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Health State Dependence of Consumption Behavior with Bequest Motive

Evidence from the Netherlands

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Health State Dependence of Consumption Behavior with Bequest Motive: Evidence from the Netherlands

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Abstract

We examine health state dependence of consumption in the presence of the bequest motive in the Netherlands. To that end, we use the life-cycle model of consumption behavior where individuals' health status is treated as a preference shifter and they derive utility from bequeathing wealth. We estimate the model using the Strategic Survey Questions (SSQs) from the novel Health Care Costs survey of the Dutch Longitudinal Internet Studies for the Social sciences (LISS) panel, as well as its Consumption and Health modules. The working sample consists of adults aged 40 years and above. Our core finding suggests that the bequest motive does not change the direction of the health dependence, but rather the magnitude. Secondly, we find significant heterogeneities in health state dependence across different health conditions and consumption measures. We observe negative health state dependence of food consumption in activities of daily living (ADL) and mental health measure (MHI5), but only ADL health state dependence of total consumption expenditure. Moreover, we show how the bequest motive modifies the magnitude of the observed health state dependences. Finally, we show that there is no health state dependence in such health measures as body mass index (BMI) and subjectively reported health.

Keywords: Consumption; Health state dependence; Bequest; Health; Strategic Survey Questions.
JEL classification: D12, I1.

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1. INTRODUCTION

To what extent do consumption patterns of individuals in good health differ from the ones observed in bad health? Economists term this difference 'health state dependence of marginal utility of consumption'[1] (Finkelstein et al., 2009, 2013). A negative state dependence occurs if the marginal utility of consumption decreases when health deteriorates: many consumption goods (e.g. traveling) are complements to good health, and their consumption declines in sickness. Thus, the optimal savings decline and the required optimal insurance should be lower than under state independence. On the contrary, positive state dependence applies if the marginal utility of consumption increases when health deteriorates, which is the case if good health is substituted with market services (e.g. assistance with self-care or additional equipment), and this in turn requires increasing optimal life-cycle savings and higher level of optimal insurance (Finkelstein et al., 2013). Despite its importance, health state dependence has been often omitted in consumption models due to empirical challenges in estimating it. Only recently there has been a surge in studies calling for more empirical research on the topic since 1) some of the theoretical models yet need to be tested, 2) existing implementations are scarce and need further investigation, 3) the findings on the sign or magnitude of the health state dependence are mixed (Finkelstein et al., 2009, 2013; Brown et al., 2016; Kools & Knoef, 2017). Apart from that, evidence on the geographical variation in health state dependence is lacking due to a focus on a few developed countries.

It is commonly challenging to identify whether bequest (willingness to leave wealth to heirs) or precautionary savings (saving for unexpected shocks) associated with changes in health leads to the observed changes in consumption. On the one hand, the presence of the bequest motive also drives the growth in consumption down as individuals derive utility from accumulating capital and bequeathing it. On the other hand, consumption might be decreasing due to deterioration in health (negative health state dependence) and the associated precautionary saving for health motive. Thus, in case the bequest motive is overlooked in the empirical estimation of the health state dependence, the model can overestimate the impact of health changes on consumption preferences due to omitted variable bias (Verbeek, 2012) and the underlying mechanisms between consumption and the bequest motive. Therefore, it is important to account theoretically and empirically for the bequest motive when determining the health state dependence of consumption.

This paper fits the specific niche in the health state dependence literature by posing the following research question: "What are the differences in consumption patterns between sick and healthy

[1] The term 'marginal utility of consumption' in this context refers to an increase in individual utility, i.e. well-being, brought by an additional unit of good or service consumed.

individuals, i.e. the degree health state dependence of marginal utility of consumption, in the presence of the bequest motive among the Dutch older adults?" We apply the life-cycle model with bequest motive in the fashion of Hurd (1997) adding preference shifters following Banks et al. (1998) to the Dutch Longitudinal Internet Studies for the Social sciences (LISS) panel data administered by CentERdata, Tilburg University. In the spirit of Ameriks et al. (2011, 2015), we use the Strategic Survey Questions (SSQs) to disentangle the bequest motive from the precautionary saving. The SSQs represent hypothetical scenarios with questions aimed at documenting behaviours in contingencies. In order to identify the bequest motive from the precautionary saving, we employ a novel one-time survey on Healthcare costs with SSQs conducted in the LISS panel in 2016 (N=525 household heads aged 40 and above).

