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Household Saving, Health, and Healthcare Utilization in Japan

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Abstract

We explore the effects of health and healthcare utilization on household saving and financial portfolios using data from the Japanese Household Panel Survey and the Keio Household Panel Survey. Poor psychological well-being is found to be associated with lower levels of savings and smaller financial portfolios, whereas associations with poor physical health are largely absent. Significantly, our findings do not support the hypothesis that poorer physical health is associated with savings accumulation. In contrast, healthcare utilization in the form of hospital visits, hospitalization, and health screening is associated with greater savings and larger financial portfolios. This suggests that healthcare based incentives to accumulate savings and financial wealth are related to channels associated with investment in health.

JEL Classification: C33; C35; D14; G11; I10.

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1 Introduction

Household saving has been the subject of considerable attention in the academic literature and policymaking circles. Particular interest has focused on the motivation to save, which has been investigated in a well-established empirical literature.[1] More recently, consideration has been given to the decline in household saving experienced in many developed countries. The case of Japan is particularly interesting as the saving rate turned negative in 2014 for the first time since 1955, when comparable data was first collected.[2] Whilst the Japanese household saving rate has been falling since the 1980s, the most recent decline stands in sharp contrast to the mid-1970s, during which almost a quarter of income was saved by households.[3] Understanding the drivers of saving in Japan is therefore of considerable importance. This is particularly so given the social and economic repercussions in Japan that are likely to arise as a result of its aging population and the sustained fall in fertility (MacKellar et al. 2004). As acknowledged by the Japanese government in 2014: 'With the net savings by households and the corporate sector on a declining trend, the current account surplus would structurally diminish and we will be forced to rely on foreign investment to fund our national debt without a steady reduction in the budget deficit' (Cabinet Office of Japan 2014, p.4).

This paper extends the literature on saving by investigating its relationship with health and healthcare utilization in Japanese households. Very few contributions have explored these relationships in the context of Japan, which is characterized by a system of universal health insurance coverage. Specifically, we explore the association between household saving, psychological well-being, physical health, and healthcare utilization using household level data from the *Keio Household Panel Survey* (KHPS) and *Japanese Household Panel Survey* (JHPS). Hence, our comprehensive analysis explores the effects of health status as well as the effects of investments in health as captured by healthcare utilization (see the seminal

[1] An excellent overview of the literature on household saving is provided by Browning and Lusardi (1996).

[2] See https://www.japantimes.co.jp/opinion/2015/02/13/editorials/negative-savings-rates-loom/. Retrieved on December 29, 2018.

[3] Braun, Ikeda, and Joines (2009) show that in the 1990s, Japan's aging population accounted for between two to three percentage points of the fall in the Japanese saving rate. They argue that for the rest of the 21st century, the average value of the Japanese saving rate will not rise above 5%, which is exceptionally low by historical standards.

contribution by Grossman 1972).

The saving motive and its relationship with health has been the focus of numerous studies, the majority of which use US data and find evidence in support of the hypothesis that individuals engage in precautionary saving to self-insure against future health events (Edwards 2008; Lusardi 2001). This finding is perhaps unsurprising given that unlike other high-income countries such as Japan, the US does not have a system of universal health coverage, and US households are more susceptible to high out-of-pocket expenses (Bauer, Hicks, and Casselman 2018).[4]

As a counterpoint to the above studies, Guariglia and Rossi (2004) analyse data from the 1996 to 2000 waves of the *British Household Panel Survey* (BHPS), and find that for the UK, where healthcare is typically free at the point of service, individuals do not use precautionary saving as a means to self-insure against the risks of unanticipated private healthcare costs, which may be incurred whilst awaiting public treatment. In relation to this finding, Atella, Rosati, and Rossi (2006) found that major changes in the Italian healthcare system from 1985 to 1996, which led to households paying a greater share of out-of-the-pocket medical expenses, increased precautionary saving.

Unlike the UK and Italy, which have a 'national health service' (hereafter NHS) model of publicly financed healthcare, the Japanese healthcare system provides universal coverage through a system of mandatory social insurance.[5] Like the NHS model, this form of coverage lowers an individual's exposure to substantial future health costs, meaning that the incentive to accumulate precautionary savings should be reduced. This line of reasoning aligns with van Ooijen, Alessie, and Kalwij (2015), who in the context of the Netherlands note that: 'The almost complete coverage of the health- and long-term care insurance system makes precautionary saving less necessary' (p.355). However, depending on the type of out-of-pocket costs that households might still be expected to pay, such an incentive might not be

[4] Bauer, Hicks, and Casselman (2018, p.2) describe universal coverage as a system where '...all people have access to the necessary services without putting themselves through substantial financial hardship'.

[5] Other countries that have a NHS health system include Denmark, New Zealand, Norway, and Sweden. In contrast, Japan has a similar system to countries such as Germany, France, Belgium, and the Netherlands, where 'major health shocks are covered by the public health system, but individuals may face expenditures for health care partially covered (co-payments) or not reimbursed by the public scheme' (Paccagnella, Rebba, and Weber 2013, p.289).

eliminated completely.

This suggests that the structure of Japanese household financial portfolios, which include savings, might still be affected by uncertainties associated with health risks, albeit to a lesser extent than countries with healthcare systems like the US.[6] In relation to this point, Atella, Brunetti, and Maestas (2012) analyse the *Survey of Health, Aging and Retirement in Europe* (SHARE) for high-income European economies. Interestingly, their findings suggest that in countries without a publicly financed NHS system, households are more likely to be discouraged from holding risky financial assets. This is due to households being less protected against the risk of unexpected health expenses. Significantly, the non-NHS countries considered in their study all have mandatory social health insurance systems like the Japanese healthcare model.

In addition to physical health, mental health may influence saving behavior. The number of studies that consider the relationship between mental health or psychological distress and financial decision-making is small relative to those focusing on physical health. Bogan and Fertig (2013, p.957) state: 'while theory strongly suggests that mental health could affect investment decisions, no empirical assessment of this issue exists'. These authors (Bogan and Fertig 2013) argue that mental health can impact on household portfolio allocation decisions through several distinct channels; specifically through an individual's cognitive ability, their ability to regulate mood and emotions, and behavioural factors such as individual risk preferences and discount rates. Using data from the US *Health and Retirement Survey* (HRS), where respondents are adults aged fifty years or above, they find that mental health influences the decision to hold safe financial assets such as savings, through reducing financial risk taking. The distinction between physical and mental health is also highlighted in Bogan and Fertig (2018), who use the US *Panel Survey of Income Dynamics* (PSID) and the HRS to

[6] Although beyond the scope of this study, we note that in 2000, the Japanese government introduced a long-term healthcare (LTC) social insurance system to address the increasing cost of long term healthcare provision. 50% of the funding derives from tax revenues, with the remainder comprising premiums and co-payments from individuals aged forty years or more (Rhee, Done, and Anderson 2015). Whilst those needing such care may still face out-of-pocket expenses, Mitchell, Piggott, and Shimizutani (2004, p.26) note that consumers are 'quite well protected against catastrophic LTC costs.' For a comparison of long-term healthcare in England and Japan, see Curry, Castle-Clarke, and Hemmings (2018); for a comparison with Germany and South Korea, see Rhee, Done, and Anderson (2015).

investigate the impact of mental health on retirement savings. Psychological distress is found to reduce the probability of holding retirement accounts by up to twenty-four percentage points, with the share of retirement savings as a proportion of a financial portfolio falling up to sixty-seven percentage points. The present contribution is to the best of our knowledge the first to explore the relationship between psychological well-being and saving behavior using micro-data on Japanese households.

