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"Dying and Dissaving"

Doctoral Student Presentations

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Presenter: Clara Fernström, PhD student at Stockholm School of Economics

Dying and Dissaving

Job market paper – Preliminary draft

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Abstract

Does a sudden drop in survival probability make people adjust savings? Standard life cycle theory suggests so. Using Swedish administrative data, I link precisely measured negative health shocks to subsequent saving. Exploiting exogenous variation in the timing of health shock, I also contribute to understanding the causal effect of health on wealth. The main finding is that the young, rich, and healthy dissave when their objective survival probability falls whereas the old, poor, and unhealthy do not. In particular, financial capacity to dissave matters. Consistent with bequest motives, parents do not dissave. However, there is no support for bequest motives among spouses; to the contrary, singles increase savings by more than those with a spouse.

JEL: D11, D12, D14, D15, G11, I14

Key words: household finance, life cycle, savings, consumption, survival probability, mortality risk, health

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1 Introduction

The individual's survival probability is a key component of many economic models. We typically assume that individuals optimize to smooth consumption over their expected lifetime when they choose how much to save, work, or allocate to risky assets. Survival probability matters for the effective discount rate; the lower the survival probability, the more future utility is discounted. In this paper, I attempt to assess the quantitative impact of survival probability on the consumption-saving decision. Using exogenous variation in survival probability and health we can also learn more about individual time and risk preferences. An initial step is a reduced-form analysis.

To study the effect of survival probability on the consumption-savings decision, the ideal experiment would be to randomly assign individuals survival probabilities and follow their choices over time. Instead, I analyse how health shocks affect individuals' savings through changes in objective survival probabilities.

First, I set up a simple two-period model to show the theoretical effect of a health shock on the consumption-saving decision. A health shock may have implications for survival probability, income (if the health shock occurs before retirement), and for marginal utility of consumption. I vary the survival probability, both with and without health-state dependent income and marginal utility of consumption. In particular, the model gives the intuition behind the dying-and-dissaving hypothesis; the lower the survival probability, the lower the savings.

Second, I analyse the effect of year-on-year changes in survival probabilities on savings decisions. To this end, I construct an annual panel of objective survival probabilities and savings, based on Swedish administrative data. Compared to survey data, the data is detailed and accurate, and covers the full population. I have large variation in health changes, rather than relying on limited health information or a limited set of diagnoses. Therefore, I can calculate an objective and informative measure of survival probability.

Third, I isolate the effect of mortality risk on savings from other savings motives. In particular, the Swedish institutional setting, with comprehensive social insurance, limits the motivation to save for medical or long-term care expenses. I account for health-associated changes in income and marginal utility of consumption, and the expectations thereof.

Fourth, to identify the causal effect of health on wealth, I exploit randomness in timing of the diagnosis by comparing individuals with the same diagnosis a few years apart.

I find evidence in support of the dying-and-dissaving hypothesis among the young, rich, and healthy. Among the old, poor, and sick, a fall in survival probability is instead associated with an increase in savings. The individual's capacity to dissave, and increase consumption, matters. In particular, dying-and-dissaving is observed among those with financial wealth that can sustain at least two years worth of consumption (whether or not they have debt capacity). This pattern is not driven by concurrent income shocks or expected future income, nor is it driven by the financially poor having more severe diagnoses. I find some support for bequest motives among parents, who increase savings in response to a fall in survival probability by more than those without children. However, there is no support for bequest motives among spouses. To the contrary, singles increase savings by more than those with a spouse. This result has at least two possible explanations. First, the two-person household could work as an insurance mechanism for future income uncertainty. Second, marginal utility of consumption could depend on the state of having company, both in terms of making consumption more enjoyable while the partner is alive, and in terms of facilitating consumption by providing assistance.

The average effect of survival probability remains negative after controlling for health-related income and marginal utility measures. Lower income at diagnosis, relative to pre-diagnosis income leads to lower savings. Lower *future* income prospects at diagnosis leads to lower savings. Lower marginal utility at diagnosis leads to higher savings, suggesting that the effect of bad health dominates the effect of lower survival probability. Lower *future* marginal utility at diagnosis leads to higher savings.

The quasi-experimental results are qualitatively similar to the descriptive results, and thus, lends causal interpretation to the estimated effect of survival probability on savings. Overall, I argue that these results support an extended life-cycle model.

My paper contributes to a large literature reconciling life-cycle models with empirical findings. In standard life-cycle theory, individuals smooth consumption over lifetime (e.g. Modigliani and Brumberg 1954, Friedman 1957, Ando and Modigliani 1963). But in the data, people typically consume less in old age and do not dissave as much as is predicted (e.g. King and Dicks-Mireaux 1982, Banks et al. 1998, Browning and Crossley 2001). One explanation is lifetime uncertainty. On the one hand, as lifetime is uncertain there is an incentive to save also in old age to avoid outliving one's assets (e.g. Yaari 1965, Davies 1981). On the other, as survival becomes less and less probable with age, the intertemporal trade-off between consumption today and consumption tomorrow increasingly favors the former (e.g. Domeij and Johannesson 2006). This explanation invites the question whether people re-optimize, and accordingly re-smooth consumption and saving, when they are faced with new information on expected lifetime. A second, and complementary, explanation is bequest motives (e.g. Laitner and Juster 1996). A third, and also complementary, explanation is that health status, which worsens with age, affects marginal utility of consumption, and thus the optimal level of consumption (e.g. Viscusi and Evans 1990, Sloan et al. 1998, Domeij and Johannesson 2006, De Nardi et al. 2009, De Nardi et al. 2010, Bueren 2018, Finkelstein et al. 2013).

Relatedly, there is a literature on the effect of *subjective* mortality beliefs on savings using survey data. Groneck et al. (2017) and Heimer et al. (2015) show that the young under-estimate their survival probability whereas the old over-estimate it, and that this can explain the under-saving of the young, and over-saving of the old relative to the standard model. Balasubramaniam (2017) exploits exogenous shocks to subjective survival probabilities through natural disasters and mass shootings and find an effect on financial risk-taking.

Most previous papers are based on US survey data with noisy measures of wealth and are not representative of the population (limited to a particular age group, under-representation of the very poor and the very rich). Additionally, there are known issues with subjective mortality beliefs, including focal points and measurement error (e.g. Bloom et al. 2006).

Most closely related to my paper is the literature on health and the effect of *objective* mortality risk on financial decisions using administrative data.[1] Kvaerner (2017) uses data on a limited set of Norwegian, retired, households with cancer diagnoses and estimates the bequest motives of this group. The measure of mortality risk is a binary indicator of good or bad chances of surviving. He finds that the effect of a mortality shock on net wealth depends on family composition; dissaving is only observed among singles.

As far as I know, I am the first to study the effect of objective survival probability on active annual consumption-savings decisions rather than on net wealth. I define the actual probability of surviving based on population-wide data covering all diagnoses rather than using a binary indicator of survival chances based on one type of diagnosis. Since I analyse the effect over the full life cycle I can also study the effect of concurrent income shocks rather than studying only retired households. Even though there are merits to closing down the income channel, I document that the effect of survival probability varies over life. Moreover, I cover various diagnoses with different implications for marginal utility of consumption which allows me to study broader effects of health shocks. With this detailed setting I will also be able to understand more about individual time and risk preferences.

Finally, a strong positive correlation between health and economic outcomes is well established, but the direction of causality is not (Smith 1999). Empirical challenges make it hard to say whether it is bad health that limits wealth accumulation, or lack of wealth that causes bad health. Or is it some unobservable characteristic, such as impatience, that determines choices with negative effects on both health and wealth? For example, two recent papers find negative effects of bad health on economic outcomes. Dobkin et al. (2018) use

[1] See also Lundborg et al. (2015) who study the effect of health on labor market outcomes. Åslund (2000) studies the effect of health on labor earnings and total income of patients and spouses.

an event study approach and find that hospital admissions reduce e.g. earnings, income, and access to credit. Gupta et al. (2017) find that cancer diagnoses increase bankruptcy and foreclosures, especially among households with home equity.[2] I use exogenous variation in the exact timing of a health shock to contribute to understanding how health affects wealth accumulation. The effect of health on economic choices is crucial from a policy perspective; to understand how policy can be improved we need to understand the implications of worsening health status. Also, we need to understand the underlying mechanisms of how worsening health status affect individual economic outcomes.

The remainder of the paper is structured as follows. In Section 2, I describe the theoretical framework. In Section 3, I describe the data and variable definitions. In Section 4 and 5, I describe the empirical strategy and results. In Section 6 and 7, I discuss the results and conclude.

2 Theoretical framework

What is the theoretical effect of a health shock on savings? A health shock may have implications for survival probability, income (if the health shock occurs before retirement), and for marginal utility of consumption. A simple two-period model gives the intuition.

2.1 Simple two-period model

Consider a two-period model. An agent is born in period 1. Survival to period 2 is uncertain and given by $\phi \in \{\phi_l, \phi_h\}$. Think of an agent with $\phi = \phi_l$ as being in bad health. The agent is given initial assets a_0 that she allocates between consumption in the two periods. In period 1 she decides how much to consume, c_1, and how much to save, s, for consumption in period 2. She makes the decision conditional on her survival probability ϕ. Her utility from

[2] Studying the opposite direction of causality, Cesarini et al. (2016) find zero effect of wealth shocks from lottery gains on children's' health outcomes.

consumption is $u(c)$. The optimization problem is

$$\max_{\{s\}} u(c_1) + \beta\, \mathrm{E}[u(c_2)] \tag{1}$$

s.t.

$$a_0 = c_1 + s, \tag{2}$$

and

$$s = c_2. \tag{3}$$

The solution is given by the Euler equation

$$u'(c_1) = \beta\, \mathrm{E}[u'(c_2)]. \tag{4}$$

Let

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma}, \tag{5}$$

where σ is the coefficient of relative risk aversion, and

$$u'(c) = c^{-\sigma}. \tag{6}$$

By substituting the budget constraints in (2) and (3) into the Euler equation (4) and evaluating the expectation of survival to period 2, we solve for savings as a function of survival probability

$$s(\phi) = \frac{a_0}{1 + (\beta\phi)^{\frac{1}{-\sigma}}}. \tag{7}$$

If the agent has a low survival probability ϕ_l, she thus saves less than if she draws a high survival probability ϕ_h,

$$s(\phi_l) < s(\phi_h). \tag{8}$$

Thus, a health shock that reduces survival probability should lead to a fall in savings. The reason why mortality risk matters is that it increases the effective discount rate; consumption tomorrow becomes less valuable relative to consumption today, and the individual saves less.

Hypothesis 1 (H1): *When there is a negative shock to the survival probability, savings drops.*

In fact, the full distribution of conditional survival may matter for the current savings decision. Figure 1 shows the simulated life-cycle profiles of savings, consumption, and income in a simple buffer-stock model (Carroll 1997). The red lines show the savings profiles of individuals with different survival probability paths: population average (solid) and diagnosed average (dashed). The dashed line is consistently lower; lower survival probability entails lower savings in each period.

Also, (7) shows that the effect of survival probability ϕ on savings s is closely related to individual time and risk preferences, β and σ. In particular, the effect of survival probability on savings depends on the concavity of the utility function, i.e. the degree of relative risk aversion σ (Jappelli and Pistaferri 2017). Structural estimation of (7) using variation in survival probability and health in the data allows me to estimate the time and risk preference parameters. In a first attempt to understand the empirical relationships I analyse the reduced-form effect of survival probability on savings.

2.2 Health-state dependent income

Assume that the agent also receives some income y_1 and y_2 in each period. We will allow for the health state to affect income in respective period. The optimization problem is the same, and the budget constraints are instead

$$a_0 + y_1 = c_1 + s, \tag{9}$$

and

$$y_2 + s = c_2. \tag{10}$$

By substituting the budget constraints in (9) and (10) into the Euler equation (4) and evaluating the expectation of survival to period 2, we solve for savings as a function of survival probability and income

$$s(\phi, y_1, y_2) = \frac{a_0 + y_1 - y_2(\beta\phi)^{\frac{1}{-\sigma}}}{1 + (\beta\phi)^{\frac{1}{-\sigma}}}. \tag{11}$$

First, let income in period 1, y_1, vary with the survival probability ϕ. Income in period 2, y_2, is given. If the agent has a high survival probability ϕ_h, income in period 1 will be also be high $y_{1,h}$. If she has ϕ_l, she gets $y_{1,l}$. Then,

$$s(\phi_l, y_{1,l}) < s(\phi_h, y_{1,h}). \tag{12}$$

Thus, if the health state is associated with an immediate fall in income, e.g. due to inability to work, there is reason to draw on savings.

Hypothesis 2 (H2): *When there is a negative shock to current income, savings drops.*

Next, let instead income in period 2, y_2, vary with the survival probability ϕ. Income in period 1, y_1, is given. If the agent has a high survival probability ϕ_h, income in period 2 will be also be high $y_{2,h}$. If she has ϕ_l, she gets $y_{2,l}$. The effect on savings is *ambiguous*. There are two counteracting forces. Lower income in period 2 strengthens incentives for saving in period 1. However, since the probability of surviving to period 2 is low, the expected value of savings falls. If $\phi_h - \phi_l$ is small and $y_{2,h} - y_{2,l}$ is large, the effect from lower income in period 2 dominates, and savings increases.

$$s(\phi_l, y_{2,l}) \lesseqgtr s(\phi_h, y_{2,h}). \tag{13}$$

Hypothesis 3 (H3): *When there is a negative shock to expected future income (concurrent with a negative shock to survival probability), the effect on savings is ambiguous.*

2.3 Health-state dependent utility

The health state may also affect marginal utility of (non-medical) consumption (e.g. Finkelstein et al. 2013). Consumption becomes less enjoyable or physically impossible. The direction of the effect on savings depends on timing. We go back to the model in Section 2.1 and adjust the utility function, so that the utility of consumption depend on health state h (following e.g. Domeij and Johannesson 2006),

$$u(c, h) = h\frac{c^{1-\sigma}}{1-\sigma}, \tag{14}$$

and thus,

$$u'(c, h) = hc^{-\sigma}. \tag{15}$$

For a healthy agent, $h = 1$, whereas for an agent who has bad health, $h < 1$. We allow the health state to vary between periods and assume $c > 1$. By substituting the budget constraints in (2) and (3) into the Euler equation (4) using (15) and evaluating the expectation of survival to period 2, we solve for savings as a function of survival probability and health state

$$s(\phi, h_1, h_2) = \frac{a_0}{1 + (\beta\phi\frac{h_2}{h_1})^{\frac{1}{-\sigma}}}. \tag{16}$$

First, let health state in period 1, h_1, vary with the survival probability ϕ. Health state in period 2, h_2, is given. If the agent has a high survival probability ϕ_h, health state in period 1 will be also be high $h_{1,h}$. If she has ϕ_l, she gets $h_{1,l}$. The effect on savings is *ambiguous*. There are two counteracting forces. Bad health in period 1 limits the marginal utility from consuming in period 1 which increases savings. However, since the probability of surviving to period 2 falls, the incentive for saving weakens. If $\phi_h - \phi_l$ is small and $h_{1,h} - h_{1,l}$ is large, the effect from health state in period 1 dominates, and savings increases.

$$s(\phi_l, h_{1,l}) \lesseqgtr s(\phi_h, h_{1,h}). \tag{17}$$

Hypothesis 4 (H4): *When there is a negative shock to current marginal utility of consumption (concurrent with a negative shock to survival probability), the effect on savings is ambiguous.*

Next, let instead health state in period 2, h_2, vary with the survival probability ϕ. Health state in period 1, h_1, is given. If the agent has a high survival probability ϕ_h, health state in period 2 will be also be high $h_{2,h}$. If she has ϕ_l, she gets $h_{2,l}$. Then,

$$s(\phi_l, h_{2,l}) < s(\phi_h, h_{2,h}). \tag{18}$$

Hypothesis 5 (H5): *When there is a negative shock to expected future marginal utility of consumption, savings drops.*

2.4 Heterogeneity

These effects may vary with family composition. For example, the effect of reduced survival probability may vary with the presence and strength of a bequest motive. If there is no bequest motive, a reduction in survival probability implies dissaving. If there is a bequest motive, a reduction in survival probability implies a trade-off between dissaving while alive and increasing saving for bequests. Depending on the strength of the bequest motive, a reduction in survival probability may imply lower or higher savings. Inheritance taxation and life insurance may alter this trade-off. This means that the effect of a reduction in survival probability should vary with family composition as well as with inheritance taxation and life insurance. I assume that the strength of the bequest motive is constant across health states. The optimization problem (without health-dependent income and utility) is then

$$\max_{\{s\}} u(c_1) + \beta[\phi u(c_2) + (1-\phi)\omega u(b)] \tag{19}$$

s.t.

$$a_0 = c_1 + s, \text{ and } s = c_2. \tag{20}$$

Hypothesis 6 (H6): *When there is a negative shock to survival probability, the effect on savings depends on the strength of bequest motives.*

Also, the hypothesized effects in Section 2.1-2.3 may vary with financial resources. For someone without assets, low income, and subsequent borrowing constraints, the potential effect of a lower survival probability will be bounded.

