year	-0.66***	-0.13	-0.57***	0.02	-0.47***	-0.16**	-0.62***	-0.03
	(0.17)	(0.13)	(0.16)	(0.11)	(0.07)	(0.07)	(0.07)	(0.07)
k =2: 2nd year	-0.77***	-0.06	-0.55**	0.00	-0.46***	-0.07	-0.60***	-0.04
	(0.25)	(0.19)	(0.24)	(0.16)	(0.09)	(0.09)	(0.10)	(0.10)
k =3: 3rd year	-0.75**	-0.07	-0.38	0.06	-0.41***	-0.10	-0.48***	-0.04
	(0.33)	(0.25)	(0.32)	(0.21)	(0.11)	(0.12)	(0.13)	(0.13)
k =4: 4th year	-0.86**	-0.04	-0.31	0.08	-0.43***	-0.07	-0.49***	-0.02
	(0.42)	(0.32)	(0.41)	(0.27)	(0.14)	(0.15)	(0.16)	(0.16)
k =5: 5th year or more	-0.93*	-0.04	-0.39	0.06	-0.37**	-0.05	-0.56***	-0.04
	(0.52)	(0.39)	(0.51)	(0.34)	(0.18)	(0.18)	(0.20)	(0.20)
Number of obs.	284	284	304	304	1,678	1,678	1,698	1,698
(Obs. for retiring HHs)	284	284	304	304	284	284	304	304
Number of HHs	57	57	57	57	375	375	366	366
Adj. R^2	0.120	0.017	0.287	0.065	0.085	0.062	0.167	0.056

Notes: See notes for Table A2.

Table A4. How did the impact of retirement on consumption differ among households? With low/high savings, a large/small income drop, and with/without a lump-sum retirement allowance

A4-1. Only households whose head retired at some point during the observation period

A. Estimated coefficients

Retirement Dummies (RD(k))	< 1 > Wealth-consumption ratio < median			< 2 > Wealth-consumption ratio > median		
	RD(k)	*RD(k)* × *CDum1*	*RD(k)* × *CDum2*	*RD(k)*	*RD(k)* × *CDum1*	*RD(k)* × *CDum2*
	(a_1)	(b_1)	(c_1)	(a_2)	(b_2)	(c_2)
k =0: Year of retirement	-0.00	-0.00	-0.13	0.10	-0.15	0.10
	(0.13)	(0.14)	(0.16)	(0.12)	(0.13)	(0.13)
k =1: 1st year	-0.28	0.21	0.02	-0.06	-0.03	0.11
	(0.18)	(0.16)	(0.16)	(0.16)	(0.15)	(0.15)
k =2: 2nd year	-0.19	0.18	0.00	-0.06	-0.01	0.09
	(0.25)	(0.21)	(0.21)	(0.26)	(0.21)	(0.23)
k =3: 3rd year	-0.14	0.11	-0.04	-0.08	0.03	0.18
	(0.34)	(0.26)	(0.27)	(0.34)	(0.29)	(0.30)
k =4: 4th year	-0.27	0.43	-0.03	0.10	-0.37	0.02
	(0.44)	(0.34)	(0.35)	(0.41)	(0.37)	(0.36)
F test: Coeff. on retirement dummies = 0 for all *k*	1.51	1.03	0.27	0.70	0.96	0.30
Number of obs. (of which for retiring HHs)	260 (260)			289 (289)		
Number of HHs	57			57		
Adj. R^2	0.04			0.04		

B. Derived patterns of consumption decline after retirement by household type

Retirement allowance	< 1 > Wealth-consumption ratio < median				< 2 > Wealth-consumption ratio > median			
	No		Yes		No		Yes	
Income drop	Large	Small	Large	Small	Large	Small	Large	Small
	(a_1)	$(a_1)+(b_1)$	$(a_1)+(c_1)$	$(a_1)+(b_1)+(c_1)$	(a_2)	$(a_2)+(b_2)$	$(a_2)+(c_2)$	$(a_1)+(b_1)+(c_1)$
k =0: Year of retirement	-0.00	0.00	-0.13	-0.13	0.10	-0.05	0.20 *	0.05
	(0.13)	(0.14)	(0.18)	(0.17)	(0.12)	(0.14)	(0.11)	(0.15)
k =1: 1st year	-0.28	-0.07	-0.26	-0.05	-0.06	-0.09	0.05	0.02
	(0.18)	(0.18)	(0.19)	(0.19)	(0.16)	(0.17)	(0.14)	(0.17)
k =2: 2nd year	-0.19	-0.01	-0.19	-0.01	-0.06	-0.07	0.03	0.02
	(0.25)	(0.26)	(0.27)	(0.27)	(0.26)	(0.23)	(0.19)	(0.24)
k =3: 3rd year	-0.14	-0.03	-0.18	-0.07	-0.08	-0.05	0.10	0.13
	(0.34)	(0.35)	(0.36)	(0.35)	(0.34)	(0.31)	(0.26)	(0.33)
k =4: 4th year	-0.27	0.16	-0.30	0.13	0.10	-0.27	0.12	-0.25
	(0.44)	(0.45)	(0.45)	(0.48)	(0.41)	(0.41)	(0.33)	(0.44)