Whilst there exists a well-developed literature on saving in Japanese households, studies which explore its relationship with health and healthcare utilization are sparse. Nevertheless, there exist a number of important studies that provide a general overview of patterns of Japanese household saving behavior, as well as exploring the motives underlying the decision to save. Such contributions are exemplified by Kitamura and Takayama (1994), Horioka and Watanabe (1997), and Kitamura, Takayama, and Arita (2001). In the latter study, the authors use data from the *National Survey of Family Income and Expenditure* from 1984, 1989, and 1994, and uncover a marked decline in the propensity of Japanese baby-boomers to save after 1989. Hayashi (1997) finds that the rate at which Japanese households save is significantly lower than generally thought, and further, that Japanese household wealth accumulation begins early, persisting until very late on in the life-cycle. Other contributions have also investigated the determinants of Japanese saving behavior in the context of bequests (Hayashi, Ando, and Ferris 1988), as well as exploring the disparity between saving rates in the US and Japan (Hayashi, Ito, and Slemrod 1988). Moreover, Aizawa and Helble (2015) use KHPS data to explore the extent to which home ownership is affected by health conditions and health related behavior. Home ownership is associated with better health states, and is positively correlated with healthcare expenditure. The authors suggest that respondents who attend voluntary medical screenings more frequently do so as a means to invest more in their future health.

Our findings generally indicate a significant association between our respective health and healthcare utilization measures, and the level of household savings and total financial assets. This association exists across the distributions of savings and total financial assets, and extends to the composition of a household's financial portfolio.

The paper proceeds as follows. Section 2 describes the data while Section 3 presents the random effects Tobit analysis. Section 4 extends the Tobit analysis by considering effects across the distributions of savings and total financial assets using censored quantile regression analysis. Section 5 explores how our measures are associated with portfolio re-balancing effects; here, fractional regression models (Papke and Wooldridge 1996) are jointly estimated with the Tobit specifications used in Section 3 to simultaneously capture the size and composition effects of health and healthcare utilization on a household's financial portfolio. Finally, Section 6 concludes.

2 Data

Our data is drawn from two Japanese household panel surveys, namely the JHPS and KHPS. Both surveys are conducted by the Panel Data Research Center at Keio University using the drop-off and pick-up method, and have been used relatively sparingly in the household finance literature. Respondents are selected by a stratified two-stage random sampling procedure from all eight regions of Japan, and the sample size for each region is determined according to the share of its population in the National Residents Register. The KHPS has been conducted annually since 2004, whereas the JHPS was established in 2009.[7] Each survey collects detailed information relating to respondents' socio-economic status, financial position, and personal characteristics. Although the JHPS and KHPS run in parallel to each other, and in many cases ask identical questions, the JHPS has a greater focus on education and healthcare. Nevertheless, it still shares a number of common health and healthcare related questions with the KHPS. We analyse data from the 2005-2018 waves of the KHPS, resulting in information relating to $5,063$ households, and $34,407$ household/year observations. The JHPS sample covers the years from 2009-2018, and is based on information relating to $3,131$ households, resulting in $18,849$ household/year observations.[8] Finally, the response rates for both the

[7] For more information about the sampling methods used, see: `https://www.pdrc.keio.ac.jp/en/paneldata/datasets/jhpskhps/`.

[8] As our analysis is conducted at the household level, all households are included regardless of the employment status of the head of household. Our approach is in line with existing studies on saving in Japan such as Ito, Takizuka, and Fujiwara (2017), Fujiki, Hirakata, and Shioji (2012), and Hayashi, Ando, and Ferris

KHPS and JHPS samples are very high, averaging at 92.4 and 90.1, respectively. This suggests that attrition is very low, and attrition bias is unlikely to be an issue.

2.1 Saving and financial assets

KHPS and JHPS respondents are asked to self-report the value of the household's financial assets in two distinct categories, namely 'deposits' and 'securities'. This allows us to identify two 'stock' measures of household saving. Our first measure treats deposits as the stock of savings. Specifically, the stock of savings held at the time of the interview is the value of: postal savings certificates; national and regional (e.g., Shinkin) bank holdings of time deposits, installment savings and ordinary deposits; company deposits; gold investment and savings accounts; and wealth held in the form of medium-term government bond funds. The financial assets in this category are relatively risk free. Our second measure takes the value of a household's total financial assets held at the time of the interview, and is thus defined as savings plus securities, where securities comprise: shares (reported at market value); bonds (at par value); stock investment trusts (market value); corporate and public bond investment trusts (market value); and loans in trust and money in trust (par value). Compared to the measure of the stock of savings, securities are higher risk and held by relatively fewer households. We explore how our health and healthcare utilization measures are associated with both the stock of saving and total financial assets.[9]

Table B.1 in the Online Appendix presents summary statistics relating to our dependent variables. Panel A reports that for our respective samples, the average level of household savings is approximately 8.2 (8.6) million yen for KHPS (JHPS) respondents; for total financial assets, this figure rises to approximately 9.9 (10.7) million yen. In Panel B, summary statistics corresponding to natural log transformations of these variables are presented, which are explicitly modelled in Sections 3, 4, and 5. Following the existing literature, log transformations were only applied to households with savings and total financial assets greater

(1988).

[9]All variables are denominated in Japanese yen, and the values are reported in real terms, having been adjusted using the 2018 price level. The values of assets such as land and housing are not included in the financial asset categories in the KHPS and JHPS. Such assets are accounted for by including net worth in our modelling approach, as detailed below.

than zero, and households reporting zero savings or no total financial assets were assigned a zero.[10] Approximately 22 (21) % of KHPS (JHPS) respondents report having no savings at all, whereas around 21 (20) % of KHPS (JHPS) respondents report having no financial assets.[11] In comparison, Bricker et al. (2017) report that in 2013 only 5.5% of US households failed to hold any financial assets. Similarly, in Great Britain, in 2016, 98% of households held some form of formal financial asset (*Wealth and Assets Survey*, Office for National Statistics). This further highlights the importance of exploring financial asset holding in Japan due to significant differences with similarly developed OECD countries.

2.2 Health and healthcare utilization measures

Our health measures comprise indices of psychological well-being and physical health, and information relating to body mass index (BMI). These measures are considered alongside healthcare utilization measures that relate to treatment provision, health screening, and treatment costs. Other than the treatment cost variable, which in the case of a married respondent captures the joint cost of treatment faced by the head of household and the spouse, all measures pertain to the respondent, an approach that is standard in the literature.[12] Full details of the survey questions on which our health measures are based are provided in Table 1, and the summary statistics and the distributions associated with our constructed measures are presented in Table B.2 and Figures A.2 to A.6 in the Online Appendix, respectively.

We construct two indices that respectively capture physical health and psychological well-being. Our approach is closest to Besstremyannaya (2015), who constructs a single index of physiological distress based on the JHPS responses that form the basis of our two separate indices. In constructing two indices, we therefore distinguish between questions that relate

[10] Figure A.1 in the Online Appendix presents histograms for these series.

[11] Similar figures are found in other surveys for Japan. For example, the *Financial Literacy Survey*, conducted by the Central Council for Financial Services Information, reports that the percentage of households who do not have any financial assets is 18%, 14%, and 13%, in 2011, 2016, and 2019, respectively. Similarly, the *Comprehensive Survey of Living Conditions* reports that the percentage of household with no financial assets is 10%, 16%, and 15% in 2010, 2013, and 2016, respectively. In addition, the saving rate in Japan has declined in recent years. OECD data shows that the saving rate in Japan was the second highest (22.8%) among OECD countries in 1975, with this rate dropping to 2.4% in 2015.