The Netherlands render an ideal setting to study health state dependence. First, the available Dutch datasets allow implementing and comparing different approaches to estimating health state dependence. On the top of that, the Dutch social security system has had generous wage replacement rates in retirement (70%) and comprehensive health insurance with low reliance on out of pocket medical expenditures, around 7% (Bakx et al., 2016). The latter two factors allow for better identification of health state dependence as there are fewer counterfactual drivers of consumption changes as compared to other countries, e.g. the need for saving against income uncertainty in retirement or against out of pocket health expenditures. Moreover, the intentions of the Dutch government to reconsider the generosity of pension benefits and long-term care (Bakx et al., 2016) warrants the relevance of the Dutch evidence on health state dependence for the policy makers.

In addition to country specific policy implications, the socioeconomic consequences of population ageing provide a broader motive and emphasize the actuality of the proposed research question. For one, according to the special report in the Economist (2017), "Longevity is one of humanity's great accomplishments. Yet it is seen as one of society's great headaches." Indeed, the number of older adults worldwide in 2017 rose to 962 million, which constitutes merely 13% of the global population, while the same demographic in Europe makes up for a more lofty 25%. The pertinent concern originates in the support ratio, i.e. the proportion of working age population to retired, leading to a decrease in payroll tax revenues and a surge in social security and health care spending. On the positive side, older adults are still willing to work and spend. For example, 60% of consumption growth by 2030 is expected to belong to the over-60s in Western Europe and Northeast Asia (McKinsey Global Institute, 2016). Conventionally, health state dependence, especially in the presence of the bequest motive, has been mostly overlooked in the consumption and savings models, which might explain why a substantial number of adults do not save enough for the retirement. The

figure for the Dutch households comprised 2.5 million in 2017 (DutchNews, 2017). At the same time, the literature documents that older adults bequeath substantial amounts of wealth (Love et al., 2009; Alessie et al., 1999).

Our contribution to the current literature is as follows. First of all, we compute the health state dependence of consumption in the presence of the bequest motive for eight different measures of health, mental (MHI5 – Mental Health Index, Subjective Health, Subjective Change in Health) and physical (ADL – Activities of Daily Living, IADL – Instrumental Activities of Daily Living, BMI – Body Mass Index, Number of Chronic Conditions, Mobility). Secondly, we measure and compare the state dependence between two consumption baskets, food and total. By doing so, we show how heterogeneous the health state dependence is. Thirdly and most importantly, to our best knowledge, we are the first to show empirically that the bequest motive does not change the consumption, yet it modifies the observed health state dependencies, mostly attenuating them.

The rest of the paper is structured as follows. Section 2 introduces relevant stands of literature. Section 3 presents the research design, including the theoretical and econometric approach to the analysis, and our hypotheses. Section 4 elaborates on the data, construction of variables, and the descriptive statistics. Section 5 conveys the results and validates them. Section 6 discusses the results and their limitations. Section 7 concludes the paper considering its implications.

2. LITERATURE REVIEW

2.1. Life-Cycle Models

The life cycle models are built on the life-cycle hypothesis first introduced by Modigliani & Brumberg (1950). In its basic version, the model considers how forward looking individuals and couples spread their consumption over the life time depending on the interest rate, the rate of time preference, level of income, and uncertainties about their mortality rate (Hurd, 1997). The derived optimal solution suggests that if the interest rate equals the rate of time preference of the individuals, then the consumption path is flat. Since its introduction, the model has found a variety of applications, especially in the analysis of consumption and saving after the retirement. Since we are primarily interested in how the health state affects the marginal utility of consumption and we would like to keep the counterfactual factors aside of the model, it is best to infer it from the life cycle model applied to the consumption behaviour of older adults. Therefore, in Section 3, we discuss in detail the life-cycle model augmented for the bequest motive in the fashion of Hurd (1997) and for the health state

dependence in the fashion of Banks et al. (1998). Below, we further elaborate on the relevant literature to measuring health state dependence and the bequest motive.