A4-2. Including control households

A. Estimated coefficients

Retirement Dummies (RD(k))	< 1 > Wealth-consumption ratio < median			< 2 > Wealth-consumption ratio > median		
	RD(k)	*RD(k)* × *CDum1*	*RD(k)* × *CDum2*	*RD(k)*	*RD(k)* × *CDum1*	*RD(k)* × *CDum2*
	(a_1)	(b_1)	(c_1)	(a_2)	(b_2)	(c_2)
k =0: Year of retirement	-0.01	-0.02	-0.12	0.08	-0.17	0.06
	(0.09)	(0.12)	(0.13)	(0.10)	(0.13)	(0.12)
k =1: 1st year	-0.29 ***	0.23 *	-0.00	-0.11	-0.01	0.10
	(0.11)	(0.13)	(0.13)	(0.13)	(0.14)	(0.14)
k =2: 2nd year	-0.12	0.15	-0.09	-0.23	0.08	0.23
	(0.15)	(0.17)	(0.18)	(0.20)	(0.20)	(0.20)
k =3: 3rd year	-0.14	0.16	-0.12	-0.32	0.18	0.31
	(0.19)	(0.22)	(0.22)	(0.25)	(0.26)	(0.26)
k =4: 4th year	-0.19	0.38	-0.12	-0.11	-0.10	0.10
	(0.23)	(0.28)	(0.29)	(0.31)	(0.34)	(0.33)
F test: Coeff. on retirement dummies = 0 for all *k*	2.76**	1.51	0.42	1.14	1.10	0.51
Number of obs. (of which for retiring HHs)	1654 (260)			1683 (289)		
Number of HHs	572			572		
Adj. R^2	0.06			0.06		

B. Derived patterns of consumption decline after retirement by household type

Retirement allowance	< 1 > Wealth-consumption ratio < median				< 2 > Wealth-consumption ratio > median			
	No		Yes		No		Yes	
Income drop	Large	Small	Large	Small	Large	Small	Large	Small
	(a_1)	$(a_1)+(b_1)$	$(a_1)+(c_1)$	$(a_1)+(b_1)+(c_1)$	(a_2)	$(a_2)+(b_2)$	$(a_2)+(c_2)$	$(a_1)+(b_1)+(c_1)$
k =0: Year of retirement	-0.01	-0.03	-0.13	-0.15	0.08	-0.09	0.14	-0.03
	(0.09)	(0.10)	(0.13)	(0.13)	(0.10)	(0.12)	(0.09)	(0.12)
k =1: 1st year	-0.29	-0.06	-0.29 **	-0.06	-0.11	-0.12	-0.01	-0.02
	(0.11)	(0.11)	(0.13)	(0.12)	(0.13)	(0.13)	(0.10)	(0.13)
k =2: 2nd year	-0.12	0.03	-0.21	-0.06	-0.23	-0.15	0.00	0.08
	(0.15)	(0.15)	(0.17)	(0.16)	(0.20)	(0.18)	(0.13)	(0.19)
k =3: 3rd year	-0.14	0.02	-0.26	-0.10	-0.32	-0.14	-0.01	0.17
	(0.19)	(0.19)	(0.21)	(0.20)	(0.25)	(0.23)	(0.18)	(0.25)
k =4: 4th year	-0.19	0.19	-0.31	0.07	-0.11	-0.21	-0.01	-0.11
	(0.23)	(0.23)	(0.26)	(0.29)	(0.31)	(0.30)	(0.22)	(0.34)

Notes: See notes for Table A2. *CDum1*: Dummy for households that experienced a small income drop at retirement. *CDum2*: Dummies for households that received a lump-sum retirement allawance.

