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Panel Data Research Center, Keio University
2-15-45 Mita, Minato-ku, Tokyo 108-8345, Japan
info@pdrc.keio.ac.jp
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Abstract

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Shinya Kajitani
Department of Industrial Relations, Faculty of Social Studies, Doshisha University
Karasuma-higashi-iru, Imadegawa-dori, Kamigyo-ku, Kyoto-shi 602-8580, JAPAN
skajitan@mail.doshisha.ac.jp

Colin McKenzie
Keio University
1-25-11-910 Shirokane, Minato-ku, Tokyo, Japan
mckenzie@keio.jp

Kei Sakata
Australian Institute of Family Studies
Level 4, 40 City Road, Southbank VIC 3006, Australia
kei.sakata@aifs.gov.au

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Does Retirement Change Health Behaviors?

Shinya Kajitani
Faculty of Social Studies, Doshisha University, Kyoto, Japan
Colin McKenzie[1]
Keio University, Tokyo, Japan
Kei Sakata
Australian Institute of Family Studies, Melbourne, Australia

Abstract

The purpose of this paper is to examine the impact of retirement on health behaviors and intentions relating to those behaviors for Japanese men. The health behaviors investigated relate to alcohol and tobacco consumption, and physical exercise. This paper uses data from the first 15 waves of the Longitudinal Survey of Middle-aged and Elderly Persons (LSMEP) to estimate regression models explaining these health behaviors and intentions. An instrumental variable estimator using instruments constructed from the eligibility ages for various aspects of the Japanese pension system is used to account for the endogeneity of retirement and household income. Individual heterogeneity is dealt with by using a fixed effects estimator. Retirement has no effect on the extent to which individuals report that they will take care not to drink too much, nor smoke too much, but there is a positive impact on their resolve to engage in a sufficient amount of exercise. Retirement also leads to a decline in the proportion of respondents drinking alcohol in more than moderate amounts. The proportion of men who are smoking falls and the number of cigarettes smoked is reduced, while the proportion engaging in moderate amounts of exercise increases after retirement. Changes in income explain little of the health behaviors observed.

Keywords: retirement, alcohol, tobacco, exercise, health behaviors, health intentions, stress.

JEL codes: I12, J25

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[1] Corresponding Author: Colin McKenzie, Keio University, 2-15-45 Mita, Minato-ku, Tokyo 108-8345, JAPAN. ORCID: 0000-0001-9867-6735. Email: mckenzie@keio.jp

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Statements & Declarations

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Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Author Contributions

All three authors (SK, CM and KS) actively contributed to the planning, implementation and writing up of this research. SK is the only author with access to the data and he undertook all the data analysis including preparation of all the Tables that appear in the paper. However, all three authors were actively involved in deciding what models to estimate, how they might be interpreted, and what estimation results should be presented in the paper. CM produced the initial draft of the text of the paper, and SK and KS reviewed carefully this draft and rewrote parts of the draft. Both SK and CM have made conference presentations related to this research based on earlier versions of this paper.

1. Introduction

Aging populations in many Western countries with associated expansions of government expenditures on social security and medical items have prompted a vigorous discussion of the merits and demerits of raising pension eligibility ages (see Lalive et al. (2023) and OECD (2024)), and the impact of retirement on health outcomes (see, for example, Nishimura et al. (2018), Motegi et al. (2020), Garrouste and Perdrix (2022) and Filomena and Picchio (2023)). According to a recent survey of the literature on the impact of retirement on health outcomes, "[r]etirement leads to better self-reported health, less depression, a decrease in healthcare consumption, a decline in cognition and an ambiguous effect on physical health" (Garrouste and Perdrix (2022)). In a recent study using longitudinal data for 35 countries, Sato et al. (2023) find retirement leads to a reduction of the risk of heart disease of 2.2% points and a decrease of physical inactivity of 3.0% points. However, before we consider actual health outcomes, we worry about health behavior like smoking, drinking and exercise which are within an individual's power to control to some extent.

What are some of the possible mechanisms connecting retirement, health, and health behaviors? It is standard to associate retirement with a drop in labor income and a resulting drop in the consumption of those items that are normal goods. However, according to the life-cycle hypothesis for consumption, consumption smoothing over the life-cycle may mean that even though there are large changes in labor income, there is no large change in consumption patterns (including consumption of alcohol and tobacco) around the time of retirement provided that retirement is a predictable event (see, for example, Wakabayashi (2006) and Hori and Murata (2018) for a discussion of related issues). According to Grossman's (1972) model, retirement is likely to alter the cost-benefit calculation of investment in health, so that less investment in health may result from retirement because the benefits from this investment in the form of higher productivity and higher wages are no longer available, but of course the opportunity cost of the investment is presumably lower too (see also Galama et al. (2013)). An important change associated with retirement is time use. By definition, retirement means an individual is not working so if they have switched from full-time work to retirement they have freed up not only the time they spent at work but also the time they spend on commuting. An alternative way to look at this is a change in the way that the time is used. This change in time usage should mean there is more time available for exercise and social activities. The change to retirement may lead to a change in stress levels because there are no more work-related deadlines, and you do not have to deal with difficult work colleagues[2]. Given knowledge about the additional time they have in retirement, individuals may make resolutions to engage in healthier behavior after they retire. Communication through drinking (*Nominikeshon* in Japanese) is often said to be important in doing business in Japan whether it is drinking with your work colleagues or your business colleagues[3]. This

[2] There may be stress associated with boredom when you do not know how to use your time in retirement. The presence of grandchildren in the household may also reduce stress during retirement.

[3] There is anecdotal evidence to support this suggestion, but the statistical evidence suggests that drinking with business colleagues is not as frequent as anecdotal evidence might suggest. According to Business

drinking opportunity will disappear with retirement, so the amount of alcohol could be expected to decline for individuals for whom this business practice is important (see, for example, Motegi et al. (2016)). Cheng and Lu (2024) find that Chinese males become more risk averse after retirement, but females do not. If that finding extends to males more generally, then for males retirement may lead to reductions in risky behavior like alcohol and tobacco consumption and increases in non-risky behavior like exercise.

The purpose of this paper is to examine the impact of retirement on health behavior and intentions relating to this behavior for Japanese men using data from the first 15 waves of the Longitudinal Survey of Middle-aged and Elderly Persons (LSMEP) that covers the 15 year period from 2005 until 2019. The health behaviors investigated relate to alcohol and tobacco consumption and physical exercise. For completeness, we also analyze self-reported health and psychological distress.

What is the empirical evidence relating to the impact of retirement on health behaviors? Gorry and Slavov's (2023, table 1) survey of some existing studies finds that both inside and outside the US most studies find retirement leads to increases in physical activity, while the effects on smoking and drinking depend on the country examined and the study. Using three nationally representative datasets for the U.S., Gorry and Slavov (2023) find that retirement leads to a decrease in alcohol consumption at the intensive margin and varying impacts on exercise behaviors. Using eight waves of data from the English Longitudinal Study of Ageing (ELSA), and a fixed effect instrumental variable estimator, Leckcivilize and McNamee (2022) find that the probability of engaging in more physical activity is increased by retirement. Yan et al. (2022) estimate fuzzy discontinuity regressions using panel data from the China Health and Nutrition Survey (CHNS) from 2004 to 2015 to conduct empirical analysis to examine the association between retirement and health behaviors. They find that the transition to retirement is associated with reduced consumption of alcohol and tobacco and increased exercise. Vansweevelt et al.'s (2022) meta study of 24 papers finds that the association of retirement with overall physical activity depended on social economic status (SES) with a larger decline among adults from lower SES groups. However, for recreational physical activity, there were favorable changes for high SES status.