2.2. Health State Dependence

Health state dependence denotes the change in marginal utility derived from nonmedical consumption with health status (Finkelstein et al., 2009, 2013). The degree and sign of health state dependence are important in determining optimal level of life-cycle savings and health care insurance, and in designing social security and long-term care insurance. A negative health state dependence occurs when the difference in utility in healthy and sick states increases with consumption (Figure 1). On the contrary, the positive health state dependence occurs when the difference in the utility between two states decreases with consumption (Figure 2). Since with the negative health state dependence many consumption goods (traveling) would be complements to good health, the optimal savings would decline and required optimal insurance should be lower than under state independence. Conversely, the positive state health state dependence implies substitution between health and consumption goods (e.g. assistance with self-care), and require increasing optimal life-cycle savings and higher level of optimal insurance. For example, Finkelstein et al. (2013) find that seemingly moderate degree of health state dependence has a substantial effect on health insurance benefits and on the optimal level of life cycle savings.

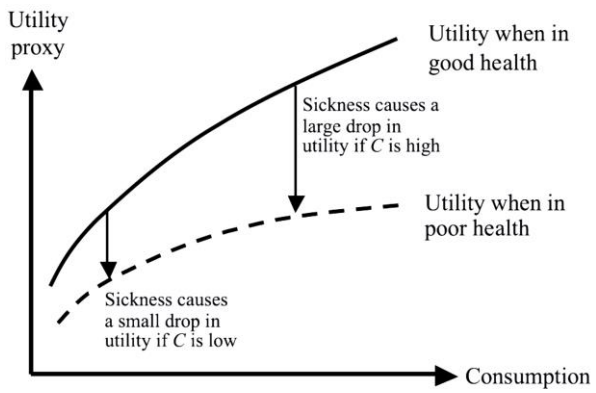

Figure 1. Negative health state dependence.
Source: Finkelstein et al. (2013)

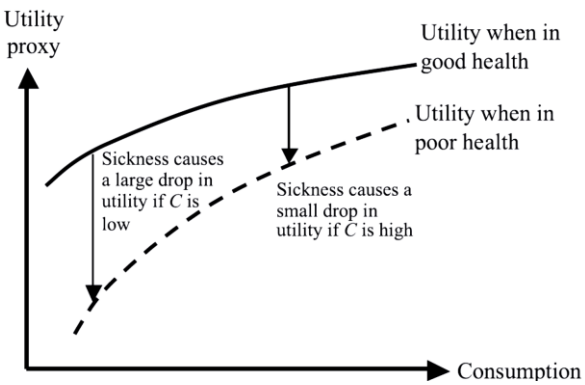

Figure 2. Positive health state dependence.
Source: Finkelstein et al. (2013)

Despite its importance, health state dependence has been often assumed away when determining health-insurance demand or life-cycle savings due to empirical challenges associated with approaches to estimating it (Finkelstein et al. 2009). The first class of approaches focuses on demand for shifting resources between the health states. One way to implement it is through individuals' willingness to pay (revealed demand) for products and services offering state-dependent compensations, e.g. health insurance. However appealing, this approach has a few setbacks. For one, insurance companies lack

information on consumers, which leaves room for exploitation and fraud from the consumers' side (moral hazard) and limits the range of contracts. Assumptions on risk aversion (attitude of individuals to uncertainty) further complicate this approach as they affect the insurance demand and a wide range of available estimates in the literature convolutes any inferences about the health state dependence. The second option elicits health state dependence from the association between health and the time profile of consumption. The variability in consumption patterns among individuals with different health trajectories allows inferring about the health state dependence. Due to a lack of data on health risks and broad consumption measures, no studies attempted to use this approach, which clearly leaves room for further investigation. Alternatively, one could estimate health state dependence based on the consumption profiles of otherwise similar individuals, where one experiences a health shock and another one does not. Since resources possessed by individuals need to either be consumed or bequeathed, one needs information on the bequest motives (Finkelstein et al., 2009). Because almost no data set provides broad health, consumption, and savings motives measures at the same time, it has been challenging to estimate health state dependence.

A second class of approaches concerns itself with estimating the variation in the *utility change* due to health shock, e.g. unexpected illness or disability, for individuals of different consumption levels. Practical challenges here pertain to estimating marginal utility and have been dealt with using compensating differentials or approximating marginal utility with self-reported "subjective" well-being. Compensating differentials rely on evaluating the relationship between individuals' consumption and a monetary compensation they would need for specific health risks. Viscusi & Evans (1990), Evans & Viscusi (1991), Sloan et al. (1998) find wide range of estimates applying the above approach to different samples and diseases. Health state dependence can be also observed from the changes in utility proxy due to health shocks and the variation in these changes across consumption levels. Whereas the latter requires appropriate measures of utility, both methods need information on risk aversion.