Table A5. How did the impact of retirement on consumption differ among households? With low savings, a large/small income drop, expected/unexpected retirement

A5-1. Only households whose head retired at some point during the observation period

A. Estimated coefficients

Retirement Dummies (RD(k))	< 1 > *RD(k)* (a_1)	*RD(k) × CDum1* (b_1)	*RD(k) × CDum3* (c_1)	< 2 > *RD(k)* (a_2)	*RD(k) × CDum1* (b_2)	*RD(k) × CDum4* (c_2)
k =0: Year of retirement	-0.06	-0.01	0.03	-0.09	0.24	0.12
	(0.17)	(0.16)	(0.18)	(0.19)	(0.19)	(0.18)
k =1: 1st year	-0.25	0.19	-0.01	-0.06	0.23	0.12
	(0.26)	(0.16)	(0.24)	(0.24)	(0.19)	(0.19)
k =2: 2nd year	-0.22	0.18	0.02	0.04	0.12	0.15
	(0.36)	(0.21)	(0.33)	(0.34)	(0.24)	(0.24)
k =3: 3rd year	-0.37	0.06	0.25	0.04	0.07	0.25
	(0.47)	(0.28)	(0.41)	(0.46)	(0.31)	(0.33)
F test: Coeff. on retirement dummies = 0 for all *k*	0.32	0.70	0.21	0.15	0.61	0.20
Number of obs. (of which for retiring HHs)		242 (242)			155 (155)	
Number of HHs		57			34	
Adj. R^2		0.04			0.16	

B. Derived patterns of consumption decline after retirement by household type

Income drop	< 1 > Agricultural working hours: Did not increase, Large (a_1)	Did not increase, Small (a_1)+(b_1)	Increased, Large (a_1)+(c_1)	Increased, Small (a_1)+(b_1)+(c_1)	< 2 > Medical expenditure: Increased, Large (a_2)	Increased, Small (a_2)+(b_2)	Did not increase, Large (a_2)+(c_2)	Did not increase, Small (a_1)+(b_1)+(c_1)
k =0: Year of retirement	-0.06	-0.07	-0.03	-0.04	-0.09	0.15	0.03	0.27
	(0.17)	(0.21)	(0.15)	(0.14)	(0.19)	(0.19)	(0.19)	(0.18)
k =1: 1st year	-0.25	-0.06	-0.26	-0.07	-0.06	0.17	0.06	0.29
	(0.26)	(0.28)	(0.18)	(0.17)	(0.24)	(0.23)	(0.21)	(0.20)
k =2: 2nd year	-0.22	-0.04	-0.20	-0.02	0.04	0.16	0.19	0.31
	(0.36)	(0.38)	(0.25)	(0.25)	(0.34)	(0.34)	(0.30)	(0.29)
k =3: 3rd year	-0.37	-0.31	-0.12	-0.06	0.04	0.11	0.29	0.36
	(0.47)	(0.50)	(0.34)	(0.34)	(0.46)	(0.45)	(0.41)	(0.39)

A5-2. Including control households

A. Estimated coefficients

Retirement Dummies (RD(k))	< 1 > *RD(k)* (a_1)	*RD(k) × CDum1* (b_1)	*RD(k) × CDum3* (c_1)	< 2 > *RD(k)* (a_2)	*RD(k) × CDum1* (b_2)	*RD(k) × CDum4* (c_2)
k =0: Year of retirement	0.00	-0.00	-0.07	-0.14	0.04	0.16
	(0.12)	(0.13)	(0.14)	(0.14)	(0.15)	(0.16)
k =1: 1st year	-0.25	0.24 *	-0.05	-0.31 *	0.23	0.15
	(0.19)	(0.13)	(0.20)	(0.16)	(0.16)	(0.16)
k =2: 2nd year	-0.10	0.16	-0.08	-0.17	0.14	0.13
	(0.26)	(0.18)	(0.27)	(0.20)	(0.21)	(0.21)
k =3: 3rd year	-0.35	0.15	0.18	-0.17	0.17	0.08
	(0.33)	(0.22)	(0.34)	(0.26)	(0.27)	(0.27)
F test: Coeff. on retirement dummies = 0 for all *k*	1.05	1.50	0.43	1.23	0.79	0.32
Number of obs. (of which for retiring HHs)		1636 (242)			1549 (155)	
Number of HHs		572			549	
Adj. R^2		0.06			0.067	