Hypothesis 7 (H7): *When there is a negative shock to survival probability, the effect on savings depends on initial financial wealth and capacity to take on debt, i.e. real net wealth.*

The hypotheses are summarized in Table 3 in terms of the expected sign on the coefficients estimated as specified in Section 4.

I intend to simulate a life-cycle model of precautionary savings with health-state dependent utility and stochastic processes determining survival probability, income, and health state. The idea is to model different health shocks with different implications for these dimensions. I base the model on previous work by e.g. Carroll (1997), Deaton (1991), Domeij and Johannesson (2006), French (2005), De Nardi (2004), De Nardi et al. (2009), De Nardi et al. (2016), and (Yogo, 2016).

3 Data

I match individual data at annual level on health, economic and demographic information from National Board of Health and Welfare and Statistics Sweden. In this panel I follow health events as well as financial outcomes and behaviors over time.

3.1 Sample construction

I use a random sample of 20 percent of all individuals that are alive some time during 2000 – 2007.[3] I restrict to individuals aged at least 15 in year 2000. Also, I only consider individuals that do not move between 2000-2007.

3.2 Annual savings

The main outcome of interest is the saving-consumption decision. These are key economic entities but typically difficult to measure. I follow Koijen, Van Nieuwerburgh, and Vestman (2015) and Sodini, Nieuwerburgh, Vestman, and von Lilienfeld-Toal (2017) who impute a measure of consumption by using the identity that all income is either consumed or saved.

[3] I have pre-registered the hypotheses and the analysis plan. In the spirit of Fafchamps and Labonne (2017), I have split the data set in two part. First, I do the analysis on a random sample of 20 percent and will update the analysis plan if necessary, before I do the analysis on the full population.

Given the high level of detail in Swedish administrative data, it is possible to clean out wealth changes due to price effects for almost all assets separately.[4] Hence, the annual active savings decision is observable and defined as

$$\begin{aligned} \textit{Savings}_{it} =& \Delta\text{Bank account}_{it} + \Delta\text{Risky assets}_{it} + \Delta\text{Housing}_{it} + \\ & \Delta\text{Capital insurance}_{it} + \text{Private pension contribution}_{it} - \Delta\text{Debt}_{it}. \end{aligned} \tag{21}$$

Savings is the sum of changes in bank account holdings, changes in risky assets, holdings of mutual funds, stocks, and bonds (only active rebalancing), changes in non-residential real estate (only active rebalancing), changes in capital insurance accounts, and contributions to private pension accounts. Any withdrawal from private pension accounts is taxed as labor income and cannot be distinguished from other types of income. I subtract changes in debt to measure net savings. We can imagine that an individual with lower survival probability either sells assets, or takes a loan to increase consumption.

To deal with large outliers and non-positive values, I use the inverse hyperbolic sine transformation of *Saving* in the main analysis. Except for small values, this is approximately equal to the natural logaritmic transformation for positive values, and its negative for negative values. The interpretation of the coefficient is the same as if it had been the standard natural logaritmic transformation, i.e. in the log-level regression specification, we interpret the coefficient in percent. Throughout the paper, I refer to *IHS(Saving)* as

$$\textit{IHS}(\textit{Savings}_{i,t}) = ln(\text{Savings}_{i,t} + \sqrt{\text{Savings}_{i,t}^2 + 1}). \tag{22}$$

Figure 2 shows how median net wealth, annual saving, income, and consumption evolve over life, split by gender and health status. In general, they show the hump-shaped patterns

[4] Key papers includeCalvet, Campbell, and Sodini (2007); Calvet, Campbell, and Sodini (2009); Calvet and Sodini (2014); and Bach, Calvet, and Sodini (2017).

common in the literature. Annual savings decreases after retirement, but stays positive and mostly flat until the late years in life when it increases again. Means of the same variables illustrate the impact of outliers (Figure 3). For example, mean of annual savings is negative for young and old, consistent with consumption smoothing behavior. Median savings is mostly positive but follows the same pattern.

3.3 Survival probability

To test the hypotheses in Section 2 empirically, I define measures corresponding to each theoretical mechanism. I compare different diagnoses with different implications. For example, I can compare diagnosis A, with a large effect on survival probability and a small effect on income, to diagnosis B, with a small effect on survival probability and large effect on marginal utility.

I am interested in diagnoses that reveal new information about survival prospects. The assumption is that individuals of same age, gender, and diagnosis have the same survival prospects.

I define diagnosis-level characteristics by age groups (with 5-year span), gender, and diagnosis, and assign these to diagnosed individuals. If an individual has multiple diagnoses one year, I select the one most severe diagnosis according the scale listed in Appendix A. All other diagnoses I consider "less severe" and are grouped together with healthy individuals of same age and gender. Altogether, I have 540 groups (2 gender, 15 age, 18 diagnosis-categories). The motivation for the selection and ranking of the diagnoses is that it covers diagnoses common in the literature. Most notably, I want to allow for comparisons with studies based on the Health and retirement study in the US. The ranking is also meant to distinguish acute diseases from chronic ones.

The main explanatory variable of interest is survival probability. It is defined as the share of individuals that survive from one year to the next, with the same age, gender, and diagnosis,

$$
\begin{aligned}
\textit{Survival probability}_{it} = &\text{ Share of individuals alive year } t+1 \text{ of same 5-year } \textit{age group}, \\
&\textit{gender}, \text{ and } \textit{diagnosis} \text{ group that were alive year } t. \qquad (23)
\end{aligned}
$$

The aim is to consistently define the point in time when the individual learns about her new survival probability as well as capture the development of the future conditional survival probability path. In particular, Figure 4 shows average survival probability for different diagnosis groups over time relative to the point of the first diagnosis. I also account for the group survival probability the year *after* diagnosis, *conditional* on surviving one year. Only if a worse diagnosis occurs, the survival probability is calculated in the new diagnosis-age-gender group. Thereafter, if no new diagnosis is registered, the survival probability goes back to the relevant average in the healthy age-gender group. Note the large heterogeneity between diagnoses.

Average survival probability in the sample is 0.98, with a standard deviation of 0.04 (Table 1). Figure 5 shows average survival rate over life, split by gender and health status. Heterogeneity in survival rate between different diagnosis groups is illustrated in Figure 6.

3.4 Income and marginal utility

Health may also affect savings through changes in income and marginal utility. I define these mechanisms as diagnosis characteristics $\boldsymbol{Z_{it}}$, i.e. as averages of all individuals of the same age, gender, and diagnosis.

To measure the current income change, I use the ratio of disposable income in the year of diagnosis to disposable income in the pre-diagnosis year. To measure the expectation of future income, I use the ratio of average income in the three years after diagnosis to income in the pre-diagnosis year. These measures are defined as

$$Z_{\text{Current income},i,t} = \frac{\text{Income}_{adg,t}}{\text{Income}_{adg,t-1}} \tag{24}$$

and

$$Z_{\text{Future income},i,t} = \frac{\text{Average income}_{adg,t+1\to t+3}}{\text{Income}_{adg,t-1}}. \tag{25}$$

To measure marginal utility of consumption I use a measure of disease severity as a proxy, i.e. to what extent a certain diagnosis will affect the possibilities to consume. In particular, I proxy for marginal utility of consumption by length of hospitalisation. The idea is that a diagnosis that is associated with long hospitalisation is likely to limit the possibilities to consume than a diagnosis with short hospitalisation. Long hospitalisation both signals severity and restricts consumption of certain goods such as travelling. I have one measure of current marginal utility (severity), and one measure of expected marginal utility (severity) in the subsequent years,

$$Z_{\text{Current MU},i,t} = (-)\text{Number of days hospitalized}_{adg,t} \tag{26}$$

and

$$Z_{\text{Future MU},i,t} = \text{Average MU}_{adg,t+1\to t+3}. \tag{27}$$

These proxies captures some dimensions that limit the marginal utility of consumption.

4 Empirical strategy

In the first part of the analysis, I describe how these diagnosis-level characteristics affect individuals' savings for different groups. In the second part, I use quasi-experimental difference-in-differences estimation as the key strategy to identify the causal effect of survival probability on savings.

4.1 Descriptive analysis

I describe the effect of survival probability on savings, holding demographic factors constant. I add controls and fixed effects stepwise, including income and severity measures $\boldsymbol{Z_{it}}$ and estimate

$$\begin{aligned} Savings_{it} =& \beta \, Survival\ probability_{it} + \\ & \boldsymbol{\gamma} \, \boldsymbol{Z_{it}} + \alpha_i + \boldsymbol{\delta} \, \boldsymbol{X_{it}} + year_t + diagnosis_{dt} + \varepsilon_{it}. \end{aligned} \tag{28}$$

Following the hypotheses in Section 2, I expect the coefficients β and $\boldsymbol{\gamma}$ to have the signs listed in Table 3. I control for pre-determined as well as time-varying individual characteristics $\boldsymbol{X_{it}}$ including gender, age, education, and family composition. I include individual fixed effects to control for any time-invariant unobservable heterogeneity. The identifying variation is within individuals over time, i.e. the key is that there are no time-varying, unobserved factors correlated with health and savings at the individual level. Year fixed effects alleviate concerns business cycle factors correlated with savings and health. Diagnosis fixed effects are defined by the most severe diagnosis in year t, and allows for controlling for diagnosis-specific variation within individuals.

4.2 Quasi-experimental analysis

The main specification for identifying causality is a difference-in-differences set-up based on timing of diagnosis. I compare individuals who are diagnosed in year τ to individuals with the same diagnosis Δ years later. The identifying variation is the difference between those diagnosed, and those who will be diagnosed a few years later. The key identifying assumption is that timing of the diagnosis is as good as random, at least within a small window Δ. Similar identification strategies are used by Fadlon and Nielsen (2017), Kvaerner (2017), Martinello and Druedahl (2017), and Nekoei and Seim (2018). Let $Treat$ be an indicator variable that takes the value 1 if the individual is diagnosed and 0 otherwise, and estimate

$$\begin{aligned} Savings_{it} =& \tilde{\beta}\,\text{Treat}_i \times \text{Post}_t + \\ & \rho\,\text{Post}_t + \alpha_i + \boldsymbol{\delta}\,\boldsymbol{X_{it}} + year_t + diagnosis_{dt} + \varepsilon_{it}. \end{aligned} \tag{29}$$

For individuals diagnosed in year τ, $Treat = 1$. For individuals diagnosed with the same diagnosis in year $\tau+\Delta$, $Treat = 0$. The main coefficient of interest is $\tilde{\beta}$ and is the differential effect of a diagnosis on savings, relative to a comparable control group.

The choice of Δ involves a trade-off between comparability of treated and control groups and the desire to follow the outcome for a period that is as long as possible. For example, Fadlon and Nielsen (2017) set $\Delta = 5$. I set $\Delta = 3$ given the sample period is relatively short. Thus, in the analysis, I use a six-year window, i.e. observations three years before the treatment group's first, year of diagnosis, and two years after. In a robustness analysis, I use a "rolling window" to increase power.

Next, to estimate the causal effect of survival probability on savings directly we allow for continuous treatment. Treat is replaced by the change in survival probability at the time of the treatment group's first diagnosis. Thus, the treatment group will experience varying changes in survival probability depending on the individual's diagnosis. The control group will not experience any substantial change. The effect of survival probability on savings, $\hat{\beta}$, is estimated as

$$\begin{aligned} \mathit{Savings}_{it} =& \hat{\beta}\, \mathit{Survival\ probability\ drop}_i \times \mathrm{Post}_t + \\ & \rho\, \mathrm{Post}_t + \boldsymbol{\gamma}\, \boldsymbol{Z_{it}} + \alpha_i + \boldsymbol{\delta}\, \boldsymbol{X_{it}} + \mathit{year}_t + \mathit{diagnosis}_{dt} + \varepsilon_{it}. \end{aligned} \tag{30}$$

4.3 Heterogeneity

I document some dimensions of heterogeneity. In particular, the effects could vary with family composition as discussed in Section 2.4. For example, individuals with a spouse or children, may have different incentives to save due to bequest motives, compared to single individuals without heirs. A reduction in survival probability implies a trade-off between dissaving while alive and increasing savings for bequests. By splitting the sample across family composition I study how lower survival probability affects these groups differently.

5 Results

5.1 Descriptive analysis

In the simple regression, ignoring the panel structure of the data, there is a positive relationship between survival probability and annual savings (Table 4, Column 1). As survival probability falls, so does annual savings. However, this relationship is endogenous for many reasons, e.g. individuals with worse survival prospects may have different savings patterns. The relationship breaks down when I control for demographic factors correlated with survival probability and saving: age, gender, and age*gender (Column 2). As I control for unobserved time-invariant characteristics by including individual fixed effects, the coefficient turns negative (Column 3). Including both demographic factors and unobserved heterogeneity the coefficient of -1.2 means that one standard deviation drop in survival probability (0.04 percentage points) leads to a 5 percent *increase* in annual savings (Column 4). The result is robust to adding year fixed effects, additional time-varying demographic variables such as family composition, as well as time-varying diagnosis group estimated as in specification (28) (Table 5). It is also robust to re-coding small values of saving to 1000 or -1000.

The role of bequest motives

In Table 5, Column 3, the effect of being in a couple is positive for saving, possibly due to economies of scale within the household. The effect of having children is negative for saving, consistent with the idea that children are costly.

To understand bequest motives better, I compare individuals with different family composition during the sample period. If bequest motives were at play, singles would save less than individuals with a spouse (or increase savings by less) in response to changes in survival probability. I find that singles increase savings by *more* than those with a spouse. In response to one standard deviation drop in survival probability, singles increase savings by 8 percent whereas those with a spouse increase savings by 3 percent (Table 6). Note that we cannot interpret this differential effect causally since there might be unobserved differences between those with and without spouses that might be correlated with the response to survival probability. There are a at least three interpretations of this result. First, the household could work as an insurance mechanism. If the change in survival probability is concurrent with a shock to income uncertainty, the single household might want to increase savings for precautionary motives whereas individuals in couples might rely on their spouse. Alternatively, there could be role of life insurance that is present in couples but not in single households. However, the result is the same after restricting only to retired individuals, offering limited support for this interpretation.Second, marginal utility of consumption may be higher in better states, in terms of having company. If the surviving spouse prefers consumption when the dying partner is alive, she would prefer to use savings for consumption instead of receiveing them as bequest later. As long as the dying individual takes the utility of a surviving spouse at least partially into account, the downward pressure on savings increases among couples. Such an effect should be stronger among older couples, and weaker among younger ones, in particular, if the surviving spouse is younger. Third, the same diagnosis may affect marginal utility of individuals with and without a spouse differently as the spouse may offer some practical assistance in facilitating consumption such as travelling.

If bequest motives were at play, individuals without children would save less than those with children (or increase savings by less) in response to changes in survival probability. I find some evidence that this is the case. Individuals with children increase savings by 5 percent when survival probability falls by 1 standard deviation (Table 7, Column 3).

As an additional test, I compare singles, with and without children, to those with a spouse, without and with children (Table 8). If bequest motives had been at play, the coefficient would be highest for singles without children (Column 2), lower for singles with children or couples without children (Column 3 and 4), and lowest for couples with children (Column 5). We do not see such a pattern. The coefficient is lower for singles with children than for singles without children. Similarly, the coefficient is lower for couples with children than for couples without children. However, both coefficients on couples, with and without children, are higher than both coefficients on singles.

All in all, I find some support for bequest motives as a reason for saving for your children. Between couples there is no evidence for bequest motives. If income uncertainty is a play, we should not see this effect among retirees.

Working age or being retired

Figure 2 shows how annual savings varies over the life cycle. In Table 9, I compare individuals who are below or above 65 years during the sample period. The negative effect of survival probability on savings is driven by individuals who have past retirement age. However, since retirees' income does not depend on health status, the effect is unlikely to be driven by concurrent shocks to income or precautionary savings motives from lower future expected income. For working-age individuals, the coefficient is positive but not significant. These results are in line with findings in previous literature on the retirement savings puzzle, i.e. the lack of dissaving among the old. Related to aging is deteriorating health.