Using the Health and Retirement Survey's data on a sample of elderly, Finkelstein et al. (2013) implement the utility based approach and find statistically significant decline in marginal utility of consumption due to deteriorated health. Apart from approximating consumption with income flows, they also raise the issue of identifying the effect of other health conditions beyond the average effect of a disease onset. Kools & Knoef (2017) build upon the approach of Finkelstein et al. (2013) by, among other changes, replacing overall well-being with a better approximation through financial well-being for a European sample from the Survey of Health, Ageing and Retirement. Another study by Brown et al. (2016) directly estimates the health state dependence using the Strategic SSQs in the

spirit of Ameriks et al. (2011, 2015). As discussed in the next section, Ameriks et al. (2011) introduced the SSQs to infer about the bequest motive, while Brow et al. (2016) redesign the questions to evaluate how "an individual would value marginal consumption in healthy versus disabled states…". Kools & Knoef (2017) and Brown et al. (2016) also document heterogeneity in health state dependence between cognitive (negative) and physical (positive) health, indicating that it might be driven by a decline in utility and respective expenditures on leisure activities. Specifically, Brown et al. (2016) show that work-limiting and physical disabilities decrease the marginal utility of consumption less than the disabilities requiring long-term care and pertaining to mental health at older ages. In contrast, Kools & Knoef (2017) observe positive health state dependence for physical disabilities and negative health state dependence for mental health in Europe. An earlier study by Halliday (2008) based on Panel Study of Income Dynamics data (1984-1997) also suggests a significant heterogeneity in state dependence. However, the author emphasizes that this might be caused by the lack in variability of health status within individuals over time. All of the above studies however did not have a possibility to control for a bequest motive, which is an important factor for identifying the health state dependence.

2.3. Bequest Motive

The term 'bequest motive' stands for the desire of individuals to leave a portion of their wealth, monetary or in kind, to other individuals upon death. Empirically, the presence of bequest has been measured through self-reported events of inheritance (Hurd, 1997) and expectations about receiving or leaving a bequest (Dynan et al., 2002)**.** Another common method in the literature is to assume that children are the ultimate recipients of the bequeathed wealth and that the number and/or the presence of children approximate the strength of the bequest motive (Hurd, 1997; Masson & Pestieau, 1997). Specifically, having controlled for income and wealth, Hurd (1987) finds that in the presence of children, individuals decumulate their wealth faster than they would do otherwise. Likewise, controlling for mortality risk, annuity income and liquidity constraints, Hurd (1989) documents statistically significant bequest motive. Later, Kopczuk & Lupton (2007) question in their paper why and if the presence of children is the only driving factor for the bequest motive. Their argument hinges on findings from the savings literature, where wealth accumulation varies depending on the preferences of individuals irrespective of their having children. Moreover, the identification through children is complicated by the observations that individuals bequeath to partners, siblings, and other people, or depending on the legal framework, decide to transfer wealth while alive.[2] Consequently,

[2] The legal framework in the Netherlands does not seem to motivate transfers over the bequest as the same taxation scheme applies except for the exception precluded for each category, e.g. spouse, children, etc. See for further details Appendix A.

the bequest literature has introduced numerous taxonomies (Becker, 1974; Masson & Pestieau, 1997; Laitner, 1992; 2001), which can be generalized into accidental and voluntary. The latter can be further subcategorized into altruistic, and strategic among others.[3] Yet, this categorizations complicate the estimation of the bequest motive as they demand data on children's wellbeing and preferences or on quality of relationships between parents and children.

Moreover, it is not only difficult to measure the bequest motive but also to identify its effect from the other effects. One of such confounding factors is risk aversion. Specifically, it is difficult to infer whether the shape of the consumption distribution over age is driven by a strong bequest motive or a high level of risk aversion. To illustrate, Figure 3 plots the consumption profile over the life-cycle. When there is no bequest motive and the level of risk aversion is low, the profile is hump-shaped as in the blue line. If there is a bequest motive, the initial consumption is lower than in the case without to meet the budget constraint and the consumption path is smoother as the consumption declines less steeply as represented with the purple line. Finally, if there is no bequest motive yet high risk aversion, the consumption path is also flatter than in the baseline case as individuals tend to save against health and other unexpected shocks. Such effect of the precautionary motive is illustrated with the green line in Figure 3. Obviously, in practice, it is difficult to identify which of the two factors, bequest motive or precautionary saving driven by risk aversion, smooth the consumption path.