B. Derived patterns of consumption decline after retirement by household type

Income drop	< 1 > Agricultural working hours: Did not increase, Large (a_1)	Did not increase, Small (a_1)+(b_1)	Increased, Large (a_1)+(c_1)	Increased, Small (a_1)+(b_1)+(c_1)	< 2 > Medical expenditure: Increased, Large (a_2)	Increased, Small (a_2)+(b_2)	Did not increase, Large (a_2)+(c_2)	Did not increase, Small (a_1)+(b_1)+(c_1)
k =0: Year of retirement	0.00	0.00	-0.07	-0.07	-0.14	-0.10	0.02	0.06
	(0.12)	(0.15)	(0.10)	(0.09)	(0.14)	(0.14)	(0.14)	(0.13)
k =1: 1st year	-0.25	-0.01	-0.30 ***	-0.06	-0.31	-0.08	-0.16	0.07
	(0.19)	(0.20)	(0.11)	(0.10)	(0.16)	(0.15)	(0.14)	(0.13)
k =2: 2nd year	-0.10	0.06	-0.18	-0.02	-0.17	-0.03	-0.04	0.10
	(0.26)	(0.27)	(0.14)	(0.13)	(0.20)	(0.20)	(0.18)	(0.17)
k =3: 3rd year	-0.35	-0.20	-0.17	-0.02	-0.17	0.18	-0.09	0.08
	(0.33)	(0.35)	(0.18)	(0.16)	(0.26)	(0.24)	(0.23)	(0.22)

Notes: See notes for Table A2. *CDum1*: Dummy for households that experienced a small income drop at retirement. *CDum3*: Dummy for households whose head's working hours in agriculture increased after retirement. *CDum4*: Dummies for households whose medical and healthcare expenditure did not increase at retirement.

Appendix B. Estimates for the food expenditures

Table B1. Do households' food expenditures decline at retirement in Japan?

	Only households whose head retired at some point during the observation period		Including control households	
	Fixed effect	Random effect	Fixed effect	Random effect
	(i)	*(ii)*	*(iii)*	*(iv)*
RetiredDum(*k*)				
k =0: Year of retirement	-0.05	0.03	-0.01	-0.00
	(0.07)	(0.07)	(0.05)	(0.04)
k =1: 1st year	-0.09	-0.00	-0.05	-0.03
	(0.07)	(0.06)	(0.04)	(0.04)
k =2: 2nd year	-0.06	0.06	0.02	0.04
	(0.08)	(0.08)	(0.05)	(0.04)
k =3: 3rd year	-0.01	0.13	0.07	0.10*
	(0.10)	(0.09)	(0.06)	(0.05)
k =4: 4th year	-0.10	0.07	-0.01	0.02
	(0.12)	(0.11)	(0.07)	(0.07)
k =5: 5th year or more	-0.18	0.05	0.01	0.05
	(0.14)	(0.12)	(0.07)	(0.06)
Number of obs.	440		1496	
(Obs. for retiring HHs)	440		440	
Number of HHs	90		463	
Hausman test	74.0***		57.8**	
R^2: Within	0.21	0.18	0.10	0.10
Between	0.00	0.08	0.05	0.28
Overall	0.00	0.18	0.03	0.26

Notes: See notes for Table 2. The number of household members, dummies for children aged 0 to 5, aged 6-12 and aged 13-18, the number of regular employees other than the household head, and the number of non-regular employees are also included as explanatory variables.

Table B2. Are households' food expenditures correlated with the income decline at retirement?
(Households that experienced a large income drop at retirement vs. households that experienced a small/no income drop)