The role of health

To understand how the response to changes in survival probability relates to concurrent changes in health status, I compare individuals who are never diagnosed during the sample period to those who are (Table 10). For the never diagnosed the coefficient is positive, consistent with dying-and-dissaving behavior (Column 2). However, for the diagnosed the coefficient is negative (Column 3). Before diagnosis the coefficient is positive (Column 4), similar to the never diagnosed. Whereas after diagnosis, the coefficient turns negative, although not significant (Column 5).

To test the hypotheses in Section 2, I control for diagnosis-level characteristics Z, including $Current\,income$, $Future\,income$, $Current\,marginal\,utility$, and $Future\,marginal\,utility$. The sample is restricted to those that are diagnosed at some point. The impact is shown step-wise in Table 11. Neither coefficient on the two income measures is significantly different from zero (Column 2 and 3). Neither income today, nor expected income the next three years, relative to income in $t-1$, affect savings in t. Income today should matter for available resources to allocate to current savings and consumption, whereas expected income tomorrow should matter for precautionary savings motives today although the hypothesized effect is ambiguous. One caveat here is that income in t is likely to be endogenous with respect to survival probability in t if the change is driven by a severe disease that simultaneously leads to sick leave.

In line with the hypothesis, *Current marginal utility* has a negative effect on savings. The idea is that number of days in hospital is a proxy for how much the diagnosis limits the marginal utility of consumption. Spending one extra day in hospital in year t leads to 1.4 percent higher savings (Column 4). However, in contrast to the hypothesis *Future marginal utility* has a *positive* effect on saving. Expecting one day extra day in hospital per year the next three years leads to 4.9 percent higher savings in t (Column 5). Clearly, hospitalisation today is correlated with hospitalisation tomorrow. However, when both measures are included, both coefficients remain negative (not reported).

The effect of survival probability on savings remains negative and significant in almost all cases, with the exception of when I control for *Current marginal utility*. However, neither Z measure increases the explained variation in savings measured by adjusted R^2 (compared to Column 1). The negative effect of survival probability on savings is robust to adding the all Z measures together as well as year fixed effects and individual time-varying characteristics X, in addition to the baseline fixed effects (Column 5 and 6).

The role of financial resources

The effect of survival probability on savings may vary with financial resources. For someone without assets, low income, and subsequent borrowing constraints, the potential effect of a lower survival probability will be bounded. There is also a habit in annual consumption, i.e. a consumption floor. In Table 12 and 13, I explore how the effect varies with position in the net wealth and income distribution. At the start of the sample period I assign individuals to their net wealth quartile as well as an income quartile. I assume individuals do not cross quartiles during the sample period of eight years.[5] The average negative effect is mainly driven by wealth-poor as well as income-poor individuals. Individuals in the lower net wealth quartiles increase savings in response to lower survival probability whereas only

[5]Note that these results cannot be interpreted causally, see e.g. Attanasio and Hoynes 2000 who discuss differential mortality with respect to wealth.

individuals in the highest quartile show dissaving behavior (Table 12). The same holds for the income distribution (Table 13).

Theoretically, individuals who have capacity to dissave are those who are either financially wealthy and/or have capacity to take increase debt, i.e. those with substantial real net wealth. I categorize an individual to be financially wealthy if she can sustain at least two years worth of consumption with her financial wealth. Similarly, I categorize and individual to have debt capacity if her real net wealth can sustain at least two years worth of consumption. For these, I expect dying-and-dissaving behavior, i.e. a positive coefficient. Whereas for individuals with neither financial wealth nor debt capacity, the coeffecient is unlikely to be positive. Indeed, I find that individuals who are financially wealthy dissave, with or without sufficient debt capacity (Table 14, Column 3 and 4). Individuals who are financially poor without debt capacity increase saving, consistent with having limited resources (Column 1). However, individuals who are financially poor, but *with* debt capacity, do not make use of those resources, but instead increase savings on average (Column 2). This could partially be explained by higher transaction costs of going to the bank and taking a loan, compared to using more liquid financial assets. It is not the full explanation, though, since the result is robust to including only those who already had some debt before diagnosis, arguably with lower transactions costs (not reported). What seems to be driving the increase in saving is the lack of financial wealth. The pattern is the same when additional controls and year fixed effetcts are included, although with no significance for the smallest group, i.e. financially wealth without debt capacity (Table 15).

To rule out that the effect is driven by financially poor having relatively worse concurrent income shocks or future income prospects, I restrict the analysis to *retirees*. The results by consumption capacity follow the same pattern (Table 16). The same is true for the results by initial net wealth and income quartiles (not reported). Also, since I include individual fixed effects it is unlikely that the result is driven by unobserved time-invariant heterogeneity between individuals, such as low labor income due to bad health during working age, correlated with low pension and bad health after retirement.

I also want to rule out that the effect is driven by financially poor having worse diseases. To do so, I restrict the analysis to retirees with the *same diagnosis*. Tables 17-19 show the results for cancer (malign), heart attack, and chronic lower respiratory diseases. The pattern across consumption capacity is similar for different diagnoses, even though the sample turns quite small in some groups which calls for careful interpretation. The results are inconsistent with the idea that the financially poor have worse diseases. However, by this comparison I cannot rule out that the same diagnosis affects the poor more adversely.

The take-away from the descriptive analysis is that young, rich, and healthy behave accordingly with the dying-and-dissaving hypothesis whereas the old, poor, and unhealthy do not. To identify the causal effect we now turn to the quasi-experimental set-up.

5.2 Quasi-experimental analysis

I restrict the quasi-experimental analysis to individuals who have their first diagnosis between 2002 and 2007. The treatment groups are individuals who have their first diagnosis 2002-2004, and the control group are those diagnosed 2005-2007. The idea is that the first diagnosis reveals new information on the individual's survival prospects. Diagnoses in subsequent years may further deteriorate the survival prospects which is captured by *Survival probability.* The key identifying assumption is that the exact timing, i.e. t or $t + 3$, of the first diagnosis is as good as random.

Table 2 presents means and differences in means for key variables in the treatment and control group respectively. Some variables are significantly different. However, these differences will not be important since the baseline specification includes individual fixed effects. Also, the differences are small. For example, the difference in mean survival probability is less than one tenth of a standard deviation. Most importantly saving is not different pre-treatment. Without matching on cohort the treatment group is on average older at the time of diagnosis than the control group. This may be an issue if saving is highly driven by life-cycle motives. Therefore, I will also match on cohort in a later stage following Fadlon and Nielsen (2017).

The difference-in-differences result estimated as in specification (29), suggests that annual savings of the treatment group *increases* relative to savings of the control group after the first diagnosis (Table 20, Column 1 and 2). However, the coefficient is imprecisely estimated, possibly due to important differences across wealth and diagnosis groups.[6]

I allow for continuous treatment in terms of how much the first diagnosis affects survival probability. The result suggests that a fall in survival probability leads to *higher* annual savings. (Table 20, Column 3 and 4). A fall in survival probability corresponding to one standard deviation leads to 16 percent higher savings. The coefficient is significant at 0.1 percent level. This result is in line with the results in Section 5.1, i.e. inconsistent with dying-and-dissaving behavior.

The role of bequest motives

Consistent with the descriptive analysis, individuals with and without spouses react differently. Singles increase savings by *more* than those with a spouse in response the same fall in survival probability (Table 21, Column 2).

Again, consistent with the descriptive analysis, individuals with children increase savings by *more* than those without in response to a fall in survival probability diagnosis, relative to the control group (Table 22, Column 3).

[6] If power is an issue, that will be less problematic once I add the remaining 80 percent of the population. Additionally, as discussed by Fadlon and Nielsen (2017), I can also increase power by using a rolling window, allowing the not-yet-diagnosed remain in the control group until they are treated.

Working age or being retired

Similar to the descriptive evidence, the experimental evidence suggests that the young die and dissave, whereas the old do not (Table 23). The average negative effect is driven by individuals older than 65. Individuals aged 65 and younger seems to reduce savings in response to lower survival probability, although this is estimated imprecisely. Figure 10 shows the effect by age group at the time of the treatment group's first diagnosis. One caveat is that the treated are on average 2 years older without matching on cohort (Table 2).

The role of health

The role of health will matter differently depending on the type of diagnosis. Figures 11 and 12 (Panel C) show the treatment effect for two acute and severe diagnosis groups with a large effect on survival probability: bad cancer, and heart attack. On the other hand, Figure 13 shows the effect of a chronic and relatively mild disease group: chronic lower respiratory diseases.

The treatment effect varies as hypothesized with health-related income and marginal utility (Table 24). Consistent with Hypothesis 2, the coefficient on $Current\,income$ is positive, but it is small and insignificant. The coefficient on $Future\,income$ is also positive, suggesting that the effect of lower future income is dominated by the negative effect of survival probability. However, the coefficient is small and insignificant. The coefficient on $Current\,marginal\,utility$ is negative and significant, suggesting that the effect of bad health dominates the effect of lower survival probability (Hypothesis 4). The sign on $Future\,marginal\,utility$ is also negative, opposed (Hypothesis 5) and statistically significant. The effect of survival probability remains negative, also after controlling for all four factors of health-related income and marginal utility.

The role of financial resources

There is a role of pre-treatment net wealth. The richest quartile clearly shows dissaving behavior in response the the first diagnosis (Figure 15). Consistent with the descriptive analysis, the average negative effect is driven by the net wealth poor (Table 25). The same holds for the income distribution (Table 26). As discussed in Section 5.1, the capacity to dissave varies a lot before the first diagnosis. The effect of lower survival probability is negative and significant for the financially poor (with and without debt capacity) and positive for the financially rich (with and without debt capacity) (Table 27). The result is in line with Hypothesis 7 and with the descriptive results.

6 Discussion

First, timing matters. And timing matters in both directions. There are theoretical motivations for both lagging and forward-looking behavior. The effect of survival probability in t may affect mainly savings in $t+1$, e.g. if there is a mental avoidance and delay in acceptance, or just if the individual receives the diagnosis late in year t. This effect should only apply to diagnosed individuals that receive new information during the year. Conversely, from a life-cycle perspective, not only survival probability in t matters for savings in t, but also the distribution of future survival probabilities.

In Section 5.1, where I look at the concurrent effect of survival probability in t on savings in t (i.e. the active change in wealth between end-of-year $t-1$ and end-of-year t), the average effect is negative (-1.1). If I use the lag of the outcome variable, i.e. looking at the effect of survival probability in t on savings in $t+1$, I find a *positive* effect in the baseline specification, even though it turns negative (and insignificant) in the full specification with additional controls (Table 28).

There is also evidence of forward-looking behavior. Table 29 show that not only current survival probability matters for savings today, but also conditional survival probability in $t + 1$, $t + 2$, and $t + 3$. If the individual expects future survival probability to decrease, she saves more today, not in line with dying-and-dissaving hypothesis. Perhaps survival bias is part of the explanation for this result. It calls for further investigation.

Second, the role of income is unclear. There is a strong relationship between the variables saving, consumption, and income, as they are defined as an identity. I find that the average effect of survival probability on savings is -1.2. The effect on income is -0.1 and on consumption -0.2 in the same baseline specification. However, in the full model with additional individual controls, year fixed effects, and diagnosis fixed effects, the effect of survival probability is -1.4 on saving, but 0.05 on income and zero (imprecisely) on consumption. Figure 17 shows the income relative to the year of the first diagnosis for working age (Panel A) and retirement (Panel B) respectively. There is a drop, or flattening out, in income the year before diagnosis. This could be driven by a survival bias, i.e. those who survive the diagnosis have higher income. But Figure 18 shows that the effect remains even when splitting by time of survival after diagnosis. Alternatively, the income pattern could be explained by substantial sick leave before diagnosis and introduction of proper treatment which benefits work ability. The analyses restricted to retirees in Sections 5.1 and 5.2 close down the income channel, at least partially. It is limited by the fact that individuals may choose different payout schemes of private pensions depending on health status (Hagen (2015)).

7 Conclusion

I find evidence in support of the dying-and-dissaving hypothesis among the young, rich, and healthy. Among the old, poor, and sick, a fall in survival probability is instead associated with an increase in savings. The individual's financial capacity to dissave, and increase consumption, matters. In particular, dying-and-dissaving is observed among those with financial wealth that can sustain at least two years worth of consumption. This pattern is not driven by labor income shocks or more severe diagnoses among the poor. I find some support for bequest motives among parents, who increase savings in response to a fall in survival probability. However, there is no support for bequest motives among spouses. To the contrary, singles increase savings by more than those with a spouse.

The average effect of survival probability remains negative after controlling for health-related factors such as income shocks or marginal utility of consumption. Lower income at diagnosis, relative to pre-diagnosis income leads to lower savings. Lower *future* income prospects at diagnosis leads to lower savings. Lower marginal utility at diagnosis leads to higher savings, suggesting that the effect of bad health dominates the effect of lower survival probability. Lower *future* marginal utility at diagnosis leads to higher savings.

Overall, I argue that these results support of an extended life-cycle model. The importance of timing and persistence of the effect, and the exact role of income needs further study. Also, I will use the exogenous variation in survival probability to learn more about individual time and risk preferences.

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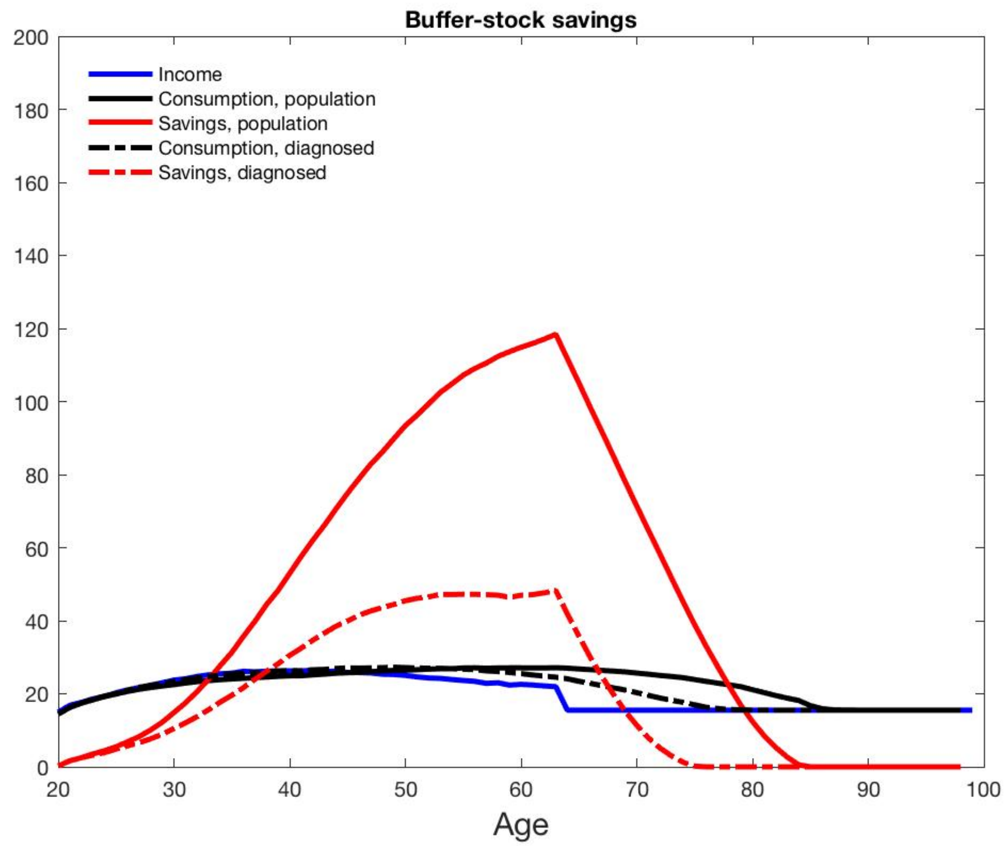
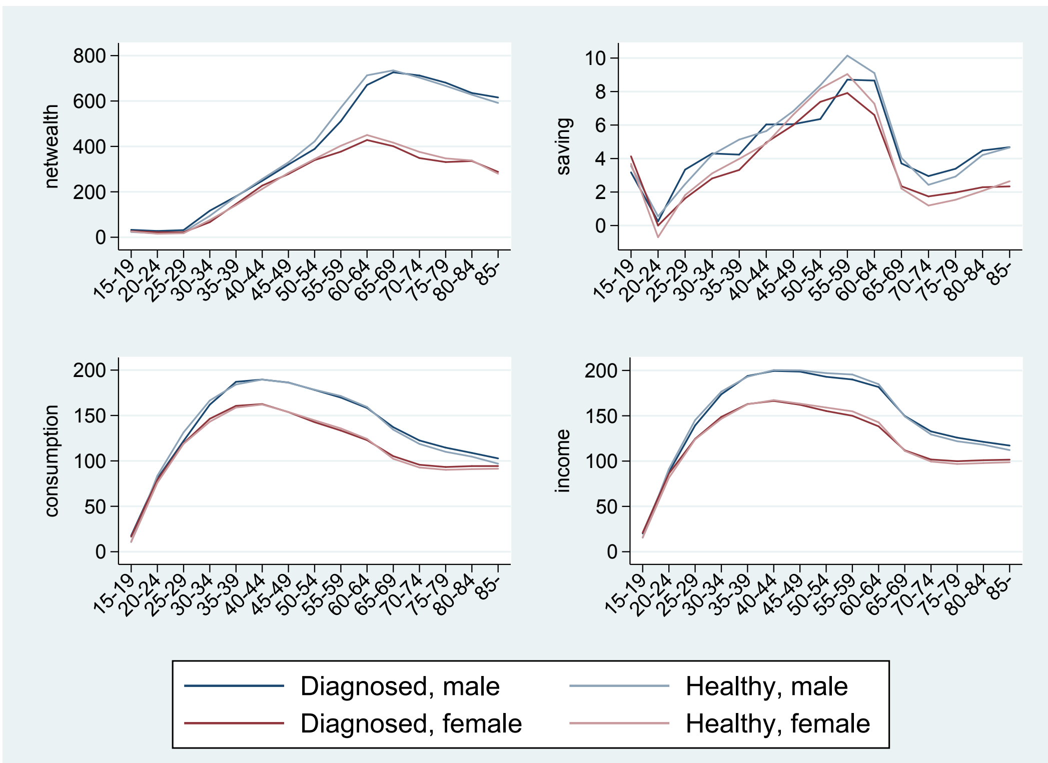
Figures