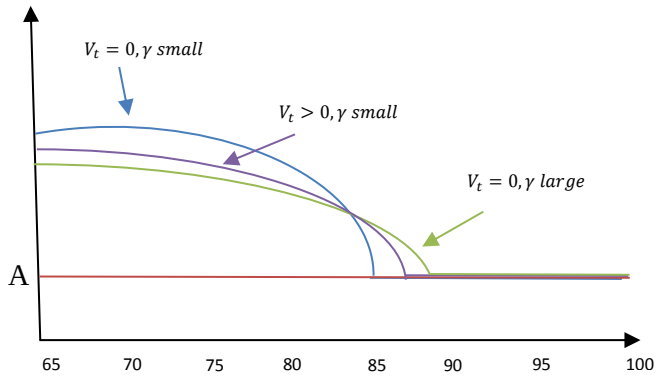

Figure 3. Bequest motive or risk aversion?

Source: Van Ooijen (2017).

Ameriks et al. (2011) address the identification issue by introducing strategic survey questions (SSQs). Having observed that assets decrease slowly and many die with significant wealth (Dynan et al., 2004; De Nardi et al., 2010), Ameriks et al. (2011) presumed that the possible reasons for the lack

[3] As the specific types of the bequest motive are out of the scope of this project, we refer an interested reader to Appendix B for an overview of the explanations for the bequest motive.

of asset run down are public long-term care aversion and bequest motives. However, it is impossible to resolve the identification problem between the two solely based on consumption data. Hence, Ameriks et al. (2011) device SSQs in an end of life and lock box form.[4] Eventually, the authors find that public care aversion is a significant driver of precautionary savings and that the bequest motives spread deep into middle class. Moreover, they also document heterogeneity in the bequest motive, e.g. it is minimal for a substantial proportion of the population and is higher on average for those with children than for those without. Ameriks et al. (2011) also discuss that the public care aversion may increase with risk aversion, which implies that bequest motive falls as both are modelled in mutually exclusive framework in the SSQs. However, they find no evidence for that claim. It is also evident from the study, that those without children appear more motivated to save for precautionary reasons than for bequest reasons, relative to those with children. The latter corroborates the assertion of Hurd (1989, 1997).

3. RESEARCH DESIGN

3.1. Theoretical approach

In this paper we use the Life-Cycle Hypothesis of Consumption in the spirit of Hurd (1997) for the theoretical basis. Next, we incorporate health state dependence following the definition of Finkelstein et al. (2009) and the health dependent marginal utility of consumption formulation of Banks et al. (1998). Following Ameriks et al. (2013), I use the strategic survey approach to identify the impact of the bequest motive.

According to the formulation of the life-cycle hypothesis of Hurd (1997), individuals are forward looking and optimize over the lifetime. Given the complexity of the representation and empirical implementation of the couples, we formally assume the singles' framework and discuss the differences and similarities in implications of both, the model for singles and couples.[5] Hurd (1997) provides a departure from the classic life-cycle model by extending it to the bequest motive. His original model is represented in the continuous time, however, to bring the model closer to the data, we present the discrete time variant.[6] So, there is a one person household in retirement starting from period *t=1* with $A_o > 0$. There is exogenous time-fixed non-capital annuity income y.[7] Next, there

[4] We refer the reader to the original paper for the end of life question and provide the details of the lock box question in Section 5.
[5] An interested reader may see the couples' framework in Appendix C or refer to Hurd's (1997) original study.
[6] The discrete version of the model is presented following Van Ooijen (2017).
[7] This assumption is in line with the Dutch Social Security System, where all retired individuals received fixed income for the duration of the retirement. See further Appendix A1.

are borrowing constraints as individuals cannot borrow against annuitized wealth, this in turn decreases the degree of substitution between private wealth and the annuity wealth. The only source of uncertainty is the mortality risk.