There are a number of existing studies that use data from the Longitudinal Survey of Middle-aged and Elderly Persons (LSMEP) to study the impact of retirement on lifestyle habits and health behavior. Two of these studies, Oshio and Kan (2017) and Kan et al. (2022), Waves 1-10 and Waves 1-8 of the Longitudinal Survey of Middle-aged and Elderly Persons, respectively, are very close to this study. Using a fixed effect

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Professionals (2023), people in the 50s go drinking 0.51 times a month with their supervisor/boss, 0.71 times a month with their business colleagues and 0.62 times a month with their subordinates. As workers get younger these frequencies rise a lot. For a sample of people in their 20s to 40s, Maido na News (2023) reports that the percentage of people who say that on average they never go out drinking in a month is 64.4%, 26.9% report once a month and 4,5% report twice a month.

instrumental variable (FEIV) estimator with instruments based on the eligibility age for the remuneration-based portion of Employee Pension Insurance (EPI) system, Oshio and Kan (2017) find that retirement has an immediate effect in improving self-rated health, reducing psychological distress and increases in exercise but no immediate impact on smoking or heavy drinking behavior. Using a regression continuity design based on the mandatory retirement age in age-based mandatory retirement schemes and splitting the sample into high school and college graduates, Kan et al. (2022) confirm the results for exercise, psychological distress and heavy drinking reported in Oshio and Kan (2017) for both groups, but the results for self-reported health and smoking depend on the educational level. Using a different Japanese panel data set, the JSTAR panel, Motegi et al. (2016) report that retirement leads to a reduction in drinking, an increase in exercise, and no change in smoking behavior.

The key findings of the paper relating to the impact of retirement are: there is no significant impact on resolutions to take care not to drink too much, nor smoke too much; there is a positive effect on the resolve to engage in a moderate amount of exercise; the proportion drinking alcohol does not change but the proportion drinking more than moderately falls; the proportion who smoke falls and the number of cigarettes smoked falls; the proportion of individuals engaging in moderate amounts of exercise increases following their retirement. In addition, falls in income explain little if any of the behavior observed.

This paper contributes to the existing literature in at least three ways. First, it examines not only actual health behavior but also an individual's intentions (resolutions) regarding their health behavior. Second, in addition to retirement it allows income to be endogenous. Finally, it uses information on both eligibility ages for receiving the fixed amount and the remuneration-based amount for the Employment Pension Insurance (EPI) system to construct instruments for retirement and income. In contrast, Motegi et al. (2016) just use the information on pension eligibility ages for receiving the fixed amount for the EPI system, and Oshio and Kan (2017) just use information on eligibility ages for receiving the remuneration-based amount for the EPI system.

The paper is structured as follows. Section 2 discusses the key features of the public pension system in Japan. Section 3 discusses the models to be estimated for health behavior and intentions related to those health outcomes, the estimation technique adopted, and the appropriateness of the instruments used in our analysis. Section 4 is devoted to a discussion of the dataset we use and the definitions of the key variables in our analysis, health behaviors and intentions, retirement status, and income. Our estimation results are presented in section 5 which is followed by a conclusion in section 6.

2. Japan's Pension System

In this section, key features of Japan's pension system are briefly introduced as they are used to construct

to the instruments used for taking account of the endogeneity of retirement decisions[4].

Japan's current public pension system consists of two subsystems: the Employee Pension Insurance (EPI, Kosei Nenkin) system for the employees of private companies and public servants, and the National Pension (NP, Kokumin Nenkin) system. From 1985, all residents of Japan aged between 20 to 59 (up to 69 for people also enrolled in the EPI) must enroll in the NP and full-time employees[5] of private companies and public servants aged up to 69 must also enroll in the EPI. Pension benefits for the NP system consist of a fixed base amount that depends on the length of time a contributor has belonged to the system, while benefits for the EPI system consist of a remuneration-based amount that depends on the length of time a contributor has belonged to the system and the amount of contributions the individual has made. Using data released by the Japanese Ministry of Health, Labour and Welfare (MHLW (2013)), we can compute that in 2005 over 60% of males enrolled in one of the pension systems were enrolled in the EPI system.

For the EPI system, pension insurance contributions are equally shared by employees and employers. For nearly all of the sample we consider, there was a minimum contribution period of 25 years before a contributor became eligible for the pension[6]. According to Kajitani and Kan (2023, p. 1021), the Pension Reform Act of 1994 incrementally increased the pensionable age for the fixed part of EPI members' pensions from 60 to 65 years for male employees starting in 2001 and in 2000, another Pension Reform Act was passed to gradually increase the pensionable age for the remuneration-based part of EPI members' pensions from 60 to 65 years for males employees, starting in 2013. For the cohorts analyzed in this paper, Table 1 indicates their pension eligibility ages following these two laws. As can be seen from Table 1, there are two important points about the eligibility ages for receiving these two components for the EPI system: (1) the two eligibility ages differ with eligibility age for the remuneration-based amount being lower; and (2) the eligibility ages have been raised over time. In contrast, for non-EPI members in the NP system the amount benefits are fixed and the pension eligibility age is 65.

In addition, there are income tests associated with EPI pension payments. For recipients aged 65 and over, the income test is based on the total of EPI pension income and labor income[7]. When this total income is less than 470,000 yen, the full EPI pension is received. Once this total income is equal to or exceeds 470,000

[4] Following Kondo and Shigeoka (2017) we treat the Elderly Employment Stabilization Law as a demand side intervention affecting firms' demands for elderly labor, so we do not discuss this law in section 2.
[5] For most of the period examined in this paper, "full-time" means working 30 hours or more per week. From 2016, "full-time" means working 20 hours or more per week with some additional conditions relating to workers in small firms working between 20 and 29 hours per week.
[6] This was shortened to 10 years for both NP and EPI by a revision to the relevant law that came into effect on 1 August 2018.
[7] That is, the NP benefits are not the subject of this income test. For EPI recipients aged less than 65, the fixed part of their pension benefits are also the subject of this income test.

yen, for every extra 100 yen of labor income, the EPI pension is reduced by 50 yen, that is, there is a claw back of 50%. Once this total income exceeds 470,000 yen plus twice the full EPI pension, the amount of the EPI pension is reduced to zero and there is then no penalty on working additional hours.

Two other parts of the Japanese pension system are enterprise pensions and private pensions, respectively. An employer may offer its employees an enterprise pension that is paid in addition to the public pension with the contribution requirements, pension eligibility requirements, and pension payments being decided by the enterprise. There are now two types of enterprise pension systems: defined contribution plans, defined benefit plans. Of course, individuals may use private financial markets to purchase pension annuities typically through life insurance companies.

3. Model

In order to investigate the impacts of retirement and income on health behaviors and related intentions, the model of interest to be estimated can be written as follows[8]:

$$Y_{it}=\alpha_1 Retirement_{it}+\alpha_2 Income_{it}+\beta X_{it}+u_{it}+v_i+w_t, \quad (1)$$

where Y_{it} is a measure of health behaviors or intentions of individual i at time t, $Retirement_{it}$ is a 0-1 dummy variable for not being in the work force (= retired) at time t that takes the value one if the individual reports not *currently* being in the workforce and zero otherwise, $Income_{it}$ is the income of the household where individual i lives, X_{it} is a vector of individual characteristics that contains the individual's marital status, age, and age*age, u_{it} is an idiosyncratic error, v_i is time-invariant individual fixed effect and w_t is an individual-invariant time fixed effect. The parameters of interest in equation (1) are α_1 and α_2.