Figure 1: Simulated life cycle profiles



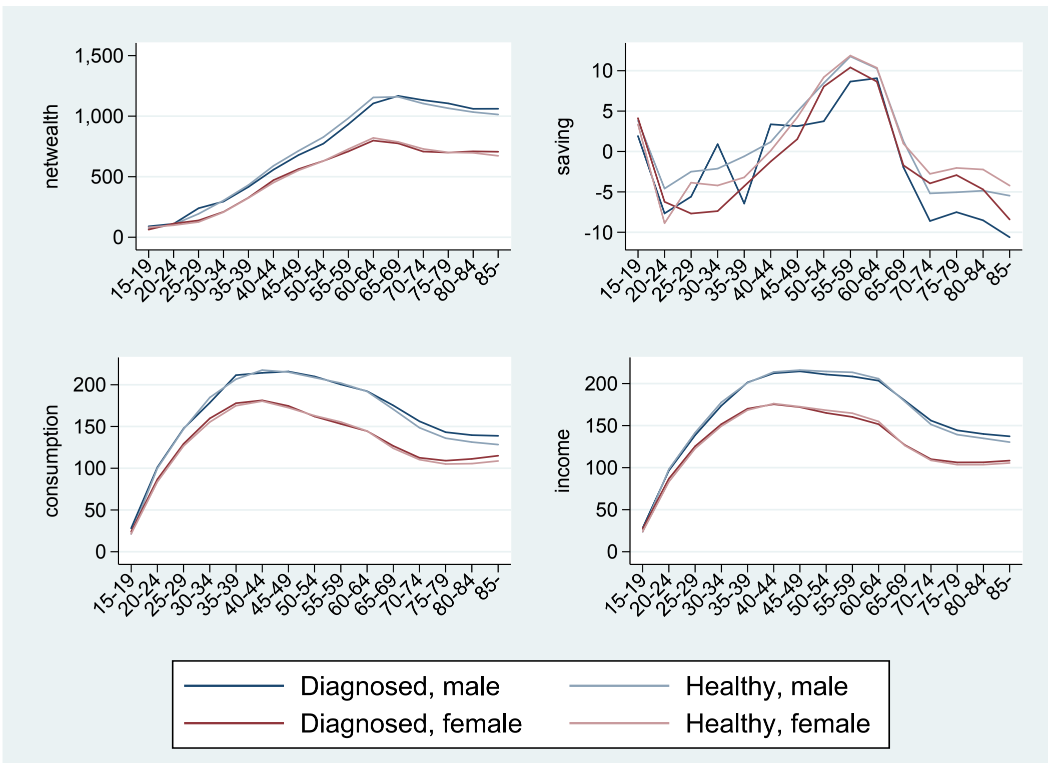
The figure shows the simulated life-cycle profiles of income, consumption, and total savings from a buffer-stock savings model following Carroll (1997). The solid lines show the profiles for individuals with uncertain lifetime with a survival probability path corresponding to population average. The dashed lines show the profiles for individuals with a lower survival probability path corresponding to the average of the diagnosed in Figure 5. Income for this group is assumed to be the same as population average.

Figure 2: Financial variables by age, gender, and health - Median



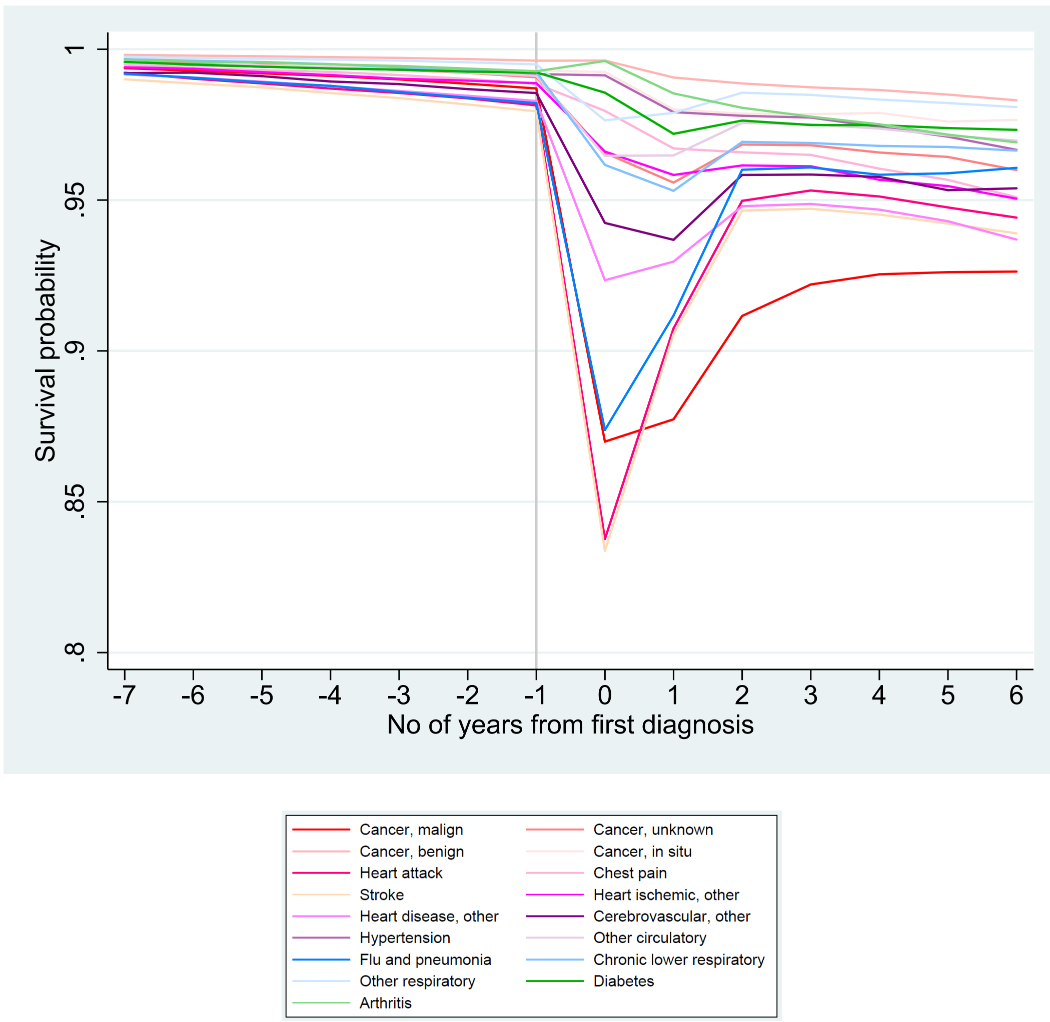
The figures show the median net wealth, annual savings, consumption, and disposable income over life by gender and health status. All variables are winsorized at 0.5th and 99.5th percentile. Negative values of imputed consumption are set to zero. All figures are denoted in thousands of SEK.

Figure 3: Financial variables by age, gender, and health - Mean



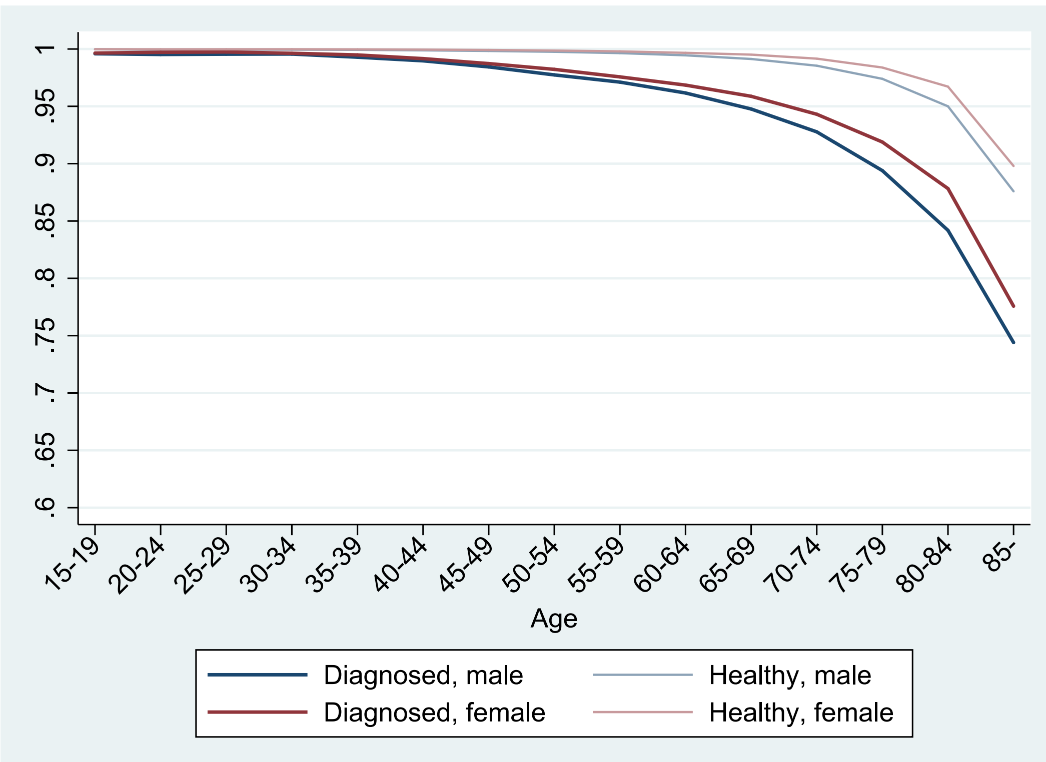
The figures show the mean net wealth, annual savings, consumption, and disposable income over life by gender and health status. All variables are winsorized at 0.5th and 99.5th percentile. Negative values of imputed consumption are set to zero. All figures are denoted in thousands of SEK.

Figure 4: Survival probability by diagnosis group from time of first diagnosis



The figure shows survival probability relative to the time of the first diagnosis for different diagnoses. In year 0, survival probability is defined as the group mean survival rate by diagnosis-age-gender, i.e. the predicted value of being alive in year 1. In year 1, survival probability is defined as the predicted value of being alive in year 2, *conditional* on being alive in year 1. It is based on the same diagnosis-age-gender group as in year 0 unless a worse diagnosis occurs. In year 3, survival probability is defined as the group mean survival rate by the diagnosis-age-gender.

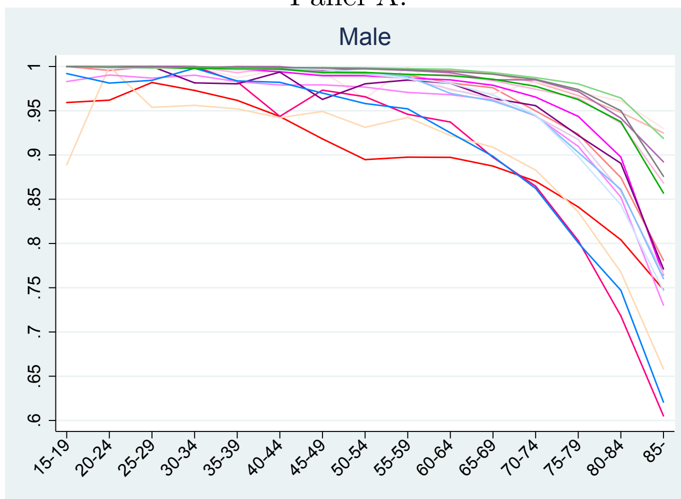
Figure 5: Survival probability by age, gender, and health



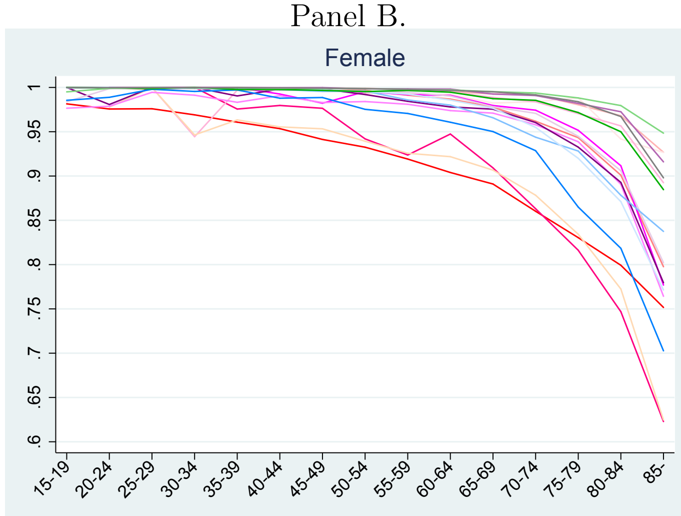
The figure shows survival probability over life by gender and health status.

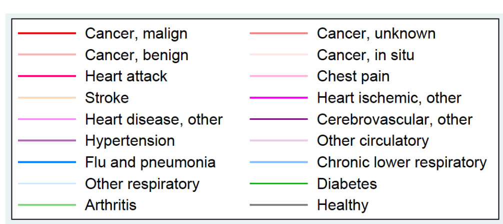
Figure 6: Survival probability by age, gender, and diagnosis group

Panel A.



Panel B.

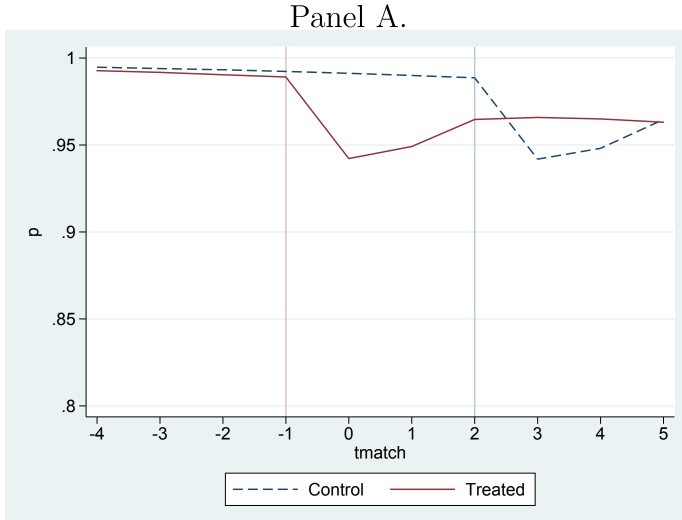




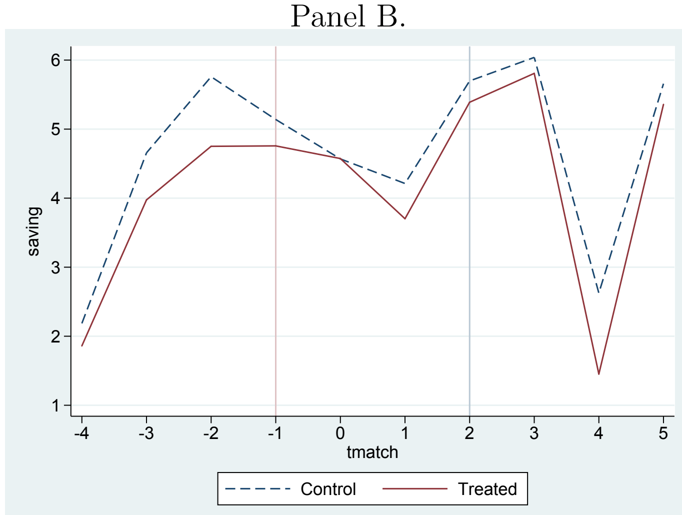
The figures show survival probability over life by diagnosis for men (Panel A) and women (Panel B) separately.