	Only households whose head retired at some point during the observation period				Including control households			
Income drop	Large		Small/None		Large		Small/None	
	Income	Food exp.	Income	Food exp.	Income	Food exp.	Income	Food exp.
	(i)	*(ii)*	*(iii)*	*(iv)*	*(v)*	*(vi)*	*(vii)*	*(viii)*
RetiredDum(*k*)								
k =0: Year of retirement	-0.24	-0.08	0.07	-0.03	-0.04	-0.01	0.07	-0.02
	(0.21)	(0.12)	(0.25)	(0.09)	(0.09)	(0.07)	(0.08)	(0.07)
k =1: 1st year	-0.87***	-0.16	-0.12	-0.02	-0.78***	-0.11**	-0.14**	-0.00
	(0.21)	(0.12)	(0.28)	(0.10)	(0.07)	(0.05)	(0.06)	(0.05)
k =2: 2nd year	-0.88***	-0.26*	-0.47	0.05	-0.62***	-0.11*	-0.32***	0.12**
	(0.25)	(0.15)	(0.37)	(0.14)	(0.08)	(0.06)	(0.08)	(0.06)
k =3: 3rd year	-0.81**	-0.18	-0.54	0.00	-0.62***	-0.10	-0.32***	0.11
	(0.32)	(0.19)	(0.46)	(0.18)	(0.11)	(0.08)	(0.09)	(0.07)
k =4: 4th year	-0.94**	-0.29	-0.52	0.02	-0.59***	-0.15*	-0.36***	0.12
	(0.38)	(0.22)	(0.58)	(0.22)	(0.12)	(0.09)	(0.12)	(0.09)
k =5: 5th year or more	-1.15**	-0.16	-0.31	-0.14	-0.61***	-0.08	-0.32***	0.12
	(0.46)	(0.27)	(0.70)	(0.27)	(0.11)	(0.09)	(0.11)	(0.09)
Number of obs.	168	168	154	154	1,224	1,224	1,210	1,210
(Obs. for retiring HHs)	168	168	154	154	168	168	154	154
Number of HHs	28	28	27	27	401	401	400	400
Hausman test	62.3***	84.5***	53.8***	98.3***	59.2**	62.0**	56.3**	62.8**
R^2: Within	0.66	0.43	0.45	0.38	0.36	0.13	0.21	0.09
Between	0.09	0.09	0.01	0.09	0.00	0.16	0.04	0.17
Overall	0.00	0.03	0.00	0.20	0.02	0.12	0.07	0.13

Notes: See notes for Table 3.

Table B3. How did the impact of retirement on income and food expenditures differ between households with high savings and households with low savings?
(Households with a high wealth-consumption ratio vs. households with a low wealth-consumption ratio)

	Only households whose head retired at some point during the observation period				Including control households			
Wealth-consumption ratio	Below median		Above median		Below median		Above median	
	Income	Food exp.	Income	Food exp.	Income	Food exp.	Income	Food exp.
	(i)	*(ii)*	*(iii)*	*(iv)*	*(v)*	*(vi)*	*(vii)*	*(viii)*
RetiredDum(*k*)								
k =0: Year of retirement	-0.03	-0.03	-0.02	-0.08	0.01	0.06	-0.02	-0.05
	(0.19)	(0.10)	(0.16)	(0.11)	(0.08)	(0.06)	(0.07)	(0.06)
k =1: 1st year	-0.33*	-0.13	-0.57***	-0.03	-0.36***	-0.07	-0.60***	0.03
	(0.18)	(0.10)	(0.16)	(0.10)	(0.06)	(0.05)	(0.07)	(0.06)
k =2: 2nd year	-0.56**	-0.16	-0.54***	-0.06	-0.42***	-0.04	-0.57***	0.07
	(0.22)	(0.11)	(0.18)	(0.12)	(0.07)	(0.06)	(0.08)	(0.07)
k =3: 3rd year	-0.72***	-0.18	-0.21	0.09	-0.48***	-0.02	-0.39***	0.21**
	(0.27)	(0.14)	(0.23)	(0.15)	(0.09)	(0.07)	(0.10)	(0.08)
k =4: 4th year	-0.70**	-0.24	-0.38	-0.06	-0.39***	-0.03	-0.53***	0.00
	(0.35)	(0.18)	(0.27)	(0.17)	(0.11)	(0.08)	(0.12)	(0.10)
k =5: 5th year or more	-0.53	-0.28	-0.58*	-0.06	-0.27***	-0.02	-0.72***	0.11
	(0.41)	(0.21)	(0.33)	(0.21)	(0.10)	(0.08)	(0.12)	(0.10)
Number of obs.	209	209	190	190	1,265	1,265	1,246	1,246
(Obs. for retiring HHs)	209	209	190	190	209	209	190	190
Number of HHs	36	36	36	36	409	409	409	409
Hausman test	64.6***	99.0***	74.4***	103.4***	63.6**	56.0**	51.9*	62.4**
R^2: Within	0.41	0.36	0.56	0.40	0.23	0.12	0.32	0.10
Between	0.09	0.01	0.02	0.04	0.00	0.23	0.03	0.03
Overall	0.01	0.02	0.00	0.01	0.01	0.19	0.06	0.01

Notes: See notes for Table 3.