[12] The respondent's spouse is the only other household member for whom the health and healthcare utilization variables are available.

to an individual's physical and psychological condition.[13] The questions used to construct our two general health indices are comparable to those which form the basis of the 12-item General Health Questionnaire (GHQ-12) (Goldberg 1972; Goldberg et al. 1997) and Kessler scales (Kessler et al. 2003). The questions assume the general form: 'Do you ever experience the following these days?' Panel A of Table 1 lists the items used. Specifically, respondents are asked to report a range of physical and mental health symptoms. The physical health and psychological well-being measures are explicitly separated to explore whether they have distinct associations with household saving. Similar to the GHQ-12 likert score, each response is given on a four point scale: 3, 'often'; 2, 'sometimes'; 1, 'almost never'; and 0, 'never'.[14] The resulting psychological well-being index has a scale ranging from zero to nine, where higher values of this index are indicative of greater levels of psychological distress. For physical health, the index ranges from zero to eighteen. In line with the psychological well-being measures, higher values correspond to poorer physical health.[15]

For the JHPS, we exploit an objective measure of health, namely, BMI, which is defined as weight in kilograms divided by height in metres squared. It is indicative of a range of health outcomes, including cardiovascular disease and all-cause mortality.[16] The sample average for BMI is 23kg/m^2, a value that is generally considered healthy. This finding aligns with Maruyama and Nakamura (2015), who stress that when compared to other high income countries, the Japanese have lower BMI, and are characterized by considerably lower rates of obesity.

[13] To explore the validity of this approach, we investigated whether using the set of questions to create two distinct indices is appropriate using factor analysis. The results suggest that the health conditions in the data load onto two factors in line with the construction of the two measures, suggesting that the responses to the questions do capture two distinct underlying unobserved health outcomes.

[14] We also adopted an approach similar to the GHQ12 caseness score, whereby we dichotomized the responses to each question, and then summed the resulting binary indicators. Our findings are robust to using this alternative approach.

[15] A number of studies show that because physical and mental health indices only capture part of an individual's true physical or mental health, they are susceptible to measurement error. This typically manifests itself in the form of a model's estimated parameters for these indices being downward biased (see, for instance, Bound 1991). Such downward bias may serve to underestimate the effect of health and healthcare utilization on financial behaviour.

[16] In our analysis, BMI enters the model as a continuous variable. We also replicated our analysis using binary variables to capture the World Health Organization (WHO) weight classifications indicating underweight ($BMI < 18.5$ kg/m^2), over-overweight (BMI $25 - 30$ kg/m^2), and obese ($BMI > 30$ kg/m^2) (with normal weight, 18·5–24·9kg/m^2, being the omitted category), and obtained similar results.

For the JHPS, we also have additional information relating to out-of-pocket treatment costs. Treatment costs correspond to expenditures made by the household for treatments at healthcare providers, which includes the cost of medicines. Out-of-pocket health expenditures have been used in a variety of contexts to measure healthcare utilization, and arguably reflect the health risks confronting the household (see, e.g., Baird 2016).

Turning to healthcare utilization, which captures investments in health, the variable relating to hospitalization and medical treatment was generated from the responses to the question: 'Did you receive medical treatment or were you hospitalized last year?' with the potential responses being: 'no health problems'; 'had symptoms, but took no action'; 'treatment at hospital or clinic'; 'was hospitalized'; 'purchased over-the-counter medicine'; and 'other'. These responses were collapsed into three variables indicating if the individual had: no health problems, did not act on a health problem or purchased over the counter medicine; received treatment at a hospital or clinic; and, finally, whether the individual was hospitalized. For the KHPS (JHPS), 43% (46%) of individuals had no health problem, 52% (49%) received treatment, and 5% (5%) of individuals reported being hospitalized.

The next healthcare utilization variable concerns whether an individual underwent medical screening. Specifically, respondents were asked: 'Did you receive a physical examination or cancer screening last year?' Panel D of Table 1 presents the available responses to this question. If a respondent answers in the affirmative, a value of one is assigned, and a zero otherwise. The types of screening in Panel D are not mutually exclusive, and are markedly different in cost and scope. Most respondents (52%), as presented in Table B.2 in the Online Appendix, report undergoing periodic screening in the past year, which is free, and thus not associated with out-of-pocket medical expenses. All Japanese residents are invited to attend this form of screening each year. For large employers, there is a legal requirement to ensure that all employees attend this type of screening. The combination of these factors may account for the high rate of affirmative responses for this form of screening, which entails individuals undergoing basic procedures such as: the recording of body measurements, BMI, and blood pressure; and hearing and eyesight tests. The type of and number of tests included in the basic screening increase with age. After reaching 35 years of age, the additional screenings may include, for example, blood tests and more involved procedures such as a barium meal.

In contrast to periodic screening, fewer respondents report undergoing multiphasic screening (11%) and cancer screening (15%). Despite having similar frequencies, these forms of screening differ from each other in a number of ways. Unless directed by a physician to do so, in which case the costs for the recommended tests would be mostly covered by insurance, individuals choosing to undergo multiphasic screening are expected to pay the full cost. This form of screening is significantly more comprehensive and extensive in scope than annual periodic screening, and depending on the type of multiphasic screening selected, may lead to substantial out-of-pocket costs.

In contrast, cancer screening will typically be performed as the result of a referral by a physician (in which case the majority of costs would be borne by the insurer), or, due to an individual participating in a national or municipal level screening programme, which will in turn be associated with relatively minor out-of-pocket expenses. The 'Other screening' category is similar to that for 'Cancer screening', in that an individual will partake if directed by a physician. The types of screening undertaken here correspond to medical investigations not related to cancer, and may include, for instance, bone density scans and blood tests for non-cancerous related conditions.

3 Tobit analysis

This section investigates how health and healthcare utilization are associated with household savings and total financial assets using Tobit analysis. In addition to the health and healthcare utilization measures, we include a set of standard control variables corresponding to head of household and household characteristics, including education, occupation, income, net worth, and region. Full definitions and summary statistics for our variable set are provided in Table B.3 of the Online Appendix; additional summary statistics split by age category are presented in Table B.4 in the Online Appendix.[17] To facilitate comparisons with

[17] We are grateful to a referee for suggesting the inclusion of occupation to help control for socioeconomic behavioural differences related to health insurance. Japanese healthcare is characterized by a framework of

the existing literature, we initially exploit the panel element of our data by using a random effects Tobit model, an approach that is common in the household finance literature (see, e.g., Guariglia and Rossi 2004).[18] Specifically, we estimate a set of specifications based on an equation of the form

$$y_{it}^{*} = \mathbf{x}_{it}'\gamma + \mathbf{h}_{it}'\phi + \varepsilon_{it}, \quad \varepsilon_{it} = \lambda_i + e_{it}, \tag{1}$$

such that

$$y_{it} = g\left(\mathbf{x}_{it}'\gamma + \mathbf{h}_{it}'\phi + \varepsilon_{it}\right) = \begin{cases} 0 & if \quad y_{it}^{*} \leq 0 \\ y_{it}^{*} & if \quad 0 < y_{it}^{*} \end{cases} . \tag{2}$$

In expressions (1) and (2), y_{it}^{*} is a latent variable, which corresponds to the observed dependent variable y_{it}, $\mathbf{x}_{it}$ is a vector of control variables, $\mathbf{h}_{it}$ is a vector of health and healthcare utilization measures, and γ and ϕ are the unknown population parameters of interest. The health and healthcare utilization measures in $\mathbf{h}_{it}$ vary across specifications, whilst the elements of $\mathbf{x}_{it}$ remain fixed. To account for the panel nature of the data, ε_{it} is decomposed such that λ_i is a time-invariant unobserved fixed effect, and $e_{it} = N(0, \sigma_e^2)$ is an independent and identically distributed random disturbance term. $t = 1, 2, ..., T$ denotes the year of the survey, and $i = 1, 2, ..., N$ denotes the household. As is common in the non-linear panel data literature, given that these unobserved heterogeneity terms are (potentially) correlated with the observed ones, the correction proposed by Mundlak (1978) is applied, which entails

universal health insurance coverage (see Sakamoto et al. 2018). For those out of the labour market plus the self-employed, this takes the form of National Health Insurance (NHI), a government health insurance scheme. The JHPS and the KHPS (from 2009 onwards) include the total monthly NHI premium for all family members. Employees are covered by the Work Place Health Insurance System (WPHIS), with the premium cost split between the employee and the employer. Unfortunately, the JHPS and KHPS do not include information on the premium associated with the WPHIS. Hence, the inclusion of the occupation controls is designed to control for its effects. For the available years, the NHI premium is generally statistically insignificant in relation to saving behaviour, and our results are robust to the inclusion of this variable.