Figure 7: Survival probability and annual savings of treatment and control groups

Panel A.



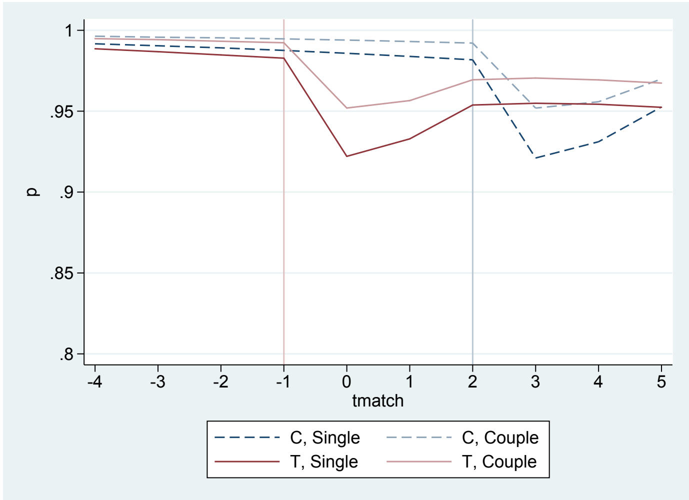
Panel B.



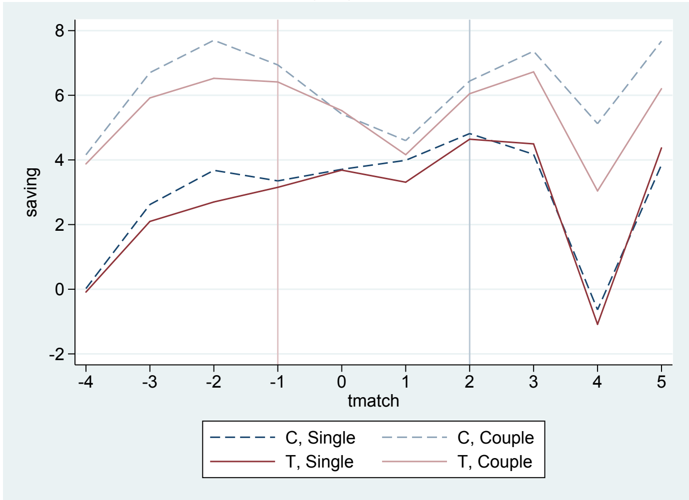
The figures show mean survival probability (Panel A) and median annual savings (Panel B) of treatment and control groups over time. The treatment group is diagnosed in year 0 and the control group in year 3. Savings is denoted in thousands of SEK.

Figure 8: Survival probability and annual savings of treatment and control groups - By marital status

Panel A.



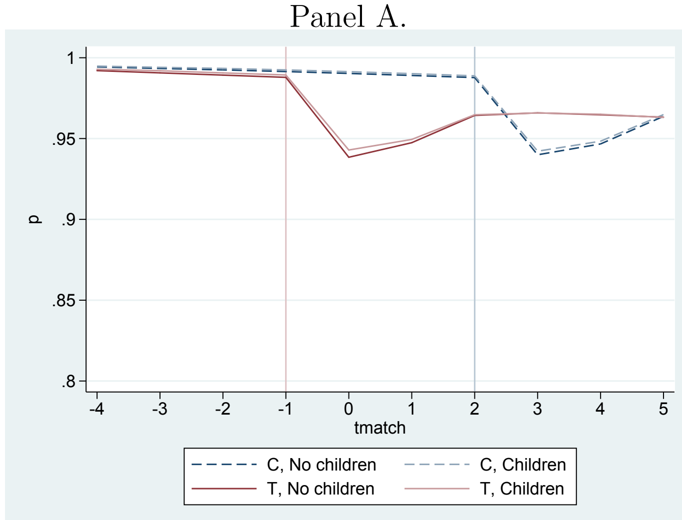
Panel B.



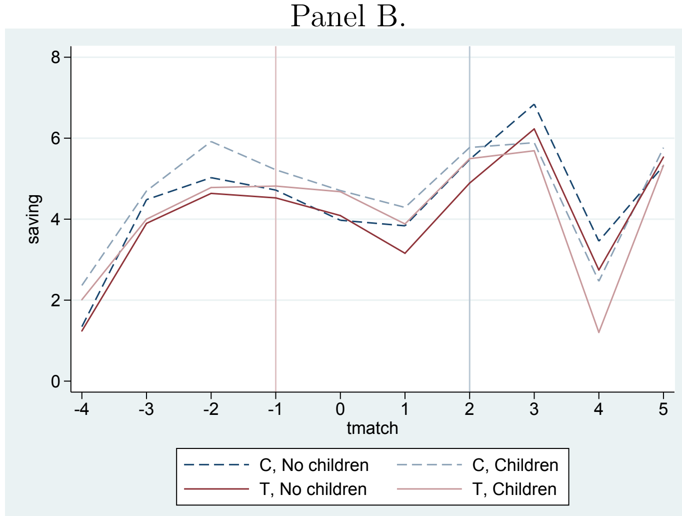
The figures show mean survival probability (Panel A) and median annual savings (Panel B) of treatment and control groups by marital status in year -1. The treatment group is diagnosed in year 0 and the control group in year 3. Savings is denoted in thousands of SEK.

Figure 9: Survival probability and annual savings of treatment and control groups - By children

Panel A.



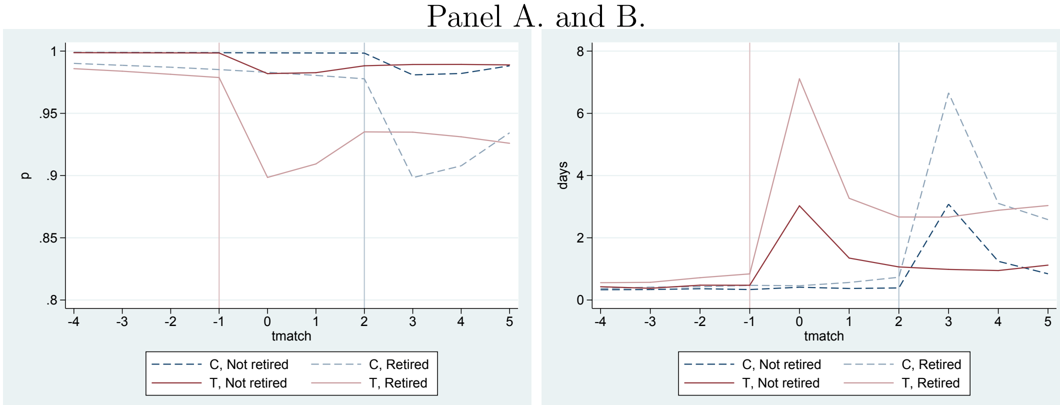
Panel B.



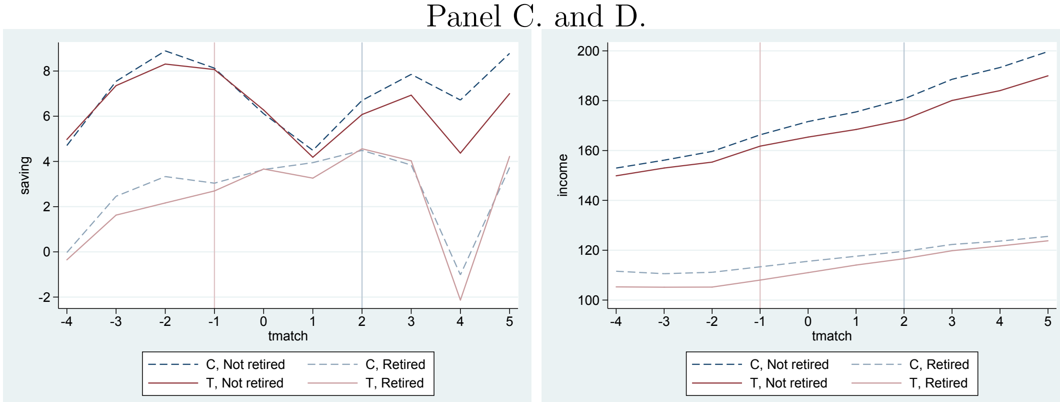
The figures show mean survival probability (Panel A) and median annual savings (Panel B) of treatment and control groups by children status in year -1. The treatment group is diagnosed in year 0 and the control group in year 3. Savings is denoted in thousands of SEK.

Figure 10: Survival probability and annual savings of treatment and control groups - By retirement

Panel A. and B.



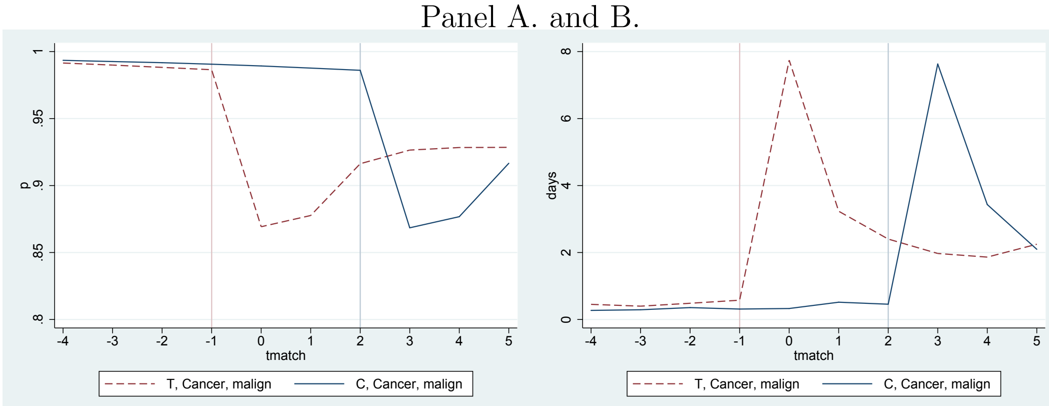
Panel C. and D.



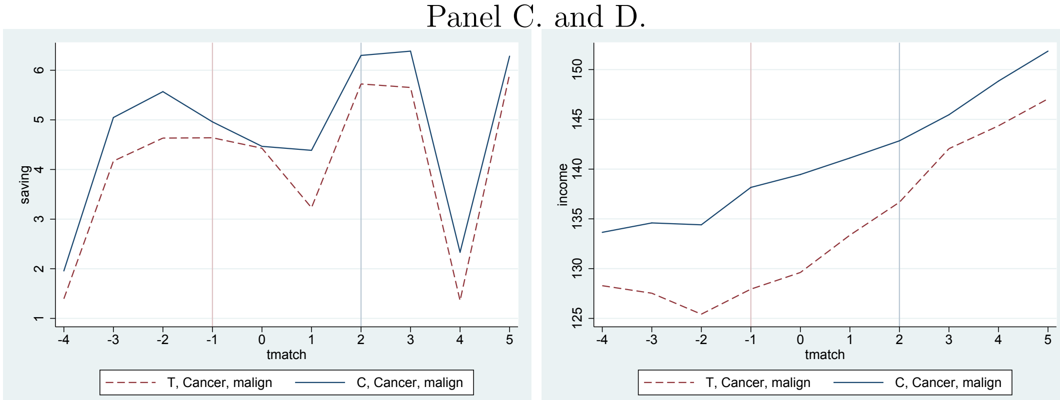
The figures show mean survival probability (Panel A) and median annual savings (Panel B) of treatment and control groups by retirement status. An individual is defined as retired if she is aged > 65 in year -1 The treatment group is diagnosed in year 0 and the control group in year 3. Savings is denoted in thousands of SEK.

Figure 11: Survival probability and annual savings of treatment and control groups - Cancer, malign

Panel A. and B.



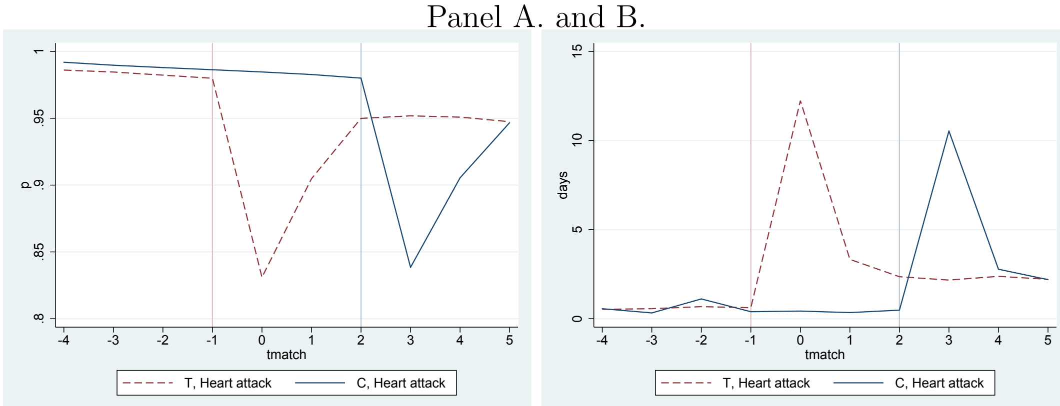
Panel C. and D.



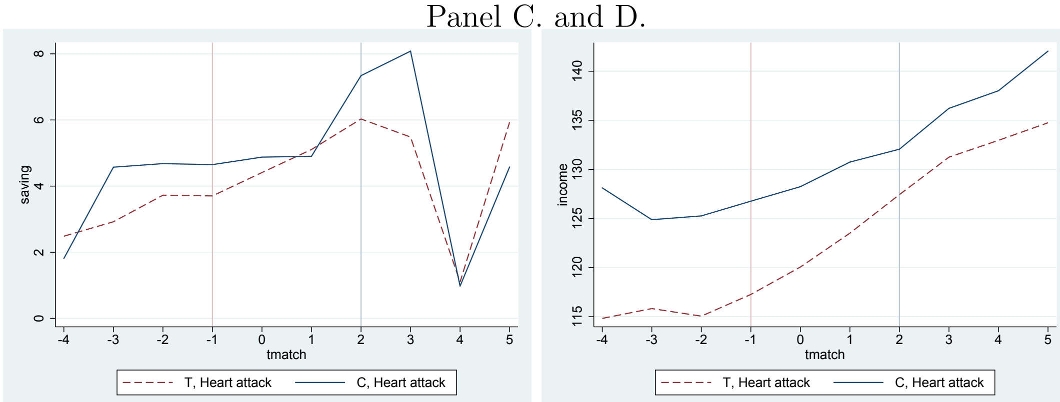
The figures show mean survival probability (Panel A), mean number of days in hospital (Panel B), median annual savings (Panel C), and median disposable income (Panel D) of treatment and control groups for individuals whose first diagnosis is malign cancer. The treatment group is diagnosed in year 0 and the control group in year 3. Savings and income are denoted in thousands of SEK.

Figure 12: Survival probability and annual savings of treatment and control groups - Heart attack

Panel A. and B.



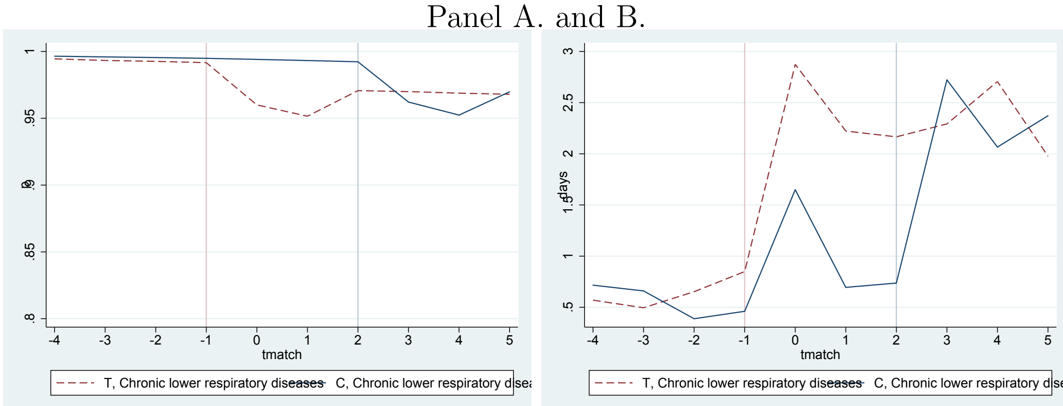
Panel C. and D.