Two of the variables we use for Y_{it} relate to the quantity of alcohol and the quantity of cigarettes a respondent consumes. In this case, equation (1) could be interpreted as a demand function for alcohol and cigarettes, respectively. Introductory micro-theory would suggest that income and the own price are

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[8] Oshio and Kan (2017) estimate an expanded version of (1), namely,

$$Y_{it}=\alpha_1 Retirement_{it}+\alpha_{21}(Age_{it}-Retirement\ Age_i)+\alpha_{22}\ Retirement_{it}(Age_{it}-Retirement\ Age_i)+\alpha_2 Income_{it}+\beta X_{it}+u_{it}+v_i+w_t, \quad (1A)$$

where Retirement Age_i is the age that the ith respondent retires at. Equation (1A) allows the time from retirement to affect health outcomes. Oshio and Kan's (2017) estimates of α_{21} are typically significant, while estimates of α_{22} are typically insignificant. We tried estimating versions of

$$Y_{it}=\alpha_1 Retirement_{it}+\alpha_{21}(Age_{it}-Retirement\ Age_{it})+\alpha_{22}\ Retirement_{it}(Age_{it}-Retirement\ Age_{it})+\alpha_2 Income_{it}+\beta X_{it}+u_{it}+v_i+w_t, \quad (1B)$$

where because we do not exclude cases of unretirement, so that the retirement age is now time dependent. The results for estimating equation (1B) using FEIV are not reported in detail because we find that the instruments tended to be "weak" and the results tended to be unstable.

important variables in explaining variations in the consumption of alcohol and cigarettes. Gallet (2007) meta-analysis of 132 empirical studies suggests that the income elasticity of alcohol consumption is positive and is larger in the long-term. The importance of including income when these the consumption of alcohol and cigarettes analysed is highlighted by Japanese-specific research. Using data from Japan's Family Income and Expenditure Survey of Japan between 1980 and 1995, Matsuda et al. (1999) report significantly negative income elasticities of tobacco, -0.41 in 1980, and -0.95 in 1995. Selvanathan and Selvanathan (2007) report income elasticities for beer and spirits for Japan over 1, and for wine of around 0.5-0.6. Over our sample period (2005-2019), the real price of cigarettes has risen significantly. However, in Japan the price of cigarettes is fixed across the country so the impact of the price of cigarettes in the "cigarette" demand fund is already taken care of by the individual-invariant time fixed effect. In contrast, the variation in the price of alcohol is rather small and most of the time series variation will be absorbed by the individual-invariant time fixed effects.

The fixed effects instrumental variable (FEIV) estimation technique is used to estimate (1) to control for unobserved heterogeneity and to deal with the potential endogeneity of decisions relating to retirement (and income) given the possibility of simultaneous determination of retirement decisions and health outcomes, for example, Galama et al. (2013), and reverse causality, namely, health status affecting retirement decisions and therefore household income, for example, Breslaw and Stelcner (1987) and Silvera et al. (2020). Even though the dependent variables in a number of cases are 0-1 dummy variables, since it is important to account for individual heterogeneity, we choose to estimate the models as linear probability models rather than using the probit or logit estimation techniques allowing for fixed effects and endogenous explanatory variables (see Wooldridge (2010)).

In equation (1) both Retirement_{it} and Income_{it} are treated as being endogenous. This paper follows the literature investigating the impact of retirement on health outcomes that uses instruments based on pension eligibility ages for the decision to retire, for example, Atalay *et al*. 2019, Bonsang *et al.* 2012, Coe and Zamarro 2011, Mazzonna and Peracchi 2012, Rohwedder and Willis 2010. When applying the FEIV technique, the models for estimated Retirement_{it} and Income_{it} in the first stage are:

$$\text{Retirement}_{it}=\gamma_{11}PA\ fixed\ part_{it}+\gamma_{12}PA\ remuneration\ based\ part_{it}+\gamma_{13}PA\ fixed\ part_{it}\text{Age}_{it}+\gamma_{14}PA\ remuneration\ based\ part_{it}\text{Age}_{it}+\delta_1 X_{it}+uu1_{it}+v1_i+w1_t, \quad (2)$$

$$\text{Income}_{it}=\gamma_{21}PA\ fixed\ part_{it}+\gamma_{22}PA\ remuneration\ based\ part_{it}+\gamma_{23}PA\ fixed\ part_{it}\text{Age}_{it}+\gamma_{24}PA\ remuneration\ based\ part_{it}\text{Age}_{it}+\delta_2 X_{it}+uu21_{it}+v2_i+w2_t, \quad (3)$$

where $PA\ fixed\ part_{it}$ is a zero-one dummy variable taking the value 1 if the respondent's age is equal to or over the pensionable age for the Employee Pension Insurance's fixed amount, and 0 otherwise, and PA

$remuneration\ based\ part_{it}$ is a zero-one dummy variable taking the value 1 if the respondent's age is equal to or over the pensionable age for the Employee Pension Insurance's remuneration-based amount, and =0 otherwise, $uu1_{it}$ and $uu21_{it}$ are idiosyncratic errors, $v1_i$ and $v2_i$ are time-invariant individual fixed effects, and $w1_i$ and $w2_i$ are individual-invariant time fixed effects. X_{it} has the same definition as for equation (1). The interaction terms in equations (2) and (3), $PA\ fixed\ part_{it}Age_{it}$ and $PA\ remuneration\ based\ part_{it}Age_{it}$ are designed to capture the possibility that the older an individual is compared to that individual's pension eligibility age, the more likely it is that that individual will retire.

The specification of equations (1)-(3) means there are two problem explanatory variables in equation (1) and four instruments available, so equation (1) is clearly over-identified with two overidentifying restrictions, so we can use Hansen's (1982) J-test to test the validity of models.

Instrument Validity

It is quite standard in the literature to construct instruments for retirement age based on features of the pension system in the country being analyzed, in particular, changes in the pension eligibility ages. For instrumental variable estimation, an instrument must satisfy three conditions: (a) it is related to the problem variable ("endogenous" variable) in the equation of interest; (b) it is unrelated to the error term in the equation of interest; and (c) (exclusion restriction) it does not appear directly as an explanatory variable in the equation of interest (Angrist and Pischke, 2009).

Using legislated changes in pension eligibility ages means that condition (b) is easily satisfied. What about condition (a)? What exactly is the connection between pension eligibility age and retirement age? Early research connecting pension eligibility ages and retirement decisions (and retirement income) includes Fields and Mitchell (1984) and Nalebuff and Zeckhauser (1984). Coile (2015) provides a survey of empirical research connecting pension eligibility ages and retirement decisions. One simple way to illustrate the connection is the consumption-retirement decision discussed in undergraduate labor economics textbooks, for example, McLaughlin (2019, pp. 105-107). The online appendix to Nakazawa (2025) provides a more sophisticated theoretical analysis that connects pension eligibility age changes and retirement decisions. In addition, using repeated cross-sectional data from the Comprehensive Survey of Living Conditions for Japan from 1986 to 2015, Nakazawa (2025) provides direct empirical evidence on the relationship between increases in the pension eligibility age for EPI remuneration-based benefits on labor market supply at the time the eligibility age changes came into effect. The unpublished first stage results for the FEIV results in Oshio and Kan (2017) estimated using panel data from waves 1-10 of the LSMEP also provide evidence supporting the connection between the pension eligibility age for EPI remuneration-based benefits on labor market supply decisions.

In the existing literature, there has been not so much debate in relation to condition (c) [exclusion restriction]. One channel for policy changes like changes in pension eligibility rules to have a direct impact on health outcomes is through forward looking behavior, namely, by individuals immediately adjusting their behavior including health investment behavior when the policy change has been announced or legislated. The existing literature has tended to implicitly ignore this possibility or when it is acknowledged assumed that these direct effects are zero or small, for example, Bound and Waidmann (2007).

In relation to the exclusion restriction, the results in Bertoni et al. (2018) can be interpreted as meaning that changes in the pension eligibility ages can also have a direct impact on healthy behavior. In their extremely interesting study using data for Italian working men aged 42-51 during the period 2001-2005, Bertoni et al. (2018) provide some evidence that changes in in the minimum retirement age can also affect healthy behaviors, regular exercise, smoking and drinking habits before actual retirement through forward looking behavior. Since the change in retirement ages in their study occurs during the sample period investigated, one interpretation of their results is that they are picking up the immediate reaction of workers to changes in eligibility conditions that they will not face until sometime in the future. Remembering that the legal changes in pension eligibility ages in Japan were made in 1994 (pension eligibility ages for EPI's fixed part) and 2000 (pension eligibility ages for EPI's remuneration-based part), and the data we use starts in 2005 (see section 4), it is reasonable to assume that the type of effects picked up by Bertoni et al. (2018) are already reflected in the healthy outcomes *before* the sample period starts in 2005.