Table B4. How did the impact of retirement on food expenditures differ among households? With low/high savings, a large/small income drop, and with/without a lump-sum retirement allowance

B4-1. Only households whose head retired at some point during the observation period

A. Estimated coefficients

	< 1 > Wealth-consumption ratio < median			< 2 > Wealth-consumption ratio > median		
Retirement Dummies (RD(k))	*RD(k)*	*RD(k) × CDum1*	*RD(k) × CDum2*	*RD(k)*	*RD(k) × CDum1*	*RD(k) × CDum2*
	(a_1)	(b_1)	(c_1)	(a_2)	(b_2)	(c_2)
k =0: Year of retirement	-0.03	-0.06	0.01	-0.34 **	0.23	0.27 *
	(0.12)	(0.14)	(0.15)	(0.15)	(0.16)	(0.16)
k =1: 1st year	-0.35 ***	0.13	0.26 **	-0.11	0.20	-0.03
	(0.12)	(0.10)	(0.11)	(0.15)	(0.15)	(0.16)
k =2: 2nd year	-0.37 **	0.25 **	0.13	0.04	0.19	-0.25
	(0.15)	(0.12)	(0.12)	(0.21)	(0.21)	(0.21)
k =3: 3rd year	-0.48	0.24	0.34 **	0.04	-0.11	0.02
	(0.20)	(0.15)	(0.16)	(0.22)	(0.26)	(0.23)
k =4: 4th year	-0.49 **	0.18	0.17	-0.12	-0.98 *	-0.10
	(0.25)	(0.19)	(0.21)	(0.29)	(0.55)	(0.29)
F test: Coeff. on retirement dummies = 0 for all *k*	3.16**	1.54	1.92*	1.22	1.48	1.23
Number of obs. (of which for retiring HHs)	192 (192)			182 (182)		
Number of HHs	36			36		
Hausman test	92.4***			100.8***		
R^2: Within	0.45			0.39		
Between	0.14			0.04		
Overall	0.21			0.01		

B. Derived patterns of consumption decline after retirement by household type

	< 1 > Wealth-consumption ratio < median				< 2 > Wealth-consumption ratio > median			
Retirement allowance	No		Yes		No		Yes	
Income drop	Large	Small	Large	Small	Large	Small	Large	Small
	(a_1)	$(a_1)+(b_1)$	$(a_1)+(c_1)$	$(a_1)+(b_1)+(c_1)$	(a_2)	$(a_2)+(b_2)$	$(a_2)+(c_2)$	$(a_1)+(b_1)+(c_1)$
k =0: Year of retirement	-0.03	-0.09	-0.02	-0.08	-0.34	-0.11	-0.07	0.16
	(0.12)	(0.13)	(0.16)	(0.16)	(0.15)	(0.14)	(0.11)	(0.15)
k =1: 1st year	-0.35 ***	-0.22 *	-0.09	0.04	-0.11 **	0.09	-0.14	0.06
	(0.12)	(0.12)	(0.13)	(0.13)	(0.15)	(0.12)	(0.10)	(0.12)
k =2: 2nd year	-0.37 **	-0.12	-0.24	0.01	0.04	0.23	-0.21	-0.02
	(0.15)	(0.16)	(0.15)	(0.16)	(0.21)	(0.14)	(0.12)	(0.17)
k =3: 3rd year	-0.48	-0.24	-0.14	0.10	0.04	-0.07	0.06	-0.05
	(0.20)	(0.20)	(0.19)	(0.19)	(0.22)	(0.17)	(0.15)	(0.19)
k =4: 4th year	-0.49	-0.31	-0.32	-0.14	-0.12	-1.10 **	-0.22	-1.20 **
	(0.25)	(0.24)	(0.23)	(0.26)	(0.29)	(0.23)	(0.16)	(0.26)

B4-2. Including control households

A. Estimated coefficients

	< 1 > Wealth-consumption ratio < median			< 2 > Wealth-consumption ratio > median		
Retirement Dummies (RD(k))	*RD(k)*	*RD(k) × CDum1*	*RD(k) × CDum2*	*RD(k)*	*RD(k) × CDum1*	*RD(k) × CDum2*
	(a_1)	(b_1)	(c_1)	(a_2)	(b_2)	(c_2)
k =0: Year of retirement	0.16 *	-0.17	-0.08	-0.27 ***	0.19	0.29 ***
	(0.08)	(0.12)	(0.14)	(0.10)	(0.13)	(0.12)
k =1: 1st year	-0.12	0.04	0.09	-0.09	0.22 *	0.06
	(0.07)	(0.09)	(0.09)	(0.10)	(0.11)	(0.11)
k =2: 2nd year	-0.16 *	0.18 *	0.09	0.20	0.07	-0.23
	(0.08)	(0.10)	(0.10)	(0.14)	(0.15)	(0.15)
k =3: 3rd year	-0.24 **	0.20	0.25 **	0.32 **	-0.05	-0.17
	(0.12)	(0.13)	(0.13)	(0.14)	(0.17)	(0.16)
k =4: 4th year	-0.10	0.14	-0.01	-0.01	0.35	-0.10
	(0.15)	(0.17)	(0.18)	(0.18)	(0.29)	(0.21)
F test: Coeff. on retirement dummies = 0 for all k	3.34***	1.85	1.20	3.38***	1.30	2.25**
Number of obs. (of which for retiring HHs)	1248 (192)			1238 (182)		
Number of HHs	409			409		
Hausman test	56.7*			70.8***		
R^2: Within	0.13			0.11		
Between	0.16			0.08		
Overall	0.12			0.05		