Formally, entering the retirement at $t = 1$, individuals maximize the expected life-time utility function,

$$\sum_{t=1}^{L}(1+\rho)^{1-t}a_t^1 u(c_t) + \sum_{t=1}^{L}(1+\rho)^{-t}m_{t+1}^1 V\big((1+r)A_t\big), \quad (\mathbf{1})$$

subject to the intertemporal budget constraint,

$$A_t = (1+r)A_{t-1} + y - c_t, \qquad t = 1, \dots, L, \qquad (\mathbf{2})$$

and the liquidity constraint,

$$A_t \geq 0, t = 1, \dots, L, \quad (\mathbf{3})$$

where $A_t -$ net worth at the end of period *t*, $y -$ annuity income, $\rho -$ the rate of time preference, $r -$ real interest rate, $c_t -$ consumption in period *t*, $a_t^1 -$ survival rate, $m_{t+1}^1 -$ mortality rate. Expression $\sum_{t=1}^{L}(1+\rho)^{-t}m_{t+1}^1 V\big((1+r)A_t\big)$ formalizes the bequest motive V which depends on the net worth A_t. In the presence of the liquidity constraints, the model predicts that the consumption should never become smaller that the annuity income, i.e. $c_t \geq y$.

Assuming the utility function with a constant relative risk aversion, $u(c_t) = \frac{c_t^{1-\gamma}}{1-\gamma}$, the resulting log-linearized Euler equation[8] for the above maximization problem is as follows:

$$\Delta lnc_{t+1} \approx \frac{r_{t+1} - (\rho + m_{t+1}^t)}{\gamma} + \frac{m_{t+1}^t}{\gamma}\left(\frac{1+r_{t+1}}{1+\rho}\right)\left(\frac{V'\big((1+r_{t+1})A_t\big)}{u'(c_t)}\right), \quad (\mathbf{4})$$

where Δlnc_{t+1} is the log-transformed change in consumption.

The main advantage of the model for our study is the integration of the bequest motive. In terms of implications, if $(\rho + m_{t+1}^t) > r$ and $V'(.) = 0$, consumption declines with age. We should also expect to see that in the presence of bequest motive, consumption path should generally flatten. That is for household with a bequest motive the growth in consumption is lower as compared to households without one. Comparing the model for singles to the one for couples, Hurd (1997) maintains that the

[8] See Appendix D for the step-wise derivation.

rate of wealth decumulation for couples is lower than for singles. Besides, in the couple's model, both spouses make decision over the bequest motive and both ensure sufficient resources for the surviving spouse in case of the death of one of the spouses.

There are however a couple of key limitations we need to consider. First, we are interested in the health state dependent utility function. However, the model does not account for taste shifters and instead assumes that the within period marginal utility does not depend of exogenous socio-demographic factors and health. Therefore, following Banks et al. (1998), we allow the Constant Relative Risk Aversion (CRRA) form of additively separable utility of consumption (c_t) function for an individual household with taste shifters:

$$u(c_t, \boldsymbol{z_t}, h_t) = exp(\theta_0 + \boldsymbol{\theta_1'}\boldsymbol{z_t} + \theta_2 h_t)\frac{c_t^{1-\gamma}}{1-\gamma} \quad (\mathbf{5})$$

Adjacent to the consumption c_t are the vector of preference shifters $\boldsymbol{z_t}$ such as age and similar socio-demographic characteristics of a individual with $\boldsymbol{\theta_1'}$ is the vector of multipliers corresponding the preference shifters, health status indicator h_t, and γ is the coefficient of relative risk aversion. All other things constant, marginal utility of consumption increases with an increase in consumption.

The resulting log-linearized Euler equation[9] for the household maximization problem with utility function dependent on taste shifters accounting for the presence of the bequest motive in line with Hurd (1997) for each household is as follows:

$$\gamma_i * \Delta lnc_{it+1} = \theta_0 + \Delta\boldsymbol{\theta_1'}\boldsymbol{z_{t+1}} + \Delta\theta_2 h_{t+1} + \theta_3\rho_i + \theta_4 m_{it+1}^t + \theta_5 bequest_i + \varepsilon_{t+1}, \qquad (\mathbf{6})$$

where $\theta_0 = r$, $\theta_4 < 0$, and $bequest_i = E_{it}\left\{ln\left[m_{it+1}^t \frac{(1+r)}{(1+\rho_i)}\frac{V'((1+r)A_{it})}{u'(c_{it})}\right]\right\}$ – the expectation of a bequest given the time preference, mortality rate, and the accumulated assets of the household, Δlnc_{it+1} is the log-transformed change in consumption, $\Delta\boldsymbol{z_{it+1}}$ – change in time-variant taste shifters, Δh_{it+1} – change in the health status for household i.