4. Data

The Longitudinal Survey of Middle-aged and Elderly Persons (Chukounensha odan chosa, LSMEP)[9] is a nationwide population-based longitudinal survey that has been conducted annually since 2005 by the Japan's Ministry of Health, Labour and Welfare (MHLW). The subjects of the survey in wave 1 were limited to individuals aged 50-59 years at the time of the survey. If apart from the respondent to the household survey, there were other household members in the age group 50-59 years, they were also surveyed. Households were chosen randomly through stratified two-stage sampling Waves 1-5 were conducted by interviewers visiting an individual's home to request cooperation with the survey and to distribute the questionnaires which were then collected by post. From wave 6, questionnaires were distributed and collected by post. Of the 40,877 people approached to participate in this survey in Wave 1 (2005), 34,240 responded, a response rate of 83.8%. From wave 3 onwards, those individuals who participated in the previous two waves are asked whether they wish to participate in the current wave. Attrition rates[10] reported by MHLW are 7.8%

[9] Details of the LMSEP and the questionnaires for each wave in Japanese are available at https://www.mhlw.go.jp/toukei/list/29-6.html (accessed 1 December 2023). Some details of waves 7-10 and 12 are available in English at https://www.mhlw.go.jp/english/database/db-ls/ls.html (accessed 1 December 2023).

[10] From wave 3, the denominator for these attrition rates is the total number of different individuals who

(wave 2), 4.6% (wave 3), 3.8% (wave 4), 2.7% (wave 5), 8.2% (wave 6), 10.0% (wave 7), 9.1% (wave 8), 6.1% (wave 9), 6.1% (wave 10), 3.8% (wave 11), 4.1% (wave 12), 4.9% (wave 13), 4.2% (wave 14) and 4.7 % (wave 15).[11] No new respondents were added after the first wave. It is important to emphasise that a spouse's answers to questions in each wave will also appear as a separate observation in the data set if: (a) the spouse was in the age group 50-59 years as of the first wave, that is, the spouse would be eligible to sampled by the survey; and (b) the spouse has not refused to answer the questionnaire for that wave.

We use data from wave 1 (2005) to wave 15 (2019) in our analysis. Even though data is available on females, our analysis is restricted is restricted to males because we found it difficult to derive stable results for the female sample (Kondo and Shigeoka (2017) also face this problem). As Table 1 indicates, in order to construct the instruments discussed in section 3, $PA\ fixed\ part_{it}$ and $PA\ remuneration\ based\ part_{it}$, we need to know the year and month and individual is born in order to be able to determine their eligibility age for the fixed part and remuneration-based part of the EPI. Fortunately, the survey provides this information. For males who are only members of the NP system, the eligibility ages displayed in Table 1 are irrelevant.

How do we define the dependent variable in equation (1), Y_{it}? There are four sets of variables related to drinking behavior, smoking behavior, exercise, and general and mental health. For drinking behavior, we know whether or not a person is a drinker (*drinking*), the amount of alcohol consumed (*amount of alcohol consumed*), whether or not the person drinks in moderation (m*ore than moderate drinking*)[12] and whether or not the person tries not to drink too much (t*ry not to drink too much*). Similarly for smoking behavior, we know whether or not a person is a smoker (*smoking*), the number of cigarettes they smoke (*number of cigarettes*), and whether or not the person tries not to smoke too much (t*ry not to smoke too much*). For exercise related behavior, we know if the person has a habit of regular exercise (*moderate exercise*), the number of days of moderate exercise (*number of days of moderate exercise*), and whether or not the person tries to exercise moderately (*try to exercise moderately*). For general and mental health, we have a self reported general health variable (*self-rated health),* a measure of K6 (*K6*) and an indicator of whether the individual is suffering psychological distress (*psychological distress*). All these variables and the other relevant variables are defined in Table 3 which also contains descriptive statistics for the variables computed from data for the first 15 Waves.

How retirement should be defined is subject the subject of a deal of discussion in the literature. When the choice of retirement variable is limited to a not working for pay definition and self-reported retirement,

participated in the previous two waves.

[11] https://www.mhlw.go.jp/toukei/list/29-6b.html#link03 (Accessed 1 December 2023)

[12] As can be seen from Table 2, more than moderate drinking is defined as whether the person drinks more than 20g of alcohol per day. In contrast, Oshio and Kan (2017) focus on heavy drinking, whether a person drinks more than 60g of alcohol per day.

Nishimura et al. (2018) report that the impact of retirement on various health outcomes is not so sensitive to the definition of retirement. How do we define retirement here? The LSMEP questionnaire does not ask directly whether or not the respondent has retired (self-reported retirement). We use the answers to two questions to determine whether or not an individual is currently in the labor force: (1) are you *normally* engaged in paid work; and (2) do you wish to engage in paid work at the moment[13]. A respondent who answers 'no' to both these questions, that is, who is currently not in the workforce, is treated as being "retired"[14], otherwise the person is treated as being not retired. We cannot distinguish between persons who have temporarily withdrawn from the workforce and those who have permanently withdrawn from the workforce. With our definition of retirement, we do observe cases of "unretirement", that is, people who switch back to being in the workforce after a period of having withdrawn from the workforce.

Income is an important variable for this paper, so it is worth explaining how household income was computed. For unmarried individuals, we treat the income reported for the respondent as being his household's income. For married individuals, respondents are asked to report their own income and their spouse's income total pre-tax, pre-social security income, and we treat the sum of the husband's and wife's income as being the household's income. However, the questions asked about respondent's and their spouse's income in waves 1 (2005) to 3 (2007) and in waves 4 (2008) to 15 (2020) are slightly different. Prior to wave 4, individuals are asked to report their total pre-tax pre-social security premium income (including pension income) for the month of October with a direction that if they are pension recipients their pension income should be the amount they received as a pension in October which will correspond to 2 months of pension payments. From wave 4, individuals are asked to report their pre-tax pre-social security premium income (excluding public pension income) and pension income separately for the month of October. For their public pension income, they are asked to explicitly report separately the amount they received as a pension in October which will correspond to 2 months of pension payments. On the assumption that respondents in Wave 1-3 include their total October pension payment in their reported income it is possible to conclude a consistent income series across Waves 1-15 for both husbands and wives, and thus households[15].

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[13] In wave 1, this question was just do you wish to engage in paid work with no time frame specified.

[14] Oshio and Kan (2017) only use information on whether an individual is working or not (question (1)) to judge whether an individual has retired. In particular, in Wave 1, individuals who are working are treated as being not retired, the status of everybody else (those who are not working) is treated as being unknown and they excluded from the analysis. In Wave 2, individuals who are not working are treated as being retired, while individuals who are working in Waves 1 and 2 are treated as being not retired. In Wave 3, individuals who are not working are treated as being retired. In any wave, individuals who are working is always treated as being not retired. Similar rules are applied in wave 4 and thereafter. The overall impact of this definition of "retirement" is that Oshio and Kan (2017) do not observe any cases of "unretirement".

[15] It is highly likely that income computed in this way is overestimated for those respondents and spouses that receive a public pension because this definition of income includes one month of non-pension income

Our initial starting point is to impose as few selection restrictions on the sample. Our initial starting point is to restrict the sample to: (a) males; (b) those observations for which we have information on all 13 dependent variables we model as well as the explanatory variables and instrumental variables; and (c) individuals for whom there are more than one observation[16]. In addition, in order to avoid outliers in income, observations with income in the top 1% percentile are excluded. This gives a sample of 114,902 observations on 13,373 individuals. Table 2 provides detailed definitions of all the variables used in our empirical analysis as well as some simple descriptive statistics for each variable on this sample with three sample selection rules applied. For about 15% of the observations the individual is retired, even though for 32% (fixed part) or 61% (remuneration-based part) of observations individuals are eligible for at least part of the pension suggesting that retirement is occurring sometime after an individual becomes eligible for a pension. For about 32% of the observations the individual smokes and for 85% of the population the individual usually drinks some alcohol.

5. Estimation Results

In section 5.1 section, we first present the results of estimating the first stage equations for retirement and income, namely, equations (2) and (3), followed by our main results for equation (1). Some robustness checks are reported in section 5.2.