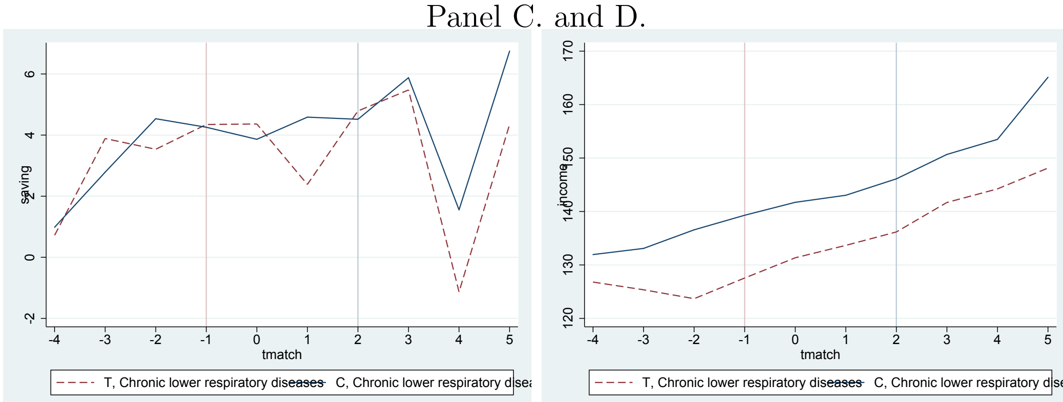
The figures show mean survival probability (Panel A), mean number of days in hospital (Panel B), median annual savings (Panel C), and median disposable income (Panel D) of treatment and control groups for individuals whose first diagnosis is heart attack. The treatment group is diagnosed in year 0 and the control group in year 3. Savings and income are denoted in thousands of SEK.

Figure 13: Survival probability and annual savings of treatment and control groups - Chronic lower respiratory diseases

Panel A. and B.



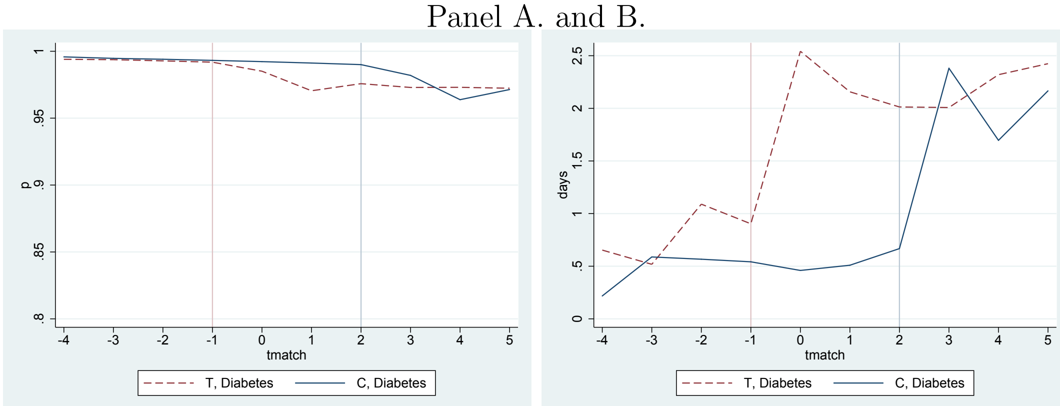
Panel C. and D.



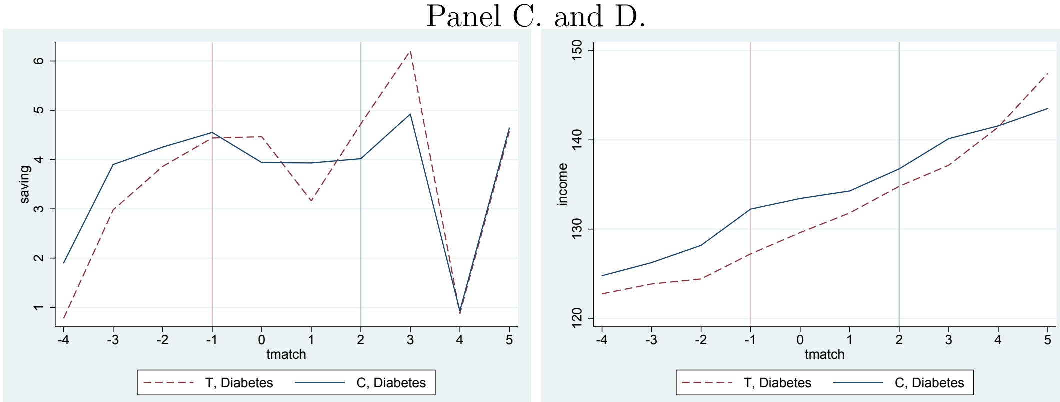
The figures show mean survival probability (Panel A), mean number of days in hospital (Panel B), median annual savings (Panel C), and median disposable income (Panel D) of treatment and control groups for individuals whose first diagnosis is a chronic lower respiratory disease. The treatment group is diagnosed in year 0 and the control group in year 3. Savings and income are denoted in thousands of SEK.

Figure 14: Survival probability and annual savings of treatment and control groups - Diabetes

Panel A. and B.



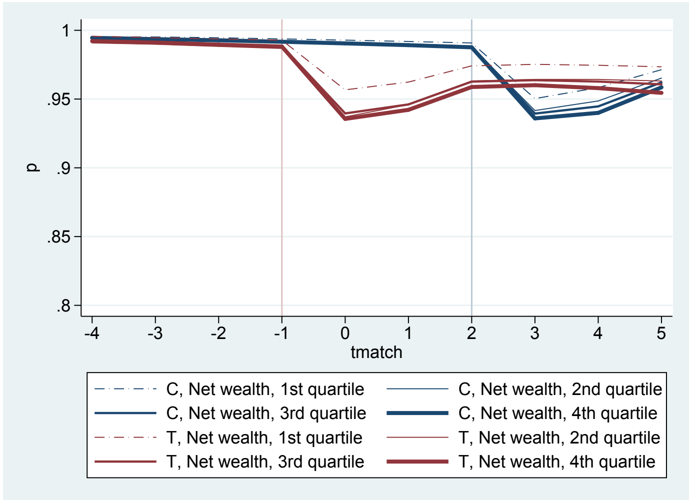
Panel C. and D.



The figures show mean survival probability (Panel A), mean number of days in hospital (Panel B), median annual savings (Panel C), and median disposable income (Panel D) of treatment and control groups for individuals whose first diagnosis is diabetes. The treatment group is diagnosed in year 0 and the control group in year 3. Savings and income are denoted in thousands of SEK.

Figure 15: Survival probability and annual savings of treatment and control groups - By initial net wealth

Panel A.

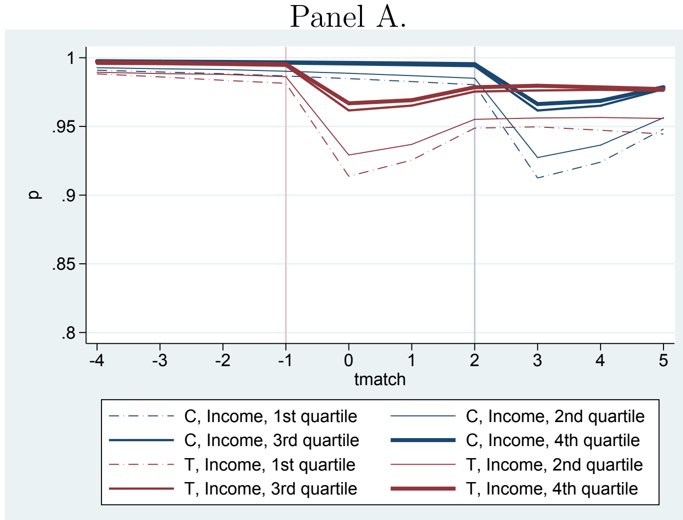


Panel B.

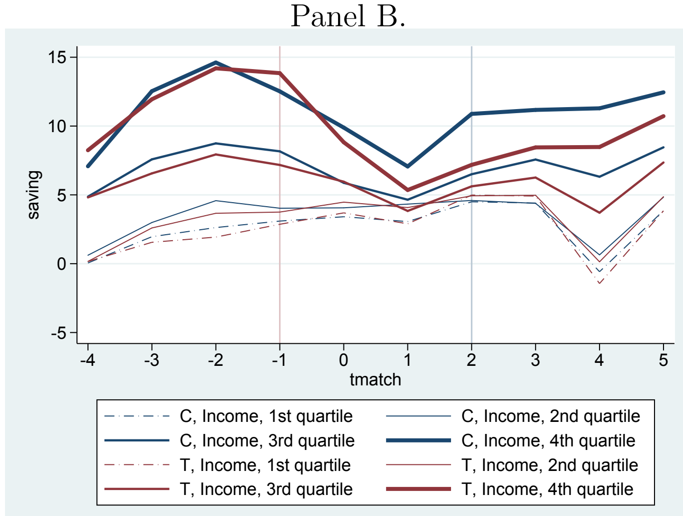
The figures show mean survival probability (Panel A) and median annual savings (Panel B) of treatment and control groups by net wealth quartiles in year -1. The treatment group is diagnosed in year 0 and the control group in year 3. Savings is denoted in thousands of SEK.

Figure 16: Survival probability and annual savings of treatment and control groups - By initial income

Panel A.



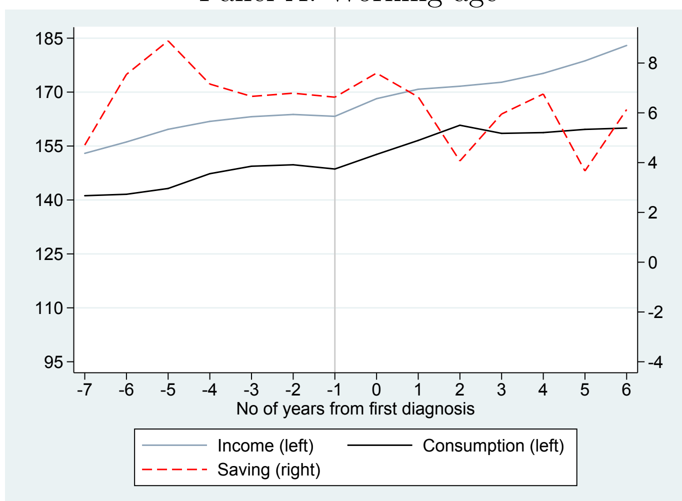
Panel B.



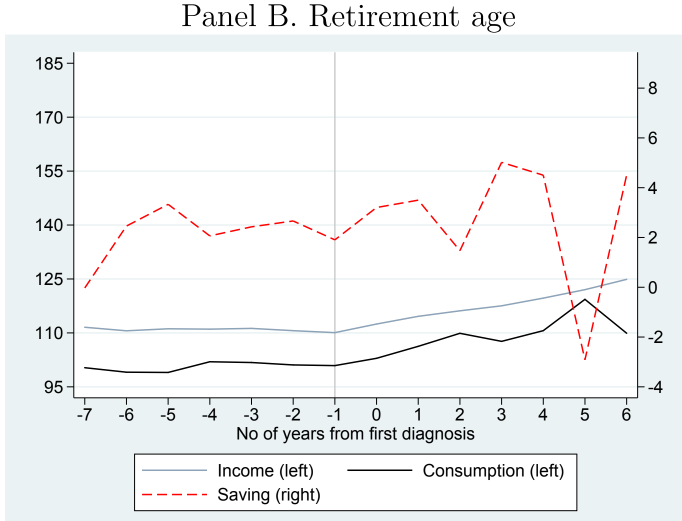
The figures show mean survival probability (Panel A) and median annual savings (Panel B) of treatment and control groups by income quartiles in year -1. The treatment group is diagnosed in year 0 and the control group in year 3. Savings is denoted in thousands of SEK.

Figure 17: Income, consumption, and savings relative to time of first diagnosis

Panel A. Working age

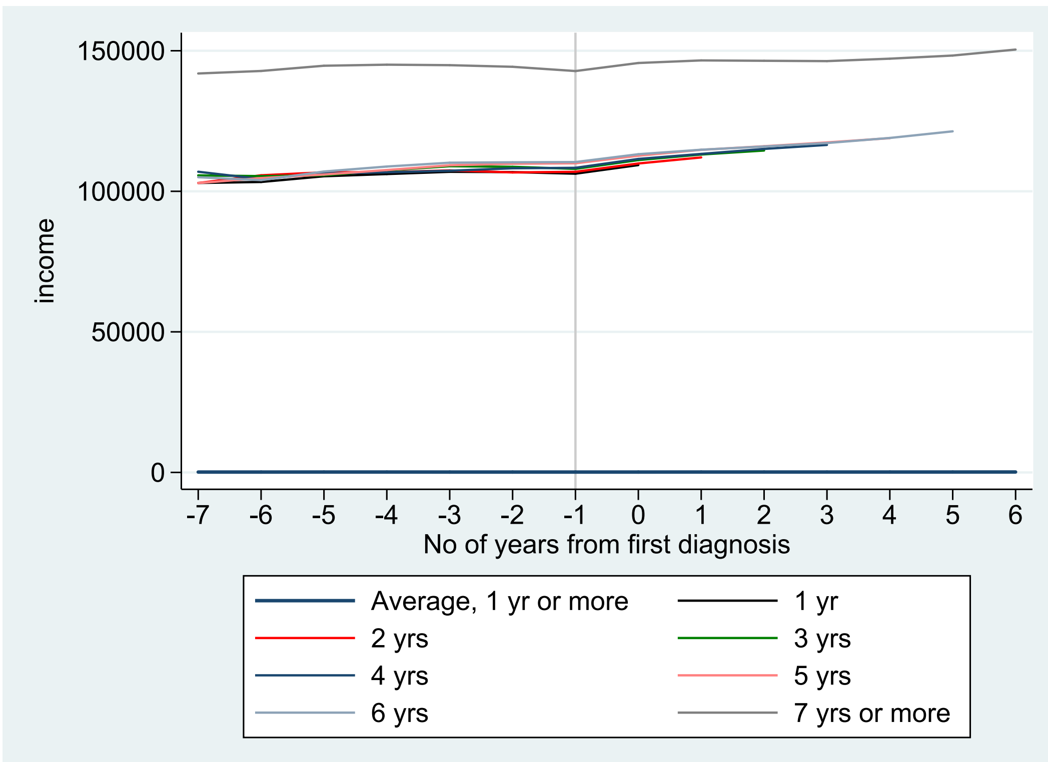


Panel B. Retirement age



The figures show median disposable income, imputed consumption, and annual saings over time relative to the first diagnosis for working age (Panel A) and retirement (Panel B). All variables are winsorized at 0.5th and 99.5th percentile. Negative values of imputed consumption are set to zero. All figures are denoted in thousands of SEK.

Figure 18: Income relative to first diagnosis by time of survival



The figure shows median disposable income relative to the time of the first diagnosis by number of years of survival after diagnosis. Disposable income is winsorized at 0.5th and 99.5th percentile.