B. Derived patterns of consumption decline after retirement by household type

	< 1 > Wealth-consumption ratio < median				< 2 > Wealth-consumption ratio > median			
Lump-sum retirement allowance	No		Yes		No		Yes	
Income drop	Large	Small	Large	Small	Large	Small	Large	Small
	(a_1)	$(a_1)+(b_1)$	$(a_1)+(c_1)$	$(a_1)+(b_1)+(c_1)$	(a_2)	$(a_2)+(b_2)$	$(a_2)+(c_2)$	$(a_1)+(b_1)+(c_1)$
k =0: Year of retirement	0.16	-0.01	0.08	-0.09	-0.27	-0.08	0.02	0.21
	(0.08)	(0.10)	(0.12)	(0.12)	(0.13)	(0.11)	(0.08)	(0.12)
k =1: 1st year	-0.12 ***	-0.08	-0.03	0.01	-0.09 ***	0.13	-0.03	0.19 *
	(0.07)	(0.08)	(0.09)	(0.09)	(0.11)	(0.09)	(0.07)	(0.09)
k =2: 2nd year	-0.16 *	0.02	-0.07	0.11	0.20 **	0.27 **	-0.03	0.04
	(0.08)	(0.09)	(0.09)	(0.10)	(0.15)	(0.11)	(0.08)	(0.12)
k =3: 3rd year	-0.24 **	-0.04	0.01	0.21 *	0.32 **	0.27 **	0.15	0.10
	(0.12)	(0.10)	(0.12)	(0.11)	(0.17)	(0.12)	(0.10)	(0.14)
k =4: 4th year	-0.10 *	0.04	-0.11	0.03	-0.01	0.34	-0.11	0.24
	(0.15)	(0.13)	(0.13)	(0.18)	(0.29)	(0.16)	(0.12)	(0.20)

Notes: See notes for Table 5.

Table B5. How did the impact of retirement on food expenditures differ among households? With low savings, a large/small income drop, expected/unexpected retirement

B5-1. Only households whose head retired at some point during the observation period

A. Estimated coefficients

Retirement Dummies (*RD(k)*)	< 1 > *RD(k)*	*RD(k)* × *CDum1*	*RD(k)* × *CDum3*	< 2 > *RD(k)*	*RD(k)* × *CDum1*	*RD(k)* × *CDum4*
	(a_1)	(b_1)	(c_1)	(a_2)	(b_2)	(c_2)
k =0: Year of retirement	0.15	-0.01	-0.25	0.01	-0.11	-0.02
	(0.20)	(0.16)	(0.21)	(0.14)	(0.15)	(0.14)
k =1: 1st year	-0.03	0.13	-0.27	-0.28 *	0.10	0.05
	(0.24)	(0.11)	(0.22)	(0.15)	(0.12)	(0.11)
k =2: 2nd year	-0.14	0.28 **	-0.19	-0.44 **	0.24 *	0.19
	(0.29)	(0.14)	(0.29)	(0.17)	(0.13)	(0.12)
k =3: 3rd year	-0.28	0.24	-0.07	-0.54 **	0.15	0.39 **
	(0.31)	(0.18)	(0.31)	(0.22)	(0.17)	(0.18)
F test: Coeff. on retirement dummies = 0 for all *k*	0.48	1.55	0.63	3.23**	1.46	1.54
Number of obs. (of which for retiring HHs)		188 (188)			176 (176)	
Number of HHs		41			34	
Hausman test		94.5***			80.6***	
R^2: Within		0.41			0.43	
Between		0.07			0.15	
Overall		0.17			0.22	