5.1 Main Results

Table 3 presents the estimates of the first stage models, equations (2) and (3). Equations (3.1) and (3.2) are the results for retirement and income, respectively, estimated on the most unrestricted sample of 114,902 observations. The first 4 variables in Table 3 are the 4 instruments being used. For both retirement and income, both variables related to the eligibility ages for remuneration-based part of the public pension are highly significant, so that raising this eligibility age decreases the probability of retirement. For retirement, the eligibility ages for the fixed part are not significant. There is no evidence that the instruments are weak (see the Cragg-Donald (1993) and Kleibergen-Paap (2006) tests, as well as the F-test of the exclusion restrictions). Perhaps not surprising and Age and Age^2 are both highly significant in explaining retirement and income.

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and two months of pension income, so that, total income is actually overestimated for those individuals receiving a pension by the amount of one month of pension income. If the sample is restricted to data from waves 4 (2008) to 15 (2020), we can compute an alternative estimate of income by computing total income for one month as one month of public pension income and one month of non-public pension income. This restriction involves a significant reduction in the sample size.

[16] Given the essential way FEIV is computed, individuals with one observation essentially drop out of the estimation sample.

These second stage estimates are then used to estimate equation (1) for thirteen different dependent variables and the results are reported in Table 4. All equations pass the Hansen J-test. An individual's resolve not to drink too much and not to smoke too much do not respond at all to retirement (equations (4.7) and (4.10), respectively), but their resolve to exercise does (equation (4.13)). Psychological distress decreases significantly as a result of retirement (equations (4.2) and (4.3)). Exercise is the only behavior where all three related variables respond significantly to retirement (equations (4.11)-(4.13)). Both the number of days of moderate exercise and the proportion of individuals engaging in moderate exercise increase significantly (equations (4.11)-(4.12)). The size of the fall in the number of cigarettes smoked as a result of retirement (-4.56) (equation (4.9)) is extremely large compared to average number of cigarettes smoked reported in Table 2 (5.7). In contrast to retirement, income is irrelevant for drinking and smoking behaviors (equations (4.4)-(4.10)), but psychological stress responds to income strongly (equations (4.2) and (4.3)).

5.2 Robustness Checks

We conduct five robustness checks, three involve imposing restrictions on the sample used in section 5.1, the other 2 involve using alternative variables for the income variable used in section 5.1.

One condition that Oshio and Kan (2017) imposed that we have not is to limit the sample to individuals who were working in Wave 1. Imposing this condition reduces the sample size by a little over 3,000 observations from 114,902 to 111,662 and the number of individuals in the sample from 13,373 to 12,942, but the qualitative results with this restriction imposed regarding the impact of retirement and income are identical (see Panel A of Table 5). Equations (3.3) and (3.4) in Table 3 report the estimates of the first stage models for this case.

As discussed in section 2, not everybody is enrolled in EPI, so using the pension eligibility ages for EPI to explain retirement decisions will be irrelevant for those individuals who are not in the EPI system. In order to determine whether an individual is likely to be in the EPI rather than NP, we need detailed information on an individual's work history including the number of hours they worked, and where they worked. This detailed information is not available in LSMEP. As indicated in section 2, individuals had to be enrolled in the system for 25 years before they could be eligible for a pension. The sample in Panel B of Table 5 is limited to males who have been employed for 20 years or more (this also excludes people in self-employment for 20 years or more). This is perhaps the closest we can get to a sample where most individuals are in the EPI system. Imposing this condition reduces the sample size substantially from 114,902 to 82,590 and the number of individuals in the sample from 13,373 to 9,183, but the qualitative results regarding the impact of retirement and income are identical (see Panel B of Table 5) with the exception of the amount of alcohol consumed which falls significantly as a result of retirement (equation (5B.5). Equations (3.5) and

(3.6) in Table 3 report the estimates of the first stage models for this case.

The motivation underlying the model in equation (1) does not allow for unretirement, so following Oshio and Kan (2017) there may some value in eliminating "unretirement observations", that is, those observations where an individual is observed to work after a period of withdrawal from the workforce, and eliminating all the observations that follow unretirement. The results for this case are reported in Panel C of Table 5. The results are essentially the same as those reported in Table 4. Equations (3.7) and (3.8) in Table 3 report the estimates of the first stage models for this case.

The final two robustness checks presented in Table 6. In Panel A, the income variable that is used in Tables 3-5, namely, that contains two months of pension income for those receiving the pension is replaced by an income variable that contains only one month of pension income for those receiving the pension and the sample is restricted to Wave 4 onwards. The number of observations falls from 114,902 to 86,062 as a result. With the exception of psychological distress (equation 6A.3), the results are essentially the same as in Table 4. In this case, psychological distress is not affected by retirement.

In Panel B, the income variable is replaced by consumption expenditure. One justification for using this variable is to take account of consumption smoothing. Another justification is that for the small number of households where there are three or more adults in the household, income is likely to be under-estimated because we only know the income of the respondent and his spouse and not the other adults, whereas consumption expenditure should cover everybody in the household. The results are essentially the same as those reported in Table 4.

6. Conclusion

We find that there is little if any evidence to support a claim that around the time they retire Japanese elderly men increase their resolve to not to smoke too much and not to drink too much. In contrast, they do increase their resolve to exercise more. In fact, they also exercise more. Both the proportion of males smoking and the number of cigarettes smoked fall as a result of retirement. For alcohol, we observe a reduction in the proportion of males drinking more than moderately. In addition, we observe significant reductions in both K6 and psychological distress suggesting that changes in the content of time use as a result of retirement may be important. Income is only relevant for K6 and psychological distress, with increases in income leading to worse outcomes.

A number of interesting issues have been left for further research. The first is the transition to retirement. This analysis has treated retirement as an on-off variable, but to nuance the retirement-non-retirement decision there is a discussion in the literature of terms like quasi-retirement and semi-retirement that

consider a two step process of retiring, namely, switching from a full-time job to a part-time job, and then switching to retirement. An alternative treatment of the transition to retirement would be to examine the impact of work hours on health behavior a la Kajitani et al. (2022). The issue of unretirement has also been ignored. The literature has suggested several possible reasons for unretirement including: caring for family members, changes (improvement) in the health status of the respondent, and unemployment insurance (see Pettersson (2014)), to temporarily receive unemployment insurance payments that have accrued while working and then to go back to work once the unemployment insurance payments run out. In addition, in our analysis, we have treated the retirement decisions of husbands and wives completely separately, but it is possible that the decision of one spouse in relation to retirement may impact on the other spouse.

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Table 1: Eligibility ages for male EPI members

Birth cohorts	Pensionable age for EPI members	
	Fixed part	Remuneration-based part
1945/4-1946/3	63	60
1946/4-1947/3	63	60
1947/4-1948/3	64	60
1948/4-1949/3	64	60
1949/4-1950/3	65	60
1950/4-1951/3	65	60
1951/4-1952/3	65	60
1952/4-1953/3	65	60
1953/4-1954/3	65	61
1954/4-1955/3	65	61
1955/4-1956/3	65	62

Source: MHLW (2022).