Tables

Table 1: Summary statistics

	Mean	Median	S.D.	Min	Max
Saving	2,485	4,700	160,772	-952,581	1,030,490
Net wealth	752,443	370,168	1,172,407	-562,382	8,444,989
Income, disp.	162,726	145,626	90,373	272	694,167
Consumption	160,185	133,097	142,210	0	1,157,775
IHS(Saving)	1.66	9.15	10.75	-14.46	14.54
Survival probability	0.98	1.00	0.04	0.60	1.00
Current income	2.46	2.16	2.46	0.84	469.70
Future income	4.61	4.04	5.50	1.00	201.39
Current MU	-1.61	-0.60	2.80	-36.97	0.00
Future MU	-1.63	-0.97	1.29	-21.28	0.00
Female	0.53	1.00	0.50	0.00	1.00
Post high school	0.24	0.00	0.43	0.00	1.00
Couple	0.64	1.00	0.48	0.00	1.00
Children	0.83	1.00	0.38	0.00	1.00
Age	58.89	59.00	15.81	15.00	108.00
Observations	4,130,579				
Individuals	556539				

Notes: The table presents summary statistics for the main sample of 20 percent of the population alive some time 2000-2007, aged at least 15 in 2000, and do not move during the period. Saving, net wealth, income and consumption are winsorized at 0.5th and 99.5th percentile. Negative values of imputed consumption are set to zero. IHS(Saving) is defined as the hyperbolic sine transformation of Saving. Current income is defined as the average ratio of income in t to income in $t-1$ at diagnosis-gender-age group level. Future income is defined as the average ratio of average income year $t, t+1, t+2$ to income in $t-1$ at diagnosis-gender-age group level. Current MU is defined as the *negative* average number of days in hospital in t at diagnosis-gender-age group level. Future MU is defined as the *negative* average number of days in hospital in t at diagnosis-gender-age group level. Female, Post high school, Couple, and Children are defined as shares.

Table 2: Differences in means experimental sample in the year before treatment

	Treated	Control	Diff.
Saving	3,941	4,374	432.6097
Net wealth	645,058	646,065	1007.3157
Income, disp.	148,731	154,844	6113.0861***
Consumption	145,723	151,774	6051.0423***
IHS(Saving)	2.07	2.01	-0.0619
Survival probability	0.99	0.99	0.0032***
Current income	2.21	2.37	0.1563***
Future income	3.95	4.34	0.3904***
Current MU	-0.77	-0.70	0.0707***
Future MU	-1.54	-1.36	0.1742***
Female	0.53	0.53	0.0002
Post high school	0.21	0.23	0.0164***
Couple	0.64	0.66	0.0217***
Children	0.84	0.84	0.0029
Age	62.15	59.67	-2.4793***
Observations	106,190	77,368	

Notes: The table presents means, differences in means, and t test of differences in means for the experimental sample pre-treatment. The treatment group is diagnosed the first time during 2002-2004, whereas the control group is diagnosed the first time during 2005-2007. Saving, net wealth, income and consumption are winsorized at 0.5th and 99.5th percentile. Negative values of imputed consumption are set to zero. IHS(Saving) is defined as the hyperbolic sine transformation of Saving. Survival probability is defined as the group mean survival rate by diagnosis-age-gender. Current income is defined as the average ratio of income in t to income in $t-1$ at diagnosis-gender-age group level. Future income is defined as the average ratio of average income year $t, t+1, t+2$ to income in $t-1$ at diagnosis-gender-age group level. Current MU is defined as the *negative* average number of days in hospital in t at diagnosis-gender-age group level. Future MU is defined as the *negative* average number of days in hospital in t at diagnosis-gender-age group level. Female, Post high school, Couple, and Children are defined as shares.

Table 3: Hypotheses

H	Coefficient	Sign
$H1$	$\beta_{Survival\,probability}$	> 0
$H2$	$\gamma_{Current\,income}$	> 0
$H3$	$\gamma_{Future\,income}$	$\lesseqgtr 0$
$H4$	$\gamma_{Current\,MU}$	$\lesseqgtr 0$
$H5$	$\gamma_{Future\,MU}$	> 0
$H6$	$\beta_{\boldsymbol{w}\,bequest\,motives}$ $< \beta_{\boldsymbol{wo}\,bequest\,motives}$	
$H7$	$\beta_{fin\,wealth\,\boldsymbol{poor}\,\&\,\mathbf{wo}\,debt\,capacity}$ $< \beta_{fin\,wealth\,\boldsymbol{poor}\,\&\,\mathbf{w}\,debt\,capacity}$ $< \beta_{fin\,wealth\,\boldsymbol{rich}\,\&\,\mathbf{wo}\,debt\,capacity}$ $< \beta_{fin\,wealth\,\boldsymbol{rich}\,\&\,\mathbf{w}\,debt\,capacity}$	

Table 4: Descriptive analysis – Baseline

	IHS(Saving)	IHS(Saving)	IHS(Saving)	IHS(Saving)
Survival probability	2.965***	0.150	-0.919***	-1.247***
	(0.12)	(0.17)	(0.19)	(0.21)
Ind*Year	4,130,579	4,130,579	4,130,579	4,130,579
Individuals			556,539	556,539
Group FE	No	A,G,A*G	No	A,A*G
Ind FE	No	No	Yes	Yes
Adj. R2	0.0002	0.0050	0.0000	0.0024

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Column 1 shows the result of the simple regression. Column 2 adds fixed effects for age group (5-year bins), gender, and age group*gender interactions. Column 3 instead adds individual fixed effects to the specification in Column 1. Column 4 adds both fixed effects for age group (5-year bins), age group*gender interactions, and individual fixed effects (that absorb gender). Column 4 is considered the baseline specification.

Table 5: Descriptive analysis – Additional controls

	IHS(Saving)	IHS(Saving)	IHS(Saving)	IHS(Saving)
Survival probability	-1.247***	-1.027***	-1.022***	-1.472***
	(0.21)	(0.21)	(0.21)	(0.32)
Couple			0.200***	0.200***
			(0.04)	(0.04)
Children			-0.468***	-0.469***
			(0.13)	(0.13)
Ind*Year	4,130,579	4,130,579	4,130,568	4,130,568
Individuals	556,539	556,539	556,539	556,539
Group FE	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Controls	No	No	X	X,D
R2	0.0024	0.0243	0.0243	0.0243
Adj. R2	0.0024	0.0243	0.0243	0.0243

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from adding controls to the baseline specification (Column 1), i.e. all specifications includes individual fixed effects as well as fixed effects for age group and age group*gender interactions. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Column 2 adds year fixed effects. In addition, Column 3 includes controls X: indicators for children, spouse, and level of education. In addition, Column 4 includes D, fixed effect for annual diagnosis group.

Table 6: Descriptive analysis – Marital status

	All	Single	Couple
Survival probability	-1.326***	-1.947***	-0.725*
	(0.22)	(0.31)	(0.32)
Ind*Year	3,679,091	1,210,060	2,469,031
Individuals	498,706	173,326	325,380
Group FE	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes
R2	0.0017	0.0014	0.0020
Adj. R2	0.0017	0.0013	0.0020

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from analysing individuals with different marital status. The sample is restricted to those who do not change marital status during the period. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions.

Table 7: Descriptive analysis – Children

	All	No children	Children
Survival probability	-1.253***	-1.014	-1.301***
	(0.21)	(0.52)	(0.23)
Ind*Year	4,086,694	695,351	3,391,343
Individuals	551,047	95,805	455,242
Group FE	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes
R2	0.0024	0.0049	0.0020
Adj. R2	0.0024	0.0049	0.0020

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from analysing individuals with different family composition. The sample is restricted to those who do not change children status during the period. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions.

Table 8: Descriptive analysis – Bequest motives – Combination of couple and children

	All	Single No children	Single Children	Couple No children	Couple Children
Survival probability	-1.331***	-1.648**	-2.052***	0.266	-0.819*
	(0.22)	(0.63)	(0.36)	(1.07)	(0.33)
Ind*Year	3,665,753	416,442	791,080	122,902	2,335,329
Individuals	497,037	58,875	114,133	17,060	306,969
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
R2	0.0017	0.0007	0.0018	0.0014	0.0021
Adj. R2	0.0017	0.0007	0.0018	0.0012	0.0020

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from analysing individuals with different family composition. The sample is restricted to those who do not change marital nor children status during the period. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. The specification in Columns 1-5 includes individual fixed effects as well as fixed effects for age group and age group*gender interactions.

Table 9: Descriptive analysis – Retirement status

	All	Age $\leq$ 65	Age > 65
Survival probability	-1.341***	0.386	-1.517***
	(0.22)	(0.74)	(0.23)
Ind*Year	3,577,449	2,411,322	1,166,127
Individuals	486,339	307,458	178,881
Group FE	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes
R2	0.0020	0.0028	0.0004
Adj. R2	0.0020	0.0027	0.0004

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from analysing individuals by age groups as a proxy for retirement status. The sample is restricted to those who do not turn 65 during the period, i.e. who are unlikely to change retirement status. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions.

Table 10: Descriptive analysis – Diagnosed

	All	Never diagnosed	Diagnosed	Before diagnosis	After diagnosis
Survival probability	-1.247***	6.185***	-1.648***	4.507**	-0.587
	(0.21)	(1.02)	(0.22)	(1.38)	(0.33)
Ind*Year	4,130,579	2,168,740	1,961,839	879,962	1,081,877
Individuals	556,539	296,969	259,570	259,570	259,570
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
R2	0.0024	0.0028	0.0020	0.0013	0.0009
Adj. R2	0.0024	0.0028	0.0020	0.0013	0.0009

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from comparing individuals who are not diagnosed (Column 2) to those who are diagnosed during the sample period (Column 3). Among the latter, Column 4 shows the result before diagnosis and Column 5 after diagnosis. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions.

Table 11: Descriptive analysis – Hypotheses

	IHS(Saving)	IHS(Saving)	IHS(Saving)	IHS(Saving)	IHS(Saving)	IHS(Saving)	IHS(Saving)
Survival probability	-1.648***	-1.646***	-1.645***	-0.774*	-1.094***	-0.913**	-1.268***
	(0.22)	(0.22)	(0.22)	(0.33)	(0.26)	(0.34)	(0.33)
Current income		0.002				0.000	0.002
		(0.00)				(0.00)	(0.00)
Future income			0.002			0.002	0.002
			(0.00)			(0.00)	(0.00)
Current MU				-0.014***		-0.005	0.000
				(0.00)		(0.01)	(0.01)
Future MU					-0.050***	-0.037	0.001
					(0.01)	(0.02)	(0.02)
Ind*Year	1,961,839	1,961,839	1,961,839	1,961,839	1,961,839	1,961,839	1,961,839
Individuals	259,570	259,570	259,570	259,570	259,570	259,570	259,570
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No	Yes
Controls	No	CI	FI	CMU	FMU	Z	X,Z
R2	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0259
Adj. R2	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0259

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from adding controls **Z** stepwise to the baseline specification (Column 1). The sample is restricted to those who are diagnosed during the sample period. All specifications includes individual fixed effects as well as fixed effects for age group and age group*gender interactions. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Column 2 adds Current income which is defined as the average ratio of income in t to income in $t-1$ at diagnosis-gender-age group level. Column 3 adds Future income which is defined as the average ratio of average income year $t, t+1, t+2$ to income in $t-1$ at diagnosis-gender-age group level. Column 4 adds Current MU which is defined as the *negative* average number of days in hospital in t at diagnosis-gender-age group level. Column 5 adds Future MU which is defined as the *negative* average number of days in hospital in t at diagnosis-gender-age group level. Column 5 adds all these controls **Z**. In addition, Column 6 includes year fixed effects, and individual controls X: indicators for children, spouse, and level of education.

Table 12: Descriptive analysis – Initial net wealth distribution

	All	Net wealth 1st quartile	Net wealth 2nd quartile	Net wealth 3rd quartile	Net wealth 4th quartile	Interaction
Surv prob	-1.247***	-4.829***	-2.534***	-0.603	0.768	-5.199***
	(0.21)	(0.54)	(0.39)	(0.41)	(0.40)	(0.50)
NW Q2 × Surv prob						1.756**
						(0.60)
NW Q3 × Surv prob						4.852***
						(0.61)
NW Q4 × Surv prob						6.636***
						(0.61)
Ind*Year	4,130,579	1,056,645	1,006,022	1,032,686	1,035,226	4,130,579
Individuals	556,539	139,135	139,135	139,135	139,134	556,539
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.0024	0.0051	0.0031	0.0016	0.0010	0.0024
Adj. R2	0.0024	0.0051	0.0031	0.0015	0.0010	0.0024

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from analysing individuals by initial net wealth quartile, defined by the wealth distribution in 2000. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Column 1 shows the baseline specification with individual fixed effects and fixed effects for age group and age group*gender interactions. Column 2-5 shows the same specification by net wealth quartile.

Table 13: Descriptive analysis – Initial income distribution

	All	Income 1st quartile	Income 2nd quartile	Income 3rd quartile	Income 4th quartile	Interaction
Surv prob	-1.247***	-1.281***	-2.140***	-1.427*	1.028	-1.584***
	(0.21)	(0.32)	(0.38)	(0.57)	(0.62)	(0.31)
Inc Q2 × Surv prob						-0.782
						(0.45)
Inc Q3 × Surv prob						0.446
						(0.59)
Inc Q4 × Surv prob						3.668***
						(0.64)
Ind*Year	4,130,579	964,196	1,010,071	1,074,325	1,081,987	4,130,579
Individuals	556,539	139,137	139,133	139,140	139,129	556,539
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.0024	0.0042	0.0018	0.0028	0.0019	0.0024
Adj. R2	0.0024	0.0041	0.0017	0.0027	0.0019	0.0024

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from analysing individuals by initial income quartile, defined by the income distribution in 2000. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Column 1 shows the baseline specification with individual fixed effects and fixed effects for age group and age group*gender interactions. Column 2-5 shows the same specification by income quartile.

Table 14: Descriptive analysis – Consumption capacity before diagnosis

	All diagnosed	Fin wealth poor No debt capacity	Fin wealth poor Debt capacity	Fin wealth rich No debt capacity	Fin wealth rich Debt capacity
Survival probability	-1.648***	-11.431***	-5.897***	2.340***	13.252***
	(0.22)	(0.34)	(0.50)	(0.53)	(0.46)
Ind*Year	1,961,839	898,952	445,982	212,938	403,967
Individuals	259,570	118,790	58,237	29,009	53,534
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
Median saving	4029	113	3668	5364	42783
Adj. R2	0.0020	0.0038	0.0025	0.0014	0.0051

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from analysing individuals by consumption capacity. The sample is restricted those who are diagnosed during the period. Consumption capacity is measured the year before the first diagnosis and is defined as having sufficient financial wealth and/or real net wealth to sustain two years worth of consumption, i.e. with liquid resources of capacity to take up debt relative to consumption habit. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions. Column 1 shows the effect for all diagnosed. Column 2 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption ≤ 2. Column 3 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption > 2. Column 4 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption ≤ 2. Column 5 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption > 2.

Table 15: Descriptive analysis – Consumption capacity before diagnosis – Additional controls

	All diagnosed	Fin wealth poor No debt capacity	Fin wealth poor Debt capacity	Fin wealth rich No debt capacity	Fin wealth rich Debt capacity
Survival probability	-1.650***	-9.864***	-6.173***	0.752	8.105***
	(0.34)	(0.50)	(0.79)	(0.86)	(0.73)
Ind*Year	1,961,839	898,952	445,982	212,938	403,967
Individuals	259,570	118,790	58,237	29,009	53,534
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	X,D	X,D	X,D	X,D	X,D
Adj. R2	0.0259	0.0543	0.0189	0.0131	0.0167

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents results from adding controls the analysis of individuals by consumption capacity. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. In all columns, I add year fixed effects, controls X, i.e. indicators for children, spouse, and level of education, and D, i.e. fixed effects for annual diagnosis group. The sample is restricted those who are diagnosed during the period. Consumption capacity is measured the year before the first diagnosis and is defined as having sufficient financial wealth and/or real net wealth to sustain two years worth of consumption, i.e. with liquid resources of capacity to take up debt relative to consumption habit. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions. Column 1 shows the effect for all diagnosed. Column 2 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption ≤ 2. Column 3 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption > 2. Column 4 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption ≤ 2. Column 5 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption > 2.

Table 16: Descriptive analysis – Consumption capacity before diagnosis – Retired

	All	Fin wealth poor No debt capacity	Fin wealth poor Debt capacity	Fin wealth rich No debt capacity	Fin wealth rich Debt capacity
Survival probability	-1.993***	-11.390***	-6.596***	1.779**	11.390***
	(0.24)	(0.37)	(0.57)	(0.55)	(0.49)
Ind*Year	728,359	266,804	141,075	128,488	191,992
Individuals	102,489	38,177	19,510	18,227	26,575
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
R2	0.0004	0.0062	0.0015	0.0004	0.0049
Adj. R2	0.0004	0.0062	0.0014	0.0004	0.0048

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents results from analysing individuals by consumption capacity. The sample is restricted to those who are diagnosed and older than 65 during the sample period, i.e. who are likely to be retired and unlikely to change retirement status. Consumption capacity is measured the year before the first diagnosis and is defined as having sufficient financial wealth and/or real net wealth to sustain two years worth of consumption, i.e. with liquid resources of capacity to take up debt relative to consumption habit. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions. Column 1 shows the effect for all diagnosed. Column 2 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption ≤ 2. Column 3 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption > 2. Column 4 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption ≤ 2. Column 5 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption > 2.