B. Derived patterns of consumption decline after retirement by household type

Income drop	< 1 > Agricultural working hours: Did not increase, Large (a_1)	Did not increase, Small (a_1)+(b_1)	Increased, Large (a_1)+(c_1)	Increased, Small (a_1)+(b_1)+(c_1)	< 2 > Medical expenditures: Increased, Large (a_2)	Increased, Small (a_2)+(b_2)	Did not increase, Large (a_2)+(c_2)	Did not increase, Small (a_1)+(b_1)+(c_1)
k =0: Year of retirement	0.15	0.14	-0.10	-0.11	0.01	-0.10	-0.01	-0.12
	(0.20)	(0.25)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.16)
k =1: 1st year	-0.03	0.10	-0.30 **	-0.17	-0.28 *	-0.18	-0.23 *	-0.13
	(0.24)	(0.24)	(0.13)	(0.12)	(0.15)	(0.13)	(0.13)	(0.13)
k =2: 2nd year	-0.14	0.14	-0.33 **	-0.05	-0.44 **	-0.20	-0.25	-0.01
	(0.29)	(0.32)	(0.16)	(0.15)	(0.17)	(0.16)	(0.16)	(0.15)
k =3: 3rd year	-0.28	-0.04	-0.35	-0.11	-0.54 **	-0.39 *	-0.15	0.00
	(0.31)	(0.35)	(0.21)	(0.18)	(0.22)	(0.23)	(0.21)	(0.18)

B5-2. Including control households

A. Estimated coefficients

Retirement Dummies (*RD(k)*)	< 1 > *RD(k)*	*RD(k)* × *CDum1*	*RD(k)* × *CDum3*	< 2 > *RD(k)*	*RD(k)* × *CDum1*	*RD(k)* × *CDum4*
	(a_1)	(b_1)	(c_1)	(a_2)	(b_2)	(c_2)
k =0: Year of retirement	0.31 **	-0.12	-0.25	0.21 **	-0.22 *	-0.12
	(0.15)	(0.13)	(0.17)	(0.10)	(0.12)	(0.12)
k =1: 1st year	0.11	0.07	-0.26	-0.07	0.02	-0.05
	(0.18)	(0.09)	(0.18)	(0.10)	(0.09)	(0.09)
k =2: 2nd year	0.03	0.15	-0.14	-0.25 **	0.17	0.17
	(0.24)	(0.11)	(0.25)	(0.10)	(0.10)	(0.11)
k =3: 3rd year	-0.06	0.20	-0.11	-0.37 ***	0.18	0.37 ***
	(0.24)	(0.14)	(0.26)	(0.13)	(0.13)	(0.13)
F test: Coeff. on retirement dummies = 0 for all k	1.20	1.55	0.90	5.34***	2.56**	3.49***
Number of obs. (of which for retiring HHs)		1244 (188)			1232 (176)	
Number of HHs		414			407	
Hausman test		55.5*			57.5**	
R^2: Within		0.13			0.14	
Between		0.15			0.14	
Overall		0.11			0.10	

B. Derived patterns of consumption decline after retirement by household type

Income drop	< 1 > Agricultural working hours: Did not increase, Large (a_1)	Did not increase, Small (a_1)+(b_1)	Increased, Large (a_1)+(c_1)	Increased, Small (a_1)+(b_1)+(c_1)	< 2 > Medical expenditures: Increased, Large (a_2)	Increased, Small (a_2)+(b_2)	Did not increase, Large (a_2)+(c_2)	Did not increase, Small (a_1)+(b_1)+(c_1)
k =0: Year of retirement	0.31 **	0.19	0.06	-0.06	0.21 **	-0.01	0.09	-0.13
	(0.15)	(0.19)	(0.09)	(0.09)	(0.10)	(0.10)	(0.10)	(0.11)
k =1: 1st year	0.11	0.18	-0.15 **	-0.08	-0.07	-0.05	-0.12	-0.10
	(0.18)	(0.18)	(0.07)	(0.07)	(0.10)	(0.08)	(0.07)	(0.08)
k =2: 2nd year	0.03	0.18	-0.11	0.04	-0.25 **	-0.08	-0.08	0.09
	(0.24)	(0.26)	(0.08)	(0.08)	(0.10)	(0.10)	(0.08)	(0.09)
k =3: 3rd year	-0.06	0.14	-0.17	0.03	-0.37 ***	-0.19	0.00	0.18 *
	(0.24)	(0.28)	(0.12)	(0.09)	(0.13)	(0.12)	(0.12)	(0.10)

Notes: See notes for Table 6.