Table 2: Descriptive statistics

Variable Name	Definition	Number of Observations	Mean	Std. dev.	Min	Max
Self-rated health	=1 if the respondent reported his health, in general, is "very good," "good," or "rather good," and =0 if he reported it as "rather poor," "poor," or "very poor."	114902	0.808	0.394	0	1
K6 (Kessler Psychological Distress Scale)	Sum of the responses to each of the following six questions: during the past 30 days, about how often did you feel (a) nervous? (b) hopeless? (c) restless or fidgety? (d) so depressed that nothing could cheer you up? (e) that everything was an effort? or (f) worthless? For each question, 4 points were awarded for an answer of "always", 3 for "mostly", 2 for "sometimes", 1 for "slightly" and 0 for "not at all".	114902	2.839	3.759	0	24
Psychological distress	=1 if K6 is 5 or more, and =0 otherwise.	114902	0.247	0.431	0	1
Drinking	=1 if the respondent usually drinks alcohol, and =0 otherwise.	114902	0.850	0.357	0	1
Amount of alcohol consumed	Amount of alcohol consumed per month.	114902	16.515	20.616	0	150
More than moderate drinking	=1 if the respondent is usually drinking more than a moderate amount (more than 20 g of pure alcohol per day), and =0 otherwise.	114902	0.495	0.500	0	1
Try not too drink too much	=1 if the respondent tries not to drink too much alcohol, and =0 otherwise.	114902	0.411	0.492	0	1
Smoking	=1 if the respondent smokes cigarettes, and =0 otherwise.	114902	0.321	0.467	0	1
Number of cigarettes	Number of cigarettes smoked per day.	114902	5.661	9.497	0	35
Try not too smoke too much	=1 if the respondent tries not to smoke too much, and =0 otherwise.	114902	0.201	0.400	0	1
Moderate exercise	=1 if the respondent has a regular exercise habit (moderate exercise), and =0 otherwise.	114902	0.421	0.494	0	1
Number of days of moderate exercise	Number of days of moderate exercise per month.	114902	5.278	9.132	0	30
Try to exercise moderately	=1 if the respondent tries to exercise moderately, and =0 otherwise.	114902	0.521	0.500	0	1
Retirement	The survey asks the respondent whether he is usually in paid work ("Yes" [a] or "No"). Then, if he answers "No," he is asked the following question: Do you want a paid job ("Yes" [b] or "No" [c])? Assigned the value 1 if he is categorized as [c], and 0 if he is in category [a] or [b].	114902	0.152	0.359	0	1
Total income	The combined income of the respondent and their spouse, if applicable, in October (unit: 10,000 yen). Note that for pension recipients income in October includes public pension payments for two months. We exclude observations where either the respondent or their spouse (if applicable) has an income in the top 1% percentile.	114902	50.048	38.704	0	500
Total income (pension for one month)	The combined income of the respondents and their spouse, if applicable, in October (unit: 10,000 yen). Note that for pension recipients income in October includes public pension payments for one month. We exclude observations where either the respondent or their spouse (if applicable) has an income in the top 1% percentile.	86061	41.320	38.867	0	500
Household expenditure	Household expenditure (unit: 10,000 yen). We exclude respondents whose expenditure are in the top 1% percentile.	114902	28.725	14.411	0	120
Age	The respondent's age as of October 31 in the relevant year.	114902	61.453	5.097	50	73
Age squared	Age squared.	114902	3802.395	626.876	2500	5329
Spouse	Marital status.	114902	0.874	0.332	0	1
PA fixed part	=1 if the respondent's age is equal to or exceeds the pensionable age for the Employee Pension Insurance's fixed amount, and =0 otherwise.	114902	0.331	0.471	0	1
PA remuneration-based part	=1 if the respondent's age is equal to or exceeds the pensionable age for the Employee Pension Insurance's remuneration-based amount, and =0 otherwise.	114902	0.616	0.486	0	1

Note: The "Amount of alcohol consumed" is defined as the amount of alcohol consumed per month (converted to 30 days) in terms of one go (180 mL) of Japanese sake or an equivalent amount of alcohol. The questionnaire lists the equivalent amounts of alcohol as 500 ml of beer, a double whiskey (60ml), 2 classes of wine (240ml) or 110 ml of 25% proof shochu. “Moderate drinking” is defined usually drinking more than a moderate level (more than 20 g of pure alcohol per day). MHLW (undatedc) provides a formula for converting alcoholic drinks measured in ml to the amount of pure alcohol content in grams they contain. For a 500 ml bottle of beer with an alcohol content listed as 5%, the amount of pure alcohol content in grams is given by 500x0.05x0.8=20g, where 0.05 is the alcohol content by volume of beer (% proof)/100 and 0.8 is its specific gravity. For a double whiskey of 60ml using 43% proof whiskey, the pure alcohol content is 20g. For one glass of 12% proof wine (120ml), the pure alcohol content is 12g. For one go of 35% proof shochu (180ml), the pure alcohol content is 50g.

Table 3: 1st stage estimation results using total income

Sample	Males		Males who worked at Wave 1		Male employees who in Wave 1 report they have worked for 20 years or more		Excluding the data of males when and after they resumed being in the workforce after the first retirement	
The 1st stage dependent variable	Retirement	Total income	Retirement	Total income	Retirement	Total income	Retirement	Total income
	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)
PA fixed part	-0.181	-64.455***	-0.236	-67.953***	-0.187	-56.672***	-0.158	-65.996***
	[0.140]	[16.469]	[0.145]	[17.145]	[0.175]	[18.153]	[0.139]	[17.152]
PA remuneration-based part	-0.681***	-205.245***	-0.716***	-209.035***	-1.019***	-229.302***	-0.839***	-208.554***
	[0.135]	[16.236]	[0.138]	[16.923]	[0.166]	[17.777]	[0.132]	[16.776]
PA fixed part * Age	0.004	1.092***	0.004*	1.145***	0.004	0.982***	0.003	1.113***
	[0.002]	[0.258]	[0.002]	[0.269]	[0.003]	[0.284]	[0.002]	[0.269]
PA remuneration-based part * Age	0.012***	3.400***	0.013***	3.459***	0.018***	3.793***	0.015***	3.455***
	[0.002]	[0.272]	[0.002]	[0.283]	[0.003]	[0.298]	[0.002]	[0.281]
Age	-0.076***	15.550***	-0.075***	16.796***	-0.067***	15.859***	-0.079***	16.159***
	[0.018]	[2.091]	[0.018]	[2.172]	[0.022]	[2.284]	[0.017]	[2.184]
Age squared	0.001***	-0.152***	0.001***	-0.163***	0.001***	-0.157***	0.001***	-0.154***
	[0.000]	[0.018]	[0.000]	[0.018]	[0.000]	[0.019]	[0.000]	[0.018]
Spouse	-0.011	13.973***	-0.014	13.697***	-0.014	15.119***	-0.022	13.652***
	[0.015]	[1.206]	[0.016]	[1.272]	[0.019]	[1.413]	[0.016]	[1.291]
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	114,902	114,902	107,520	107,520	82,590	82,590	108,316	108,316
Number of id	13,373	13,373	12,422	12,422	9,183	9,183	13,281	13,281
Cragg-Donald (1993) Wald F statistic	43.02		41.25		44.05		49.18	
Kleibergen-Paap (2006) rk Wald F statistic	35.63		34.20		35.87		38.30	
F statistic of the exclusion restrictions	59.74***	161.9***	53.97***	150.9***	64.72***	170.2***	66.64***	142.5***

Standard errors in parentheses are adjusted for individuals.
*** p<0.01, ** p<0.05, * p<0.1

Table 4: 2nd stage estimation results using total income

2nd stage dependent variable	Self-rated health	K6	Psychological distress	Drinking	Amount of alcohol consumed	More than moderate drinking	Try not to drink too much	Smoking	Number of cigarettes	Try not to smoke too much	Moderate exercise	Number of days of moderate exercise	Try to exercise moderately
	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)	(4.7)	(4.8)	(4.9)	(4.10)	(4.11)	(4.12)	(4.13)
Retirement	0.142*	-4.508***	-0.481***	-0.058	-1.659	-0.253***	0.090	-0.155**	-4.555***	0.015	0.560***	13.688***	0.653***
	[0.083]	[0.809]	[0.099]	[0.052]	[3.389]	[0.081]	[0.100]	[0.074]	[1.600]	[0.082]	[0.112]	[2.183]	[0.114]
Total income	-0.001*	0.025***	0.003***	0.000	0.003	0.000	-0.001	-0.000	0.002	0.000	-0.001	-0.026*	-0.002**
	[0.001]	[0.005]	[0.001]	[0.000]	[0.021]	[0.001]	[0.001]	[0.000]	[0.010]	[0.001]	[0.001]	[0.014]	[0.001]
Age	0.010	-0.775***	-0.085***	-0.012	0.399	-0.026*	-0.002	-0.013	-0.563**	0.018	0.057***	1.467***	0.059***
	[0.015]	[0.144]	[0.017]	[0.010]	[0.547]	[0.015]	[0.017]	[0.013]	[0.268]	[0.014]	[0.020]	[0.420]	[0.020]
Age squared	-0.000	0.007***	0.001***	0.000	-0.008*	0.000	-0.000	0.000	0.004*	-0.000	-0.001***	-0.015***	-0.001***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.005]	[0.000]	[0.000]	[0.000]	[0.002]	[0.000]	[0.000]	[0.003]	[0.000]
Spouse	0.047***	-0.859***	-0.083***	0.004	-1.106	-0.033**	0.018	-0.018	-0.431	-0.002	0.012	-0.148	0.022
	[0.015]	[0.164]	[0.019]	[0.010]	[0.688]	[0.015]	[0.018]	[0.016]	[0.340]	[0.016]	[0.021]	[0.430]	[0.021]
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902
Number of id	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373
Hansen J statistic	0.648	2.555	1.739	3.121	1.804	2.371	2.087	3.167	3.339	0.577	0.0774	0.634	1.960
Hansen J statistic P-value	0.723	0.279	0.419	0.210	0.406	0.306	0.352	0.205	0.188	0.749	0.962	0.728	0.375