Table 17: Descriptive analysis – Consumption capacity before diagnosis – Retired – Cancer, malign

	All	Fin wealth poor No debt capacity	Fin wealth poor Debt capacity	Fin wealth rich No debt capacity	Fin wealth rich Debt capacity
Survival probability	-1.908***	-15.231***	-9.249***	3.458***	15.435***
	(0.46)	(0.73)	(1.06)	(1.02)	(0.90)
Ind*Year	147,879	49,498	29,407	27,078	41,896
Individuals	21,971	7,503	4,304	4,042	6,122
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
R2	0.0006	0.0121	0.0038	0.0014	0.0103
Adj. R2	0.0005	0.0119	0.0035	0.0010	0.0100

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents results from analysing individuals by consumption capacity. The sample is restricted to those who are diagnosed with malign cancer as first diagnosis and are older than 65 during the sample period, i.e. who are likely to be retired and unlikely to change retirement status. Consumption capacity is measured the year before the first diagnosis and is defined as having sufficient financial wealth and/or real net wealth to sustain two years worth of consumption, i.e. with liquid resources of capacity to take up debt relative to consumption habit. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions. Column 1 shows the effect for all diagnosed. Column 2 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption ≤ 2. Column 3 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption > 2. Column 4 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption ≤ 2. Column 5 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption > 2.

Table 18: Descriptive analysis – Consumption capacity before diagnosis – Retired – Heart attack

	All	Fin wealth poor No debt capacity	Fin wealth poor Debt capacity	Fin wealth rich No debt capacity	Fin wealth rich Debt capacity
Survival probability	-2.883***	-11.785***	-5.866***	3.124*	7.818***
	(0.65)	(0.99)	(1.56)	(1.50)	(1.32)
Ind*Year	41,176	15,377	8,113	6,453	11,233
Individuals	5,906	2,268	1,139	939	1,560
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
R2	0.0014	0.0139	0.0038	0.0035	0.0053
Adj. R2	0.0012	0.0133	0.0027	0.0022	0.0045

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents results from analysing individuals by consumption capacity. The sample is restricted to those who are diagnosed with heart attack as first diagnosis and are older than 65 during the sample period, i.e. who are likely to be retired and unlikely to change retirement status. Consumption capacity is measured the year before the first diagnosis and is defined as having sufficient financial wealth and/or real net wealth to sustain two years worth of consumption, i.e. with liquid resources of capacity to take up debt relative to consumption habit. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions. Column 1 shows the effect for all diagnosed. Column 2 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption ≤ 2. Column 3 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption > 2. Column 4 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption ≤ 2. Column 5 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption > 2.

Table 19: Descriptive analysis – Consumption capacity before diagnosis – Retired – Chronic lower respiratory

	All	Fin wealth poor No debt capacity	Fin wealth poor Debt capacity	Fin wealth rich No debt capacity	Fin wealth rich Debt capacity
Survival probability	-0.912	-14.167***	-3.019	11.503**	18.616***
	(1.81)	(2.67)	(4.37)	(4.35)	(4.10)
Ind*Year	18,693	8,589	3,339	2,934	3,831
Individuals	2,727	1,276	479	429	543
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
R2	0.0007	0.0070	0.0033	0.0060	0.0075
Adj. R2	0.0002	0.0059	0.0006	0.0029	0.0052

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents results from analysing individuals by consumption capacity. The sample is restricted to those who are diagnosed with a chronic lower respiratory disease as first diagnosis and are older than 65 during the sample period, i.e. who are likely to be retired and unlikely to change retirement status. Consumption capacity is measured the year before the first diagnosis and is defined as having sufficient financial wealth and/or real net wealth to sustain two years worth of consumption, i.e. with liquid resources of capacity to take up debt relative to consumption habit. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions. Column 1 shows the effect for all diagnosed. Column 2 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption ≤ 2. Column 3 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption > 2. Column 4 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption ≤ 2. Column 5 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption > 2.

Table 20: Experimental analysis – Baseline

	IHS(Saving)	IHS(Saving)	IHS(Saving)	IHS(Saving)
Treat*Post	0.0907*	0.0530		
	(0.04)	(0.04)		
Surv prob*Post			-6.385***	-4.273***
			(0.39)	(0.40)
Ind*Year	1,017,107	1,017,107	1,017,107	1,017,107
Individuals		183,558		183,558
Group FE	No	A,A*G	No	A,A*G
Ind FE	No	Yes	No	Yes
Adj. R2	0.0013	0.0027	0.0017	0.0028

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from the experimental analysis. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Treat is 1 for the treatment group, i.e. individuals who diagnosed for the first time in year 2002-2004. Treat is 0 for the control group, i.e. those who are diagnosed for the first time in year 2005-2007. Post is 1 in the year of the treatment group's first diagnosis and thereafter. For example, for the treated who are diagnosed in 2002, Post is 1 in 2002 and thereafter. For the control group who is diagnosed in 2005, Post is 1 in 2002 and thereafter. Survival probability is the change in survival probability from the year before the treatment group's first diagnosis to year of diagnosis. The analysis includes observations three years before treatment group's first diagnosis, the year of diagnosis, and two years afters. Column 1 includes Treat*Post, Treat, and Post. Column 3 includes Survival probability*Post, Survival probability, and Post. Column 2 and 4 adds fixed effects for age group (5-year bins), gender, age group*gender interactions, and individual fixed effects (absorbing Treat) to the specification in Column 1.

Table 21: Experimental analysis – Marital status

	All	Single	Couple
Surv prob*Post	-4.096***	-4.513***	-2.946***
	(0.40)	(0.57)	(0.57)
Ind*Year	1,000,657	340,739	659,918
Individuals	180,628	61,994	118,634
Group FE	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes
Adj. R2	0.0026	0.0017	0.0032

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from the experimental analysis by pre-treatment marital status. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Survival probability is the change in survival probability from the year before the treatment group's first diagnosis to year of diagnosis. Post is 1 in the year of the treatment group's first diagnosis and thereafter. Column 1 shows the result from the baseline specification, including fixed effects for age group (5-year bins), age group*gender interactions, and individual fixed effects. Column 2 shows the result from the same specification for singles, and Column 3 for couples.

Table 22: Experimental analysis – Children

	All	No children	Children
Surv prob*Post	-4.096***	-2.063*	-4.548***
	(0.40)	(0.98)	(0.44)
Ind*Year	1,000,657	142,951	857,706
Individuals	180,628	25,985	154,643
Group FE	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes
Adj. R2	0.0026	0.0021	0.0027

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from the experimental analysis by pre-treatment children status. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Survival probability is the change in survival probability from the year before the treatment group's first diagnosis to year of diagnosis. Post is 1 in the year of the treatment group's first diagnosis and thereafter. Column 1 shows the result from the baseline specification, including fixed effects for age group (5-year bins), age group*gender interactions, and individual fixed effects. Column 2 shows the result from the same specification for individuals without children, and Column 3 for individuals with children.

Table 23: Experimental analysis – Retirement status

	All	Age $\leq$ 65	Age $>$ 65
Surv prob*Post	-4.273***	0.917	-1.708***
	(0.40)	(1.10)	(0.45)
Ind*Year	1,017,107	618,490	398,617
Individuals	183,558	110,479	73,079
Group FE	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes
R2	0.0028	0.0052	0.0006
Adj. R2	0.0028	0.0051	0.0006

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from the experimental analysis by pre-treatment retirement status. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Survival probability is the change in survival probability from the year before the treatment group's first diagnosis to year of diagnosis. Post is 1 in the year of the treatment group's first diagnosis and thereafter. Column 1 shows the result from the baseline specification, including fixed effects for age group (5-year bins), age group*gender interactions, and individual fixed effects. Column 2 shows the result from the same specification for individuals aged ≤ 65, and Column 3 for those aged > 65.

Table 24: Experimental analysis – Hypotheses

	IHS(Saving)	IHS(Saving)	IHS(Saving)	IHS(Saving)	IHS(Saving)	IHS(Saving)
Surv prob*Post	-4.273***	-4.271***	-4.273***	-3.749***	-3.872***	-3.823***
	(0.40)	(0.40)	(0.40)	(0.46)	(0.43)	(0.47)
Current income		0.00297				0.00222
		(0.00)				(0.00)
Future income			0.00179			0.00148
			(0.00)			(0.00)
Current MU				-0.0127*		-0.00249
				(0.01)		(0.01)
Future MU					-0.0583**	-0.0503
					(0.02)	(0.03)
Ind*Year	1,017,107	1,017,107	1,017,107	1,017,107	1,017,107	1,017,107
Individuals	183,558	183,558	183,558	183,558	183,558	183,558
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R2	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from the experimental analysis, allowing the treatment effect to vary with survival probability as well as other health-associated factors. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Survival probability is the change in survival probability from the year before the treatment group's first diagnosis to year of diagnosis. Treat is 1 for the treatment group, i.e. diagnosed for the first time in year 2002-2004. Treat is 0 for the control group, i.e. diagnosed for the first time in year 2005-2007. Post is 1 in the year of the treatment group's first diagnosis and thereafter. All columns include fixed effects for age group, age group*gender interactions, and individual fixed effects. Column 1 adds control for current income that is defined as the average ratio of income in t to income in $t-1$ at diagnosis-gender-age group level. Column 2 adds control for future income that is defined as the average ratio of average income year $t, t+1, t+2$ to income in $t-1$ at diagnosis-gender-age group level. Column 3 adds control for current marginal utility that is defined as the *negative* average number of days in hospital in t at diagnosis-gender-age group level. Column 4 adds control for future marginal utility that is defined as the *negative* average number of days in hospital in $t+1$, $t+2$, and $t+3$, at diagnosis-gender-age group level. Column 5 includes all four controls.

Table 25: Experimental analysis – Net wealth distribution before treatment

	All	Q1	Q2	Q3	Q4
Surv prob*Post	-4.273***	-12.13***	-7.466***	-2.110**	-0.159
	(0.40)	(0.77)	(0.71)	(0.80)	(0.83)
Ind*Year	1,017,107	253,835	254,249	254,345	254,678
Individuals	183,558	45,802	46,110	45,902	45,744
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
R2	0.0028	0.0049	0.0039	0.0039	0.0089
Adj. R2	0.0028	0.0048	0.0038	0.0038	0.0088

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from the experimental analysis by pre-treatment net wealth distribution. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Survival probability is the change in survival probability from the year before the treatment group's first diagnosis to year of diagnosis. Post is 1 in the year of the treatment group's first diagnosis and thereafter. Column 1 shows the average treatment effect. Column 2-5 show the treatment effect by net wealth quartile. All columns include fixed effects for age group, age group*gender interactions, and individual fixed effects.

Table 26: Experimental analysis – Income distribution before treatment

	All	Q1	Q2	Q3	Q4
Surv prob*Post	-4.273***	-4.356***	-3.910***	-1.727	0.0580
	(0.40)	(0.60)	(0.71)	(1.09)	(1.28)
Ind*Year	1,017,107	255,773	255,237	252,526	253,571
Individuals	183,558	47,059	46,275	45,230	44,994
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
R2	0.0028	0.0023	0.0018	0.0041	0.0063
Adj. R2	0.0028	0.0021	0.0017	0.0040	0.0062

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from the experimental analysis by pre-treatment income distribution. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Survival probability is the change in survival probability from the year before the treatment group's first diagnosis to year of diagnosis. Post is 1 in the year of the treatment group's first diagnosis and thereafter. Column 1 shows the average treatment effect. Column 2-5 show the treatment effect by income quartile. All columns include fixed effects for age group, age group*gender interactions, and individual fixed effects.

Table 27: Experimental analysis – Consumption capacity before treatment

	All	Fin wealth poor No debt capacity	Fin wealth poor Debt capacity	Fin wealth rich No debt capacity	Fin wealth rich Debt capacity
Surv prob*Post	-4.273***	-17.29***	-11.83***	1.314	16.29***
	(0.40)	(0.57)	(0.88)	(1.02)	(0.87)
Ind*Year	1,017,107	460,955	242,239	105,323	208,590
Individuals	183,558	83,272	43,398	19,259	37,629
Group FE	A,A*G	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes	Yes
Saving (median)	4906	2449	5354	6786	27780
Adj. R2	0.0028	0.0055	0.0030	0.0036	0.0129

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from the experimental analysis by pre-treatment consumption capacity. The outcome variable is IHS(Saving) which defined as the hyperbolic sine transformation of Saving. Survival probability is the change in survival probability from the year before the treatment group's first diagnosis to year of diagnosis. Post is 1 in the year of the treatment group's first diagnosis and thereafter. Consumption capacity is measured the year before treatment and is defined as having sufficient financial wealth and/or real net wealth to sustain two years worth of consumption, i.e. with liquid resources of capacity to take up debt relative to consumption habit. The specification includes individual fixed effects as well as fixed effects for age group and age group*gender interactions. Column 1 shows the average treatment effect. Column 2 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption ≤ 2. Column 3 shows the effect for those with a ratio of financial wealth to consumption ≤ 2 and a ratio of real net wealth to consumption > 2. Column 4 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption ≤ 2. Column 5 shows the effect for those with a ratio of financial wealth to consumption > 2 and a ratio of real net wealth to consumption > 2. All columns include fixed effects for age group, age group*gender interactions, and individual fixed effects.

Table 28: Descriptive analysis – ln(Savings) in $t+1$

	$IHS(Saving_{t+1})$	$IHS(Saving_{t+1})$	$IHS(Saving_{t+1})$	$IHS(Saving_{t+1})$
Survival probability	2.792***	-0.076	-0.082	-0.551
	(0.25)	(0.25)	(0.25)	(0.38)
Couple			1.417***	1.417***
			(0.05)	(0.05)
Children			-1.070***	-1.070***
			(0.14)	(0.14)
Ind*Year	3,574,040	3,574,040	3,574,030	3,574,030
Individuals	544,726	544,726	544,726	544,726
Group FE	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Controls	No	No	X	X,D
R2	0.0031	0.0270	0.0273	0.0273
Adj. R2	0.0031	0.0269	0.0273	0.0273

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the results from analysing the effect of survival probability in t on $ln(Saving_{t+1})$. Column 1 show the result from the baseline specification including fixed effects for age group, age group*gender interactions, and individual fixed effects. Column 2 adds year fixed effects. Column 3 adds controls X: indicators for children, spouse, and level of education. Column 4 adds controls D: fixed effects for annual diagnosis groups.

Table 29: Descriptive analysis – Future survival probabilities

	ln(Saving)	ln(Saving)	ln(Saving)	ln(Saving)
Surv prob t	-1.247***	-1.320***	-2.778***	-2.618***
	(0.21)	(0.27)	(0.32)	(0.39)
Surv prob t+1		-0.007	-1.359***	-1.437***
		(0.24)	(0.29)	(0.37)
Surv prob t+2			-2.857***	-0.853*
			(0.26)	(0.34)
Surv prob t+3				-1.151***
				(0.30)
Ind*Year	4,130,547	3,574,012	3,029,290	2,496,838
Individuals	556,535	544,722	532,452	520,737
Group FE	A,A*G	A,A*G	A,A*G	A,A*G
Ind FE	Yes	Yes	Yes	Yes
R2	0.0024	0.0032	0.0024	0.0031
Adj. R2	0.0024	0.0031	0.0024	0.0031

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The table presents the effect when future survival probabilities are added. Column 1 shows the result from the baseline specification estimating the effect of survival probability in t on $Saving_t$. Column 2 shows the result from controlling for survival probability in $t+1$. Column 3 shows the result from controlling for survival probability in $t+1$ as well as in $t+2$. Column 4 shows the result from controlling for survival probability in $t+1$, $t+2$, and $t+3$. All specifications include fixed effects for age group, age group*gender interactions, and individual fixed effects.

A Diagnoses

1. Cancer, malign

2. Cancer, unknown

3. Cancer, benign

4. Cancer, in situ

5. Heart attack

6. Chest pain

7. Stroke

8. Heart ischemic, other

9. Heart disease, other

10. Cerebrovascular, other

11. Hypertension

12. Other circulatory

13. Flu and pneumonia

14. Chronic lower respiratory diseases

15. Other respiratory

16. Diabetes

17. Arthritis

18. No diagnosis (or other less severe diagnosis)