[18] Alternative two-part modelling approaches, such as the double hurdle approach, which distinguishes between the decision to save and the amount of savings held, are not used given the challenge of finding a suitable and convincing instrument in the JHPS and KHPS. For this reason, the Tobit approach has been more commonly used in the household finance literature. However, it is important to acknowledge that the Tobit approach is sensitive to heteroscedasticity and non-normality, which, can lead to inconsistent estimates. Hence, we explore the robustness of our results by re-estimating the models in Table 2 using a censored least absolute deviations (CLAD) estimator. The CLAD approach is less restrictive and requires weaker assumptions about the error term than the Tobit model (see Powell 1984). The results from the CLAD approach are in line with those from the Tobit approach (see Table B.13 in the Online Appendix).

including the means of the time-varying continuous variables, such as income and net wealth, in the set of explanatory variables.

As the controls in **x** are not our focus, and are standard in the existing literature, see for example, Browning and Lusardi (1996), we present a single set of estimates for these variables. Moreover, the estimates for our control variables are in line with existing studies, and are unaffected by the inclusion of different health and healthcare utilization measures in **h**. These findings are reported in the Online Appendix in Table B.5, and correspond to a set of specifications for the KHPS and JHPS in which **h** contains the psychological well-being index.[19] The estimates corresponding to our health and healthcare utilization measures are presented in Table 2, which we now discuss. In these estimations, all health and healthcare utilization measures are treated as being exogenous, although this assumption is subsequently relaxed.[20]

3.1 The effects of health and healthcare utilization

Panel A of Table 2 reports the effect of augmenting the set of benchmark controls with the psychological well-being index. Panel B adopts an analogous approach using the physical health index. Whereas the psychological well-being index has a statistically significant negative association between saving and total financial assets, poor physical health is not statistically significant. This finding for mental health is consistent with Bogan and Fertig (2018), who find that in the US, mental health problems have sizable impacts on savings held in retirement accounts.

Regarding the physical health index, our findings suggest that households do not accumulate safer assets as a means of hedging the risk of adverse health shocks. In this sense, whilst the nature of Japan's system of universal healthcare coverage does not completely prevent households from incurring high out-of-pocket expenses, it appears to be sufficiently high to

[19] Results pertaining to estimates of the control set variables for all subsequent estimations are available from the authors on request.

[20] Our findings are robust to replacing the health and healthcare utilization measures of the respondent with those of their spouse. The results of these estimations based on the married sample only are presented in Table B.6 of the Online Appendix. As the assortative matching literature raises concerns regarding multicollinearity (see Becker 1973), the respective health and healthcare utilization measures of the respondent and their spouse were not included simultaneously.

lower the incentive to engage in precautionary saving behaviour.

Panel C of Table 2 presents the results relating to BMI, which has a small but negative relationship with savings. Although very few papers have investigated this relationship, a number of contributions have explored the relationship between BMI and other aspects of financial decision making. For example, Addoum, Korniotis, and Kumar (2016) analyse a number of survey data sets from the US and Europe and find support for the hypothesis that overweight individuals invest less in risky assets.

Panels D to F of Table 2 report the results from using our healthcare utilization measures. Hospital visits have a sizable positive association with saving and total financial assets (Panel D), as does health screening (Panel E, KHPS only). The sizes of the marginal effects for these variables are large and statistically highly significant. For instance, being hospitalized for the KHPS (JHPS) is associated with an increase of approximately 12.1 (8.9) % of savings, and the increase in total financial assets is equivalent to around 12.7 (10.8) %.

Caution is required when interpreting the results for different forms of screening, as a number of mechanisms may be driving our results. As 'Periodic screening' is free, one interpretation of the marginal effects, which are sizable and positive, is that individuals who attend this form of screening care more about their future health. This is reflected in greater levels of savings and larger financial portfolios, a finding which may be explained using a variation of the argument in Edwards (2008), whereby individuals who invest in future health are seeking to guard against future health shocks. Financial prudence is thus associated with prudence in health. It is also plausible that individuals become more health conscious as they age, with older individuals being more likely to attend periodic screenings. In this regard, the marginal effects in Table 2 for periodic screening may also reflect life-cycle effects.

Given their association with low out-of-pocket expenses, explanations similar to those used for the effects of periodic screening on savings and total financial assets may also account for the effects reported for 'Cancer screening' and 'Other screening', although the estimated coefficients are somewhat smaller. It may also be the case that even though the level of out-of-pocket expenses incurred for these forms of screening is low, some respondents with the lowest levels of savings and financial assets choose not to attend screening because of the associated costs. We return to this issue in the quantile regression analysis in Section 4.

Multiphasic screening has a stronger association than 'Cancer screening' and 'Other screening'. Given the potential to incur large out-of-pocket expenses with this form of screening, its uptake is likely to be strongly associated with affordability. Turning to Panel F (JHPS only), higher treatment costs are associated with a higher level of savings and larger financial portfolios. However, despite being highly statistically significant, the size of these effects is modest, which contrasts with the effects of screening.

It may be the case that the relationship between savings, and health and healthcare utilization is endogenous. To deal with this potential issue, we model the relationship between savings, and health and healthcare utilization as a recursive system. Central to the system is a Tobit specification with individual random effects of the form given by equation (1), in which $\mathbf{h}$ is treated as being endogenous.[21] A general expression of this approach is given by:

$$\begin{aligned} y_{it} &= g\left(\mathbf{x}_{it}'\gamma + \mathbf{h}_{it}'\phi + \varepsilon_{it}\right) \\ h_{it} &= f\left(\mathbf{x}_{it}'\delta + \mathbf{z}_{it}'\tau + \epsilon_{it}\right). \end{aligned} \tag{3}$$

The financial outcome y_{it} (saving or financial assets) is modelled using a Tobit model, whilst, the health equation, h_{it}, is modelled depending on the nature of the health variable. For example, the physical and psychological health measures are modelled using ordered Probit models, BMI is modelled as a linear specification, whilst treatment costs are modelled using a Tobit specification. Information relating to treatment at a hospital and hospitalization in Panel D of Table 2 was combined to create a single, binary variable, where a value of one was assigned for an affirmative response for either of the treatment or hospitalization questions, and a zero otherwise. For questions relating to hospital screening, a binary indicator was constructed whereby we assigned a one if the respondent had undergone any form of screening in the previous year, and a zero otherwise. These dependent variables are modelled using a Probit specification. All models account for individual random effects, exploiting the panel element of the data.

[21] The estimations are performed in Stata 15 using the conditional mixed-process (cmp) suite of tools developed by Roodman (2011).

The health and healthcare utilization measures are modelled using information relating to if the respondent undertakes any exercise, consumes alcohol, or smokes.[22] Having accounted for such possible endogeneity, Table 3 reports the relationships between our health and healthcare utilization measures with savings and total financial assets.