Standard errors in parentheses are adjusted for individuals.
*** p<0.01, ** p<0.05, * p<0.1

Table 5: 2nd stage estimation results using total income

Panel A: Males who worked at Wave 1

2nd stage dependent variable	Self-rated health	K6	Psychological distress	Drinking	Amount of alcohol consumed	More than moderate drinking	Try not to drink too much	Smoking	Number of cigarettes	Try not to smoke too much	Moderate exercise	Number of days of moderate exercise	Try to exercise moderately
	(5A.1)	(5A.2)	(5A.3)	(5A.4)	(5A.5)	(5A.6)	(5A.7)	(5A.8)	(5A.9)	(5A.10)	(5A.11)	(5A.12)	(5A.13)
Retirement	0.131	-4.723***	-0.492***	-0.072	-1.612	-0.251***	0.088	-0.136*	-4.577***	0.057	0.639***	14.728***	0.698***
	[0.085]	[0.848]	[0.103]	[0.053]	[3.552]	[0.084]	[0.105]	[0.077]	[1.666]	[0.085]	[0.119]	[2.309]	[0.120]
Total income	-0.001*	0.027***	0.003***	0.000	0.004	0.001	-0.001	-0.000	0.001	-0.000	-0.001*	-0.027*	-0.002**
	[0.001]	[0.005]	[0.001]	[0.000]	[0.021]	[0.001]	[0.001]	[0.000]	[0.010]	[0.001]	[0.001]	[0.014]	[0.001]
Age	0.011	-0.823***	-0.089***	-0.014	0.507	-0.023	-0.004	-0.010	-0.551*	0.020	0.068***	1.634***	0.063***
	[0.016]	[0.159]	[0.019]	[0.010]	[0.596]	[0.016]	[0.019]	[0.014]	[0.287]	[0.015]	[0.022]	[0.462]	[0.022]
Age squared	-0.000	0.008***	0.001***	0.000	-0.008	0.000	-0.000	0.000	0.004*	-0.000	-0.001***	-0.016***	-0.001***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.005]	[0.000]	[0.000]	[0.000]	[0.002]	[0.000]	[0.000]	[0.004]	[0.000]
Spouse	0.049***	-0.943***	-0.085***	0.003	-1.370*	-0.035**	0.017	-0.024	-0.632*	-0.004	0.013	-0.204	0.027
	[0.015]	[0.172]	[0.020]	[0.010]	[0.702]	[0.016]	[0.019]	[0.016]	[0.343]	[0.016]	[0.022]	[0.456]	[0.022]
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	107,520	107,520	107,520	107,520	107,520	107,520	107,520	107,520	107,520	107,520	107,520	107,520	107,520
Number of id	12,422	12,422	12,422	12,422	12,422	12,422	12,422	12,422	12,422	12,422	12,422	12,422	12,422
Hansen J statistic	0.965	2.461	1.925	3.360	3.095	4.138	2.546	2.797	3.295	0.558	0.332	1.099	2.155
Hansen J statistic P-value	0.617	0.292	0.382	0.186	0.213	0.126	0.280	0.247	0.193	0.756	0.847	0.577	0.341

Panel B: Male employees who in Wave 1 report they have worked for 20 years or more

2nd stage dependent variable	Self-rated health	K6	Psychological distress	Drinking	Amount of alcohol consumed	More than moderate drinking	Try not to drink too much	Smoking	Number of cigarettes	Try not to smoke too much	Moderate exercise	Number of days of moderate exercise	Try to exercise moderately
	(5B.1)	(5B.2)	(5B.3)	(5B.4)	(5B.5)	(5B.6)	(5B.7)	(5B.8)	(5B.9)	(5B.10)	(5B.11)	(5B.12)	(5B.13)
Retirement	0.145*	-4.673***	-0.517***	-0.047	-5.754*	-0.280***	0.100	-0.145**	-5.156***	-0.035	0.572***	13.358***	0.653***
	[0.077]	[0.759]	[0.094]	[0.047]	[3.136]	[0.076]	[0.094]	[0.069]	[1.491]	[0.077]	[0.107]	[2.091]	[0.107]
Total income	-0.001**	0.030***	0.003***	0.000	0.022	0.001*	-0.001	-0.000	0.007	0.001	-0.001*	-0.029**	-0.002***
	[0.001]	[0.005]	[0.001]	[0.000]	[0.022]	[0.001]	[0.001]	[0.000]	[0.010]	[0.001]	[0.001]	[0.015]	[0.001]
Age	-0.003	-0.830***	-0.097***	-0.015	-0.243	-0.028*	0.011	-0.005	-0.649**	0.015	0.054**	1.418***	0.065***
	[0.016]	[0.162]	[0.019]	[0.010]	[0.592]	[0.016]	[0.019]	[0.014]	[0.293]	[0.014]	[0.022]	[0.470]	[0.022]
Age squared	-0.000	0.008***	0.001***	0.000	-0.002	0.000	-0.000	0.000	0.005**	-0.000	-0.001***	-0.015***	-0.001***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.005]	[0.000]	[0.000]	[0.000]	[0.002]	[0.000]	[0.000]	[0.004]	[0.000]
Spouse	0.057***	-1.100***	-0.108***	0.012	-1.005	-0.030	0.009	-0.037*	-0.548	-0.029	0.019	-0.139	0.044*
	[0.018]	[0.207]	[0.024]	[0.012]	[0.745]	[0.020]	[0.022]	[0.019]	[0.429]	[0.019]	[0.025]	[0.522]	[0.025]
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	82,590	82,590	82,590	82,590	82,590	82,590	82,590	82,590	82,590	82,590	82,590	82,590	82,590
Number of id	9,183	9,183	9,183	9,183	9,183	9,183	9,183	9,183	9,183	9,183	9,183	9,183	9,183
Hansen J statistic	2.792	4.336	2.984	0.529	2.080	0.966	3.377	3.307	4.369	0.257	1.593	1.311	5.095
Hansen J statistic P-value	0.248	0.114	0.225	0.768	0.353	0.617	0.185	0.191	0.113	0.879	0.451	0.519	0.0783

Panel C: Excluding the data of males when and after they resumed being in the workforce after the first retirement