The estimated effects shown in Table 3 are consistent with the findings in Table 2, with an important exception: the relationship between physical health on savings and total financial assets (Panel B) is negative and statistically significant in the recursive framework. This finding is now aligns with psychological well-being, which maintains a strong negative association with savings and total financial assets. As in Panel C (JHPS only), BMI is negatively related to savings and total financial assets. Hospital visits (Panel D) have a strong and positive association with savings and total financial assets, as does health screening (Panel E, KHPS only). Panel F (JHPS only) indicates that higher treatment costs are associated with greater savings and total financial assets.

As an alternative way of dealing with potential endogeneity, we also applied the modelling approach of Bogan and Fertig (2013, 2018) in which current investment decisions are treated as being a function of past health states. Accordingly, the health and healthcare utilization measures were lagged by one wave to reduce the possibility of reverse causality. Bogan and Fertig (2013) justify this type of specification on the grounds that it may take time for a mental health state to influence investment decisions. In addition, we exploit a 'financial distress' variable, constructed using the ratio of total household debt (including mortgages) to annual pre-tax income, to mitigate the problem of endogeneity arising between the health and healthcare measures and savings. We first estimated the specifications in Panels A to F of Table 2 using one period lags of the health and healthcare utilization variables and current financial distress. This exercise was repeated with the financial distress variable included lagged by one wave in all specifications. In both sets of estimations, which are reported in Table B.7 and Table B.8 of the Online Appendix, we obtained results consistent with those

[22]Specifically: whether a person exercises/or not (only available for the KHPS); a binary variable indicating if the respondent drinks alcohol 1-2 times or more a week (1), or never or a few times a month (0); a set of binary indicators capturing if (*i*) the respondent smoked everyday or sometimes, or (*ii*) used to smoke. 'Never smoked' was the omitted indicator.

reported in Table 2.

4 Modelling distributional effects

Our attention now turns to exploring how our health and healthcare utilization measures affect savings and total financial assets across their entire distributions rather than just at the mean. We use a censored quantile regression (CQR) estimator, which like the Tobit estimator, is able to handle the censored nature of our dependent variables. Our choice of estimator has rarely been used in the household finance literature, and provides an alternative to modelling the conditional mean of a dependent variable (Fitzenberger 1997). As demonstrated in Powell (1986), the CQR estimator has a number of desirable features, and unlike the Tobit model, is based on assumptions that are not strictly parametric.[23] The CQR estimation approach is detailed in Fitzenberger (1997) and Chernozhukov and Hong (2002), and is briefly set out below.

Denote the amount of savings held by each household as $y_{it} = \max[0, y^*_{it}]$, where y^*_{it} is an untruncated latent dependent variable which corresponds to the observed value of y_{it} reported in wave t of the KHPS or JHPS, for household i $(= 1, \ldots, N)$. We condition on $\mathbf{x}_{it}$ (our standard controls) and $\mathbf{h}_{it}$ (health and healthcare utilization measures) as in expression (1). This yields

$$y_{it} = f\left(\mathbf{x}_{it}, \mathbf{h}_{it}\right) = f\left(\mathbf{H}_{it}\right) \tag{4}$$

$$\mathbf{H}_{it} \subseteq \left\{\mathbf{x}_{it}, \mathbf{h}_{it}\right\}.$$

Following Koenker and Bassett Jr. (1978), the quantile regression model is given by

$$Q_\theta\left(y_i \mid \mathbf{H}_i\right) = \beta'_\theta \mathbf{H}_i \tag{5}$$

[23] Powell (1986) demonstrates the consistency of the CQR estimator. The error term is shown to be independent, and not based on a constant variance assumption. Heteroscedasticity is subsequently not a problem, making the CQR model robust to observations with extreme values.

where time subscripts have been dropped for clarity, and the θ conditional quantile of the dependent variable y_i is captured by Q_θ. To obtain an estimator for β_θ requires minimising the expression

$$\min_{\beta_\theta} \frac{1}{N} \left\{ \sum_{y_i \geq \beta_\theta' \mathbf{H}_i} \theta \left| y_i - \beta_\theta' \mathbf{H}_i \right| + \sum_{y_i < \beta_\theta' \mathbf{H}_i} (1-\theta) \left| y_i - \beta_\theta' \mathbf{H}_i \right| \right\}. \tag{6}$$

As demonstrated in Powell (1986), solving the following expression yields the CQR estimator,

$$\min_{\beta_\theta} \frac{1}{N} \sum_{i=1}^{N} \left\{ \left[\theta - I \left(y_i < \max\{0, \beta_\theta' \mathbf{H}_i\} \right) \right] \left(y_i < \max\{0, \beta_\theta' \mathbf{H}_i\} \right) \right\}, \tag{7}$$

where I is an indicator variable, which equals one if the expression holds and zero otherwise. We estimate empirical specifications that are identical to those presented in Panels A to F of Table 2, albeit the estimated coefficients now represent the average marginal quantile effect for the censored dependent variable.[24]

Table 4 reports our findings for the physical and psychological well-being indices at each percentile of the savings and total financial asset distributions, for both the KHPS and the JHPS. Psychological well-being generally has a negative association with savings and total financial assets. The KHPS indicates a 'u-shaped' relationship between psychological well-being, savings, and total financial assets, in that the largest effects are felt at the extreme ends of the distributions. In contrast, for the JHPS, the greatest effects on savings and total financial assets are observed at the higher quantiles. In the case of physical health, the findings are mixed. Generally, savings and total financial assets are negatively associated with physical health, although for some parts of the distribution, the relationship is statistically insignificant.

For the remaining health and healthcare utilization measures, our findings are consistent with the results reported in Table 2, and, for brevity, are presented in Tables B.9 to B.12 in the Online Appendix. In accordance with the results in Table 4, the effects of our health

[24] Estimations are performed using the 'cqiv' routine in Stata with 1000 bootstrap repetitions (see Chernozhukov, Fernández-Val, and Kowalski 2015).

and healthcare utilization measures are characterized by considerable heterogeneity, with the effects at the lowest parts of the savings and total financial assets distributions being most pronounced.

We find that the relationship with BMI is consistently negative and highly statistically significant across the entire distributions of savings and total financial assets (see Table B.9 in the Online Appendix). This finding aligns with the Tobit estimations reported in Tables 2 and 3, which are characterized by negative relationships between BMI and our financial dependent variables. The largest effects of BMI are observed at the lower deciles of the savings and financial asset distributions.

The results for hospital visits and hospitalization (see Table B.10 in the Online Appendix) align with those in Table 2, in that both of these healthcare utilization measures have a positive and statistically significant effect on savings and total financial assets. For both measures, the effects on households at the very lowest decile of the savings and total asset distributions are greater than at the higher end, a pattern that is also true of the relationships corresponding to medical screening (see Table B.11 in the Online Appendix). The effects are consistently positive and statistically significant. For treatment costs (JHPS only), the estimations are based on Panel F of Table 2, and our findings are reported in Table B.12 in the Online Appendix. The effect of treatment costs is again positive across the distributions of savings and total assets, and greatest for households located at the lowest decile.

The results presented above generally indicate that the health and healthcare utilization measures have the largest impact at the lower deciles of the saving and asset distributions. This suggests that poor health negatively influences the saving decisions of those individuals who are already financially vulnerable. As such, policies which aim to support those who are in poor health and the most financially vulnerable could help prevent the growth of health and wealth inequalities.

5 Exploring portfolio re-balancing effects

Recent theoretical work suggests that the composition of household portfolios should be of interest to policymakers. In particular, Bhamra and Uppal (2019) show that under-diversified household portfolios can lead to lower macroeconomic growth. Encouraging greater diversification of household portfolios may consequently result in benefits that are not just restricted to improving household welfare. This finding is relevant to the observation that in Japan, non-participation in risky asset holding is characterized by the 'stockholding puzzle', in which holding safer assets is observed at levels greater than that predicted by financial theory (see, e.g., Fujiki, Hirakata, and Shioji 2012 and Kitamura and Uchino 2010).[25] Accordingly, attention now turns to modelling how savings as a proportion of total financial assets are associated with our health and healthcare utilization measures.