2nd stage dependent variable	Self-rated health	K6	Psychological distress	Drinking	Amount of alcohol consumed	More than moderate drinking	Try not to drink too much	Smoking	Number of cigarettes	Try not to smoke too much	Moderate exercise	Number of days of moderate exercise	Try to exercise moderately
	(5C.1)	(5C.2)	(5C.3)	(5C.4)	(5C.5)	(5C.6)	(5C.7)	(5C.8)	(5C.9)	(5C.10)	(5C.11)	(5C.12)	(5C.13)
Retirement	0.131*	-4.074***	-0.441***	-0.075	-1.317	-0.238***	0.066	-0.138**	-4.076***	0.008	0.466***	11.372***	0.570***
	[0.078]	[0.751]	[0.093]	[0.049]	[3.217]	[0.077]	[0.095]	[0.070]	[1.496]	[0.078]	[0.103]	[1.991]	[0.105]
Total income	-0.001*	0.025***	0.003***	0.000	-0.000	0.000	-0.001	-0.000	0.001	0.000	-0.001	-0.024*	-0.002**
	[0.001]	[0.005]	[0.001]	[0.000]	[0.022]	[0.001]	[0.001]	[0.000]	[0.010]	[0.001]	[0.001]	[0.014]	[0.001]
Age	0.008	-0.715***	-0.079***	-0.014	0.405	-0.027*	-0.008	-0.017	-0.595**	0.011	0.046**	1.216***	0.050**
	[0.016]	[0.148]	[0.018]	[0.010]	[0.582]	[0.015]	[0.018]	[0.014]	[0.278]	[0.014]	[0.021]	[0.420]	[0.020]
Age squared	-0.000	0.007***	0.001***	0.000	-0.008*	0.000	-0.000	0.000	0.004*	-0.000	-0.000***	-0.012***	-0.001***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.005]	[0.000]	[0.000]	[0.000]	[0.002]	[0.000]	[0.000]	[0.003]	[0.000]
Spouse	0.046***	-0.897***	-0.089***	0.003	-1.003	-0.033**	0.030	-0.014	-0.438	0.002	0.001	-0.324	0.018
	[0.016]	[0.174]	[0.019]	[0.011]	[0.746]	[0.016]	[0.019]	[0.015]	[0.337]	[0.016]	[0.022]	[0.426]	[0.021]
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	108,316	108,316	108,316	108,316	108,316	108,316	108,316	108,316	108,316	108,316	108,316	108,316	108,316
Number of id	13,281	13,281	13,281	13,281	13,281	13,281	13,281	13,281	13,281	13,281	13,281	13,281	13,281
Hansen J statistic	0.313	0.864	0.817	3.604	1.686	3.124	2.016	2.278	2.259	0.358	0.0771	0.132	1.846
Hansen J statistic P-value	0.855	0.649	0.665	0.165	0.430	0.210	0.365	0.320	0.323	0.836	0.962	0.936	0.397

Standard errors in parentheses are adjusted for individuals.
*** p<0.01, ** p<0.05, * p<0.1

Table 6: 2nd stage estimation results using alternatives to total income

Part A: Using total income (including pension for one month)

2nd stage dependent variable	Self-rated health	K6	Psychological distress	Drinking	Amount of alcohol consumed	More than moderate drinking	Try not to drink too much	Smoking	Number of cigarettes	Try not to smoke too much	Moderate exercise	Number of days of moderate exercise	Try to exercise moderately
	(6A.1)	(6A.2)	(6A.3)	(6A.4)	(6A.5)	(6A.6)	(6A.7)	(6A.8)	(6A.9)	(6A.10)	(6A.11)	(6A.12)	(6A.13)
Retirement	0.026	-1.245**	-0.093	-0.050	-0.841	-0.137**	-0.035	-0.142**	-3.655***	0.106	0.392***	10.086***	0.362***
	[0.071]	[0.596]	[0.075]	[0.044]	[2.845]	[0.067]	[0.088]	[0.057]	[1.198]	[0.069]	[0.095]	[1.853]	[0.091]
Total income (pension for one month)	-0.001	0.018***	0.001	0.000	-0.005	0.000	-0.001	-0.000	-0.003	-0.001	-0.000	-0.023	-0.000
	[0.001]	[0.007]	[0.001]	[0.001]	[0.033]	[0.001]	[0.001]	[0.001]	[0.014]	[0.001]	[0.001]	[0.022]	[0.001]
Age	0.010	-0.523***	-0.063***	-0.013	0.224	-0.028*	-0.014	-0.017	-0.563**	0.017	0.048**	1.197***	0.051***
	[0.015]	[0.124]	[0.015]	[0.010]	[0.541]	[0.014]	[0.018]	[0.013]	[0.259]	[0.014]	[0.020]	[0.427]	[0.019]
Age squared	-0.000	0.005***	0.000***	0.000	-0.007	0.000	0.000	0.000	0.004**	-0.000*	-0.001***	-0.012***	-0.000***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.004]	[0.000]	[0.000]	[0.000]	[0.002]	[0.000]	[0.000]	[0.003]	[0.000]
Spouse	0.044**	-0.703***	-0.061***	-0.009	-1.090	-0.019	0.034	-0.004	0.042	0.009	0.012	-0.416	0.003
	[0.018]	[0.177]	[0.021]	[0.012]	[0.740]	[0.018]	[0.023]	[0.018]	[0.391]	[0.020]	[0.025]	[0.510]	[0.023]
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	86,061	86,061	86,061	86,061	86,061	86,061	86,061	86,061	86,061	86,061	86,061	86,061	86,061
Number of id	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425	11,425
Hansen J statistic	1.674	2.543	0.990	2.158	2.719	0.550	1.628	1.984	2.686	0.152	0.722	0.0294	0.129
Hansen J statistic P-value	0.433	0.280	0.610	0.340	0.257	0.760	0.443	0.371	0.261	0.927	0.697	0.985	0.937

Part B: Using household expenditure

2nd stage dependent variable	Good self-rated health	K6	Psychological distress	Drinking	Amount of alcohol consumed	Moderate drinking	Try not too drinking	Smoking	Number of cigarettes	Try not too smoking	Moderate exercise	Number of days of moderate exercise	Try exercise moderately
	(6B.1)	(6B.2)	(6B.3)	(6B.4)	(6B.5)	(6B.6)	(6B.7)	(6B.8)	(6B.9)	(6B.10)	(6B.11)	(6B.12)	(6B.13)
Retirement	0.056	-2.056***	-0.218***	-0.055	-1.415	-0.206***	-0.001	-0.178***	-4.417***	0.049	0.456***	11.157***	0.482***
	[0.064]	[0.559]	[0.069]	[0.041]	[2.439]	[0.061]	[0.075]	[0.056]	[1.159]	[0.061]	[0.086]	[1.753]	[0.083]
Household expenditure	-0.003*	0.096***	0.010***	0.001	0.034	0.002	-0.004*	-0.000	0.018	0.001	-0.004	-0.102**	-0.007***
	[0.002]	[0.018]	[0.002]	[0.001]	[0.078]	[0.002]	[0.002]	[0.002]	[0.035]	[0.002]	[0.003]	[0.050]	[0.003]
Age	-0.004	-0.398***	-0.045***	-0.011	0.492	-0.018	-0.017	-0.015	-0.512**	0.022*	0.041**	1.071***	0.032*
	[0.015]	[0.124]	[0.015]	[0.009]	[0.522]	[0.014]	[0.017]	[0.012]	[0.252]	[0.013]	[0.019]	[0.403]	[0.018]
Age squared	-0.000	0.004***	0.000***	0.000	-0.008**	0.000	0.000	0.000	0.004**	-0.000*	-0.000***	-0.012***	-0.000***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.004]	[0.000]	[0.000]	[0.000]	[0.002]	[0.000]	[0.000]	[0.003]	[0.000]
Spouse	0.049***	-0.907***	-0.088***	0.002	-1.215*	-0.036**	0.021	-0.020	-0.488	-0.002	0.013	-0.085	0.026
	[0.015]	[0.158]	[0.018]	[0.010]	[0.704]	[0.016]	[0.019]	[0.016]	[0.346]	[0.016]	[0.021]	[0.426]	[0.021]
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902	114,902
Number of id	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373	13,373
Hansen J statistic	0.312	0.527	0.519	2.894	1.617	1.642	1.446	3.835	3.094	0.759	0.0604	0.0846	1.117
Hansen J statistic P-value	0.856	0.768	0.771	0.235	0.446	0.440	0.485	0.147	0.213	0.684	0.970	0.959	0.572

Standard errors in parentheses are adjusted for individuals.

*** p<0.01, ** p<0.05, * p<0.1