A novel aspect of our modelling approach lies in jointly estimating a fractional regression model (Papke and Wooldridge 1996) with the Tobit specifications reported in Table 2 of Section 3. This enables us to simultaneously investigate the relationship between our health and healthcare utilization measures with both the composition and the size of the financial portfolio using a two-equation system, in which the error terms are assumed bivariate normal. The logic underlying this approach is appealing: it allows for the possibility that when allocating monetary resources, households consider an overall amount that should be allocated to financial assets, as well as the proportions of their resources allocated to safe and risky assets. Here, we regard savings as 'safe' assets, and securities as 'risky' assets.

To model the composition of a household's financial portfolio, recall that in the KHPS and JHPS, household $i = 1, 2, ..., N$ reports the values of all assets. These assets are classified as either savings or securities. We denote these categories by $j \in \{savings, securities\}$, such that the total value of savings for household i is given by $Y_{i,savings}$, and the corresponding amount for securities is denoted $Y_{i,securities}$. The total value of household i's portfolio can therefore be expressed as $Y_i = Y_{i,savings} + Y_{i,securities}$, and the share of assets s_{ij} in each

[25] Ito, Takizuka, and Fujiwara (2017) argue that one way to increase stockholding in Japan at the household level is to improve financial literacy. A financial education initiative, which has been operating in Japan since 1983, is the *Central Council for Financial Services Information*, www.shiruporuto.jp/e.

category j will be given by

$$s_{ij} = \frac{Y_{ij}}{Y_i}. \tag{8}$$

Omitting the time subscripts for clarity, and following Papke and Wooldridge (1996), we let $E\left(s_{ij}\left|\mathbf{x}_i, \mathbf{h}_i\right.\right)$, where $E(\cdot)$ denotes the expected value of the term in parentheses, and $\mathbf{x}_i$ and $\mathbf{h}_i$ are matrices of the standard controls and the health and healthcare utilization measures, respectively. The fractional nature of the household allocation equation means that the model can be represented as:

$$E\left(s_{i,savings}\left|\mathbf{x}_i, \mathbf{h}_i\right.\right) = G\left(\mathbf{x}_i'\beta + \mathbf{h}_i'\gamma\right), \tag{9}$$

and by symmetry:

$$E\left(s_{i,securities}\left|\mathbf{x}_i, \mathbf{h}_i\right.\right) = 1 - G\left(\mathbf{x}_i'\beta + \mathbf{h}_i'\gamma\right), \tag{10}$$

where G is a known function satisfying $0 \leq G(z) \leq 1 \; \forall \; z = \mathbb{R}$, and where $\sum_j = E\left(s_{ij}\left|\mathbf{x}_i, \mathbf{h}_i\right.\right) \equiv 1$. $G(\cdot)$ is typically assumed to be a cumulative distribution function (CDF) based on the logistic function or the standard normal distribution (Papke and Wooldridge 1996); we assume the latter in this application. To estimate the univariate fractional model in isolation, we would be faced with an estimation problem identical to that associated with estimating a standard probit model (Wooldridge 2010). However, jointly estimating the fractional model described above with the Tobit model given by expression (1) requires that the error terms are bivariate normal. This seemingly unrelated regression is represented by the form:

$$\begin{aligned} y_{it} &= g\left(\mathbf{x}_{it}'\gamma + \mathbf{h}_{it}'\phi + \varepsilon_{1it}\right) \\ s_{it} &= f\left(\mathbf{x}_{it}'\delta + \mathbf{h}_{it}'\tau + \varepsilon_{2it}\right) \end{aligned} \tag{11}$$

where the asset share equation (s_{it}) is assumed to be driven by the same factors as for the Tobit equation (y_{it}). Details of how this type of joint model can be estimated under these distributional assumptions are found in Roodman (2011).

Our findings for both the KHPS and JHPS are reported in Table 5, where all specifications exploit the panel element of the data by including individual random effects. In the asset share equation, $s_{i,savings}$ is the dependent variable. The Tobit equations, which report 'size' effects, show that lower psychological well-being is associated with lower savings and total portfolio size in both the KHPS and the JHPS. The sizes of the estimated effects on savings are similar to the effects of psychological well-being in Panel A of Table 2. For both surveys, portfolio composition, as captured by the 'Share' equation, is negatively associated with psychological well-being. Although this effect is small (for the KHPS it suggests a 1% fall in the proportion of savings is associated with each incremental rise in the psychological well-being index), it indicates that psychological well-being is associated with a small portfolio rebalancing effect.

Jointly, these 'size' and 'composition' effects have an interesting implication when the 'All assets' equations are considered. Consider the KHPS, where decreasing psychological well-being, as captured by an incremental increase in the index, is associated with an approximate 5% reduction of total assets. The small marginal effect associated with the savings share indicates that, whilst the share of risky assets has risen marginally, the increase is not sufficiently large to be associated with an increase in the total value of risky assets held. Accordingly, decreasing psychological well-being is associated with lower holdings of both savings and securities. Individuals with the highest level of psychological distress thus have significantly smaller financial portfolios, but are marginally less inclined to engage in savings accumulation.[26] These results contrast with Bogan and Fertig (2013), who in the context of the US, report sizable portfolio re-balancing effects for HRS participants in response to worsening mental health, in the form of a shift away from risky to safer assets. Clearly, these differences may arise due to the different nature of our psychological well-being variables and the age demographic of the surveyed respondents, as well as differences in the Japanese and US healthcare systems, and other inherent country level differences.

For the physical health index, no association between portfolio size and composition is found, for all regressions. This finding is in keeping with the results reported in Table 2. However, for BMI (JHPS only, Section B, Panel C), its relationship with the dependent variables is similar to that associated with psychological well-being. This finding acts as a

[26] *Ceteris paribus*, if the share equation coefficient were statistically no different from zero, it would imply that the total value of assets would fall, but the proportions in which savings and securities are held would remain unchanged.

counterpoint to contributions in which support for an inverse relationship between BMI and risk-taking behaviour is found (see for instance, Addoum, Korniotis, and Kumar 2016).

Where statistically significant, our healthcare utilization variables are always associated with greater savings, larger portfolios, and a significantly greater share of assets held as savings; this is in contrast to the relationships associated with BMI and psychological well-being. However, in keeping with the results for these health measures, the magnitude of the 'size' effect, as captured by the Tobit regression, is always greater than the portfolio rebalancing effect, as captured by the 'Share' equation parameter. Consider the case of periodic screening (KHPS only). For the 'All assets' equations, undergoing this type of procedure is associated with an increase in the total amount of financial assets (savings plus securities) by approximately 18.1% ('size' effect), and an increase in the share of savings held in the household's financial portfolio of 16.5% ('composition' effect).

Comparable effects are associated with our other healthcare utilization measures, although the nature of the relationship associated with hospital visits is less pronounced (and in some instances statistically insignificant) for the JHPS (see Panel D) than for the KHPS. More generally, our findings suggest that healthcare utilization is positively associated with decisions to accumulate savings and financial wealth.

6 Conclusion

In exploring how health and healthcare utilization affect saving behavior and portfolio allocation in Japanese households, our contribution has filled a gap in the literature on household finance. Our results do not support the view that poorer physical health is associated with savings accumulation, which may be attributable to Japan's system of universal health coverage. The findings concerning psychological well-being are especially timely in that the relationship with saving has been largely overlooked in the literature on financial decision making. To the best of our knowledge, the present contribution is the first to explore the relationship between psychological well-being and savings behavior using micro-data on Japanese households. In line with Bogan and Fertig (2013), we argue that psychological well-being potentially influences saving behaviour through, for example, an individual's cognitive ability, their emotional self-regulation or behavioural factors such as their risk attitudes or discount rates. The finding that worsening psychological well-being is associated with lower levels of savings, and moreover, smaller financial portfolios has potentially far-reaching public policy implications. For instance, it may suggest that tackling factors that lessen psychological well-being in Japan, such as mental health problems, may lead to an increase in savings and larger financial portfolios at the household level. Such efforts may complement strategies aimed at encouraging portfolio diversity such as bolstering the financial literacy of households (Kitamura and Uchino 2010; Ito, Takizuka, and Fujiwara 2017). Moreover, our findings complement the work exploring the relationship between psychological well-being and consumption behavior. For instance, Guven (2012) finds that happy individuals save more and spend less. In the psychology literature, Cryder et al. (2008) report a 'misery-is-not-miserly' effect, in which sad and self-focused individuals spend more. As noted by Cryder et al. (2008, p.528), one mechanism through which such an effect might arise is due to individuals in a negative emotional state being 'predisposed to engage in mood-improving behaviors, such as...obtaining new commodities'.

We have also found that investment in health through healthcare utilization is strongly associated with higher levels of savings and larger financial portfolios, but lower risky asset holdings. This finding is important, especially when viewed through the lens of health as a form of human capital; see, for instance, the early seminal contribution of Mushkin (1962). Here, arguments that such investment improves not only the quality of life at the household level, but is associated with increases in economic productivity, and ultimately the long-run growth rate of an economy, are well known.

Our findings also demonstrate the importance of considering the effect of health and healthcare utilization across the conditional saving distribution. In this regard, our results have potentially important policy implications, in that if additional support is not given to those in poor health who are located at the lower end of the saving distribution, poor health may exacerbate and compound inequalities in the health and wealth dimensions.

Lastly, although this study has identified strong relationships between different aspects of

Japanese household finance, and health and healthcare utilization, our approach has not taken into account other important aspects of economic behaviour, such as household consumption decisions. Further, given the strength of our estimated relationships, the precise causal mechanisms that may account for our findings are arguably deserving of further exploration. We leave these possibilities open to future research.

Supplementary material

Supplementary material is available online on the OUP website. These are the Online Appendix and the do-file which replicates the results. The data used in this paper are available from https://www.pdrc.keio.ac.jp/en/paneldata/datasets/jhpskhps/.

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Table 1: Health and healthcare utilization measures

Variable name	Definition
Health measures	
Panel A: Physical health (1 to 6) and psychological well-being (7 to 9) indices	Do you presently experience any of the following conditions? Circle the number that applies for each item. (Circle one number for each item)
1. Headaches or dizziness	0 (never), 1 (rarely), 2 (sometimes), 3 (often).
2. Palpitations, out of breath	0 (never), 1 (rarely), 2 (sometimes), 3 (often).
3. Digestive problems	0 (never), 1 (rarely), 2 (sometimes), 3 (often).
4. Back, lower back, shoulder pain	0 (never), 1 (rarely), 2 (sometimes), 3 (often).
5. Tire easily	0 (never), 1 (rarely), 2 (sometimes), 3 (often).
6. Catch cold easily	0 (never), 1 (rarely), 2 (sometimes), 3 (often).
7. Find seeing people tiresome	0 (never), 1 (rarely), 2 (sometimes), 3 (often).
8. Dissatisfied with life	0 (never), 1 (rarely), 2 (sometimes), 3 (often).
9. Anxiety about the future	0 (never), 1 (rarely), 2 (sometimes), 3 (often).
Panel B: BMI (JHPS only)	
BMI	Constructed using respondent's height and weight.
Healthcare utilization measures	
Panel C: Hospital visits	Did you receive medical treatment or were you hospitalized last year? (Multiple responses permitted)
No	1 if the respondent reported (No health problems and/or Had symptoms but took no action and/or Purchased over-the-counter medicine and/or Other), 0 otherwise.
Was hospitalized	1 if the respondent reported being hospitalized, 0 otherwise.
Treatment at hospital or clinic	1 if the respondent reported treatment at hospital or clinic, 0 otherwise.
Panel D: Screening (KHPS only)	Did you receive a physical examination or cancer screening last year? (Multiple responses permitted)
No exam or screening	1 if the respondent reported no exam or screening, 0 otherwise.
Periodic screening	1 if the respondent reported having a periodic company or municipal government screening, 0 otherwise.
Multiphasic health screening	1 if the respondent reported having a multiphasic health screening, 0 otherwise.
Cancer screening	1 if the respondent reported having cancer screening, 0 otherwise.
Other screening	1 if the respondent reported having other screening, 0 otherwise
Panel E: Treatment costs (JHPS only)	
Treatment costs	Did you pay for the treatment of disease or injury last year? If you did, please write the amount of co-payment for the last year.

Table 2: Tobit marginal effects estimates for psychological well-being, physical health, and healthcare utilization measures

	KHPS		JHPS	
	Savings	**All assets**	**Savings**	**All assets**
Panel A: Psychological well-being index				
Psychological well-being	-0.0352***	-0.0363***	-0.0427***	-0.0446***
	(0.0060)	(0.0060)	(0.0077)	(0.0076)
Panel B: Physical health index				
Physical health	0.0044	0.0047	0.0064	0.0050
	(0.0037)	(0.0037)	(0.0047)	(0.0047)
Panel C: BMI (JHPS only)				
BMI			-0.0258***	-0.0263***
			(0.0086)	(0.0086)
Panel D: Hospital visits				
Treatment at hospital or clinic	0.1195***	0.1273***	0.0794***	0.0903***
	(0.0225)	(0.0223)	(0.0304)	(0.0299)
Was hospitalized	0.1140***	0.1192***	0.0855	0.1027*
	(0.0440)	(0.0436)	(0.0590)	(0.0581)
Panel E: Screening (KHPS only)				
Periodic screening	0.1409***	0.1197***		
	(0.0251)	(0.0249)		
Multiphasic health screening	0.1277***	0.1159***		
	(0.0411)	(0.0408)		
Cancer screening	0.0896***	0.0773***		
	(0.0288)	(0.0285)		
Other screening	0.0996**	0.0828*		
	(0.0476)	(0.0472)		
Panel F: Treatment costs (JHPS only)				
Treatment costs			0.0238***	0.0260***
			(0.0044)	(0.0043)
Observations	**34,407**		**18,849**	

Notes: (*i*) Standard errors in parentheses; (*ii*) ***/**/* denotes $p < 0.01$ / $p < 0.05$ / $p < 0.1$; (*iii*) All monetary values are expressed in 2018 prices; (*iv*) Averages of income and net worth are used as a Mundlak (1978) fixed effects correction; (*v*) The models in Panels A to F comprise different health and healthcare utilization specifications, each of which uses the same control variables as in Table B.5 in the Online Appendix; (*vi*) Marginal effects are obtained using the Stata 'margins' command.
Source: Authors' calculations.

Table 3: Recursive estimates for psychological well-being, physical health, and healthcare utilization measures

	KHPS		JHPS	
	Savings	**All assets**	**Savings**	**All assets**
Panel A: Psychological well-being index				
Psychological well-being	-0.1131***	-0.1148***	-0.1306***	-0.1353***
	(0.0230)	(0.0231)	(0.0300)	(0.0299)
Panel B: Physical health index				
Physical health	-0.0297**	-0.0263**	-0.0470***	-0.0529***
	(0.0125)	(0.0126)	(0.0168)	(0.0167)
Panel C: BMI (JHPS only)				
BMI			-0.0422***	-0.0416***
			(0.0132)	(0.0132)
Panel D: Hospitalized and treatment at hospital indicator				
Hospitalized and treatment	0.1823***	0.1898***	0.1619***	0.1758***
	(0.0356)	(0.0359)	(0.0521)	(0.0521)
Panel E: Screening indicator (KHPS only)				
Any screening	0.3186***	0.3229***		
	(0.0294)	(0.0296)		
Panel F: Treatment costs (JHPS only)				
Treatment costs			0.0593***	0.0682***
			(0.0197)	(0.0197)
Observations	**34,407**		**18,849**	

Notes: (*i*) See notes (*i*)-(*v*) in Table 2; (*ii*) The relationship between savings / all assets and the health and healthcare measures presented in Panels A to F are modelled as two-equation recursive systems. Specifically, a Tobit specification of the form given in equation (1) is estimated in which the health and healthcare measures in Panels A to F are treated as being endogenous; (*iii*) All estimations are performed using the *conditional mixed processes* ('cmp') suite of estimation tools in Stata (Roodman 2011); (*iv*) The estimated model coefficients are presented, and not the corresponding marginal effects.
Source: Authors' calculations.

Table 4: Censored Quantile Regressions: Psychological well-being and physical health indices

KHPS				**Savings**					
Quantile	10	20	30	40	50	60	70	80	90
Psychological well-being	-0.0901***	-0.049***	-0.0326***	-0.0249***	-0.036***	-0.0347***	-0.0343***	-0.0337***	-0.0338***
	(0.0128)	(0.0078)	(0.0045)	(0.004)	(0.0041)	(0.0042)	(0.0039)	(0.0039)	(0.0044)
Physical health	-0.0170**	-0.0095***	-0.0068**	-0.0069***	-0.0088***	-0.0095***	-0.0077***	-0.0084***	-0.0042
	(0.0067)	(0.0036)	(0.0027)	(0.0021)	(0.0023)	(0.0025)	(0.0021)	(0.0023)	(0.0028)
					All assets				
Psychological well-being	-0.0808***	-0.046***	-0.0335***	-0.0234***	-0.0341***	-0.0357***	-0.0363***	-0.0355***	-0.0367***
	(0.0126)	(0.0068)	(0.0042)	(0.0035)	(0.0046)	(0.0045)	(0.004)	(0.0041)	(0.0043)
Physical health	-0.0113*	-0.0067**	-0.0063***	-0.0053***	-0.0087***	-0.0081***	-0.0076***	-0.0079***	-0.0067**
	(0.0061)	(0.0033)	(0.0023)	(0.0018)	(0.0022)	(0.0025)	(0.0023)	(0.0025)	(0.0027)
Observations					**34,407**				
JHPS					**Savings**				
Quantile	10	20	30	40	50	60	70	80	90
Psychological well-being	-0.0304*	-0.0173*	-0.004	-0.00055	-0.0182***	-0.0305***	-0.0353***	-0.0302***	-0.027***
	(0.0169)	(0.0089)	(0.0059)	(0.0057)	(0.0057)	(0.0052)	(0.0047)	(0.0048)	(0.006)
Physical health	0.0137	0.0051	0.0047	-0.0014	-0.0073**	-0.0126***	-0.0178***	-0.0169***	-0.0178***
	(0.0089)	(0.0053)	(0.0035)	(0.0027)	(0.0031)	(0.0031)	(0.0031)	(0.0027)	(0.0034)
					All assets				
Psychological well-being	-0.0412***	-0.0203**	-0.0019	-0.009**	-0.022***	-0.0387***	-0.0398***	-0.0369***	-0.0389***
	(0.0153)	(0.0086)	(0.0055)	(0.0039)	(0.0055)	(0.0052)	(0.0048)	(0.0048)	(0.006)
Physical health	0.006	0.00099	0.0013	-0.0038	-0.0098***	-0.0181***	-0.02***	-0.019***	-0.0212***
	(0.0082)	(0.005)	(0.0034)	(0.0023)	(0.0031)	(0.0031)	(0.0028)	(0.0032)	(0.0035)
Observations					**18,849**				

Notes: (*i*) See notes (*i*)-(*v*) in Table 2; (*ii*) Health indices enter the specifications independently; (*iii*) All coefficients report the average marginal quantile effect for the censored dependent variable; (*iv*) Estimations are performed using the 'cqiv' routine in Stata with 1000 bootstrap repetitions (see Chernozhukov, Fernández-Val, and Kowalski 2015).

Source: Authors' calculations.

Table 5: Health, healthcare, savings, and household portfolio re-balancing effects: Marginal effects

	Savings		**All assets**	
Section A: KHPS	Tobit	Share	Tobit	Share
Panel A: Psychological well-being index				
Psychological well-being	-0.0406***	-0.0100**	-0.0418***	-0.0103**
	(0.0078)	(0.0049)	(0.0079)	(0.0051)
Panel B: Physical health index				
Physical health	0.0025	0.0006	0.0032	0.0009
	(0.0048)	(0.0030)	(0.0048)	(0.0031)
Panel C: Hospital visits				
Treatment at hospital or clinic	0.1482***	0.0851***	0.1560***	0.0844***
	(0.0272)	(0.0172)	(0.0269)	(0.0179)
Was hospitalized	0.1394***	0.0679**	0.1454***	0.0590*
	(0.0514)	(0.0315)	(0.0515)	(0.0334)
Panel D: Screening (KHPS only)				
Periodic screening	0.1958***	0.1447***	0.1663***	0.1529***
	(0.0326)	(0.0202)	(0.0327)	(0.0210)
Multiphasic health screening	0.1545***	0.0944***	0.1434***	0.0980***
	(0.0490)	(0.0299)	(0.0487)	(0.0316)
Cancer screening	0.1183***	0.0947***	0.1024***	0.0996***
	(0.0300)	(0.0197)	(0.0293)	(0.0211)
Other screening	0.1354**	0.0788**	0.1139**	0.0795**
	(0.0551)	(0.0354)	(0.0543)	(0.0374)
Observations		**34,407**		
Section B: JHPS	Tobit	Share	Tobit	Share
Panel A: Psychological well-being index				
Psychological well-being	-0.0480***	-0.0168***	-0.0502***	-0.0164***
	(0.0097)	(0.0059)	(0.0096)	(0.0060)
Panel B: Physical health index				
Physical health	0.0053	0.0021	0.0038	0.0023
	(0.0061)	(0.0037)	(0.0059)	(0.0036)
Panel C: BMI (JHPS only)				
BMI	-0.0297**	-0.0120*	-0.0298**	-0.0125**
	(0.0115)	(0.0061)	(0.0117)	(0.0063)
Panel D: Hospital visits				
Treatment at hospital or clinic	0.1027***	0.0405*	0.1152***	0.0349
	(0.0345)	(0.0221)	(0.0339)	(0.0228)
Was hospitalized	0.1008	-0.0244	0.1198*	-0.0402
	(0.0694)	(0.0405)	(0.0694)	(0.0418)
Panel E: Treatment costs (JHPS only)				
Treatment costs	0.0252***	0.0083**	0.0281***	0.0082**
	(0.0054)	(0.0034)	(0.0053)	(0.0035)
Observations		**18,849**		

Notes: (*i*) See notes (*i*)-(*v*) in Table 2. (*ii*) The above table reports the results based on jointly estimating a fractional regression model (Papke and Wooldridge 1996) with the Tobit specifications in Table 2. (*iii*) Errors are assumed to be bivariate normal. (*iv*) For the fractional regressions (denoted 'Share'), the dependent variable in each share equation is the value of savings expressed as a proportion of a household's total financial assets (i.e., the total value of a household's financial portfolio). (*v*) All estimations are performed using the cmp suite of estimation tools in Stata (Roodman 2011).
Source: Authors' calculations.