Second, the model assumes that individuals are retied. We refrain from formally modelling the labour supply decision to preserve to focus on the health taste shifters and the bequest motive. However, to remedy the current limitation, we account for the paid employment in the empirical model.

Finally, even in the single household form the model is demanding in terms of data. First, to account for variation in the interest rate, one needs panel data longer than two waves. Given that the

[9] See Appendix D for the step-wise derivation.

Healthcare costs survey is available only for one wave, we will have no variation in the real interest rate. Therefore, we omit it from the empirical specification as discussed further. Second, the model requires data on time preferences and risk aversion. Third, the data should allow identification of the bequest motive from others, e.g. precautionary saving. We use the self-reported preference parameters, risk aversion and the bequest motive using the Healthcare costs survey. The detailed implementation is discussed in the following sections.

3.2. Empirical Strategy

In this section we further elaborate on the empirical specification.

From the previous section, we have the derived specification as follows:

$$\gamma_i * \Delta lnc_{it+1} = \theta_0 + \boldsymbol{\theta_1'}\Delta \boldsymbol{z_{it+1}} + \theta_2 \Delta h_{it+1} + \theta_3 \rho_{it+1} + \theta_4 m_{it+1}^t + \theta_5 bequest_{it+1} + \varepsilon_{it+1}.$$

However, for the ease of interpretation, instead of cross-multiplying the $\Delta lnc_{it+1}$with γ_i, we include risk-aversion as an additional control variable.

So, the final specification is:

$$\Delta lnc_{it+1} = \theta_0 + \boldsymbol{\theta_1'}\Delta \boldsymbol{z_{it+1}} + \theta_2 \Delta h_{it+1} + \theta_3 \rho_{it+1} + \theta_4 m_{it+1}^t + \theta_5 bequest_{it+1} + \varepsilon_{it+1}. \quad (\mathbf{7})$$

where

- Δlnc_{it} is the non-medical non-durable inflation adjusted consumption by the household, *i*, scaled for the household size,
- γ_i is the coefficient of risk aversion approximated by the risk aversion measure of the household head using the Healthcare costs survey,
- $\boldsymbol{\Delta z_{it}}$ are the time variant controls of the household, ***i*,** such as the age of the household head, household size, and income scaled inflation, education, presence of a partner,
- Δh_{it} are respectively the change of the health status of the household,
- ρ_i is the rate of time preference of the household head measured using the self-reported preference from the Healthcare costs survey,
- m_{it+1}^t is the mortality rate of the household head at time t (as opposed to at birth),
- γ_i is the level of the risk-aversion of a household head,
- $bequest_{it}$ stands for the bequest motive measure corresponding to the household head. The measure is built from the allocation of wealth between bequest and long-term care, therefore it allows identification of the motive in the light of the precautionary saving,

- $\theta_0 - ... - \theta_6$ measure the effects of respective controls.

A couple of remarks should be taken into consideration. First, the data for the Healthcare costs survey is available only for one year, 2016. Therefore, we take the difference in the dependent variable and controls around that period. The two available waves are 2015 and 2017. Besides, to bring the model closer to the reality, we make several amendments to the employed measures using the available information on the partners. Section 4 discusses these amendments and the construction of each variable in detail.

3.3. Hypotheses

3.3.1. Health State Dependence (Hypothesis 1)

Since good health fosters active life style, the loss of health may lead to a decrease in marginal utility of consumption because the health of older people might impair them in enjoying such goods as travelling, active sports, eating out, and similar. On the other hand, on demand services such as grocery deliveries, handyman, senior-friendly software[10] may substitute for good health, and if such substitution is prevalent on average, we will observe positive health state dependence as proposed by Finkelstein et al. (2009). Given that we do not observe consumption expenditure on durables and help around the house, we expect that general measures of health such as the number of chronic diseases, and subjective health status will exhibit negative health state dependence based on the health complement reasoning (Finkelstein et al., 2013). Hence, we expect a negative coefficient for subjective health measures and the number of chronic diseases.

Brown et al. (2016) and Finkelstein et al. (2009) argue that the degree of change of the marginal utility of consumption depends on the type of health shocks: temporary or long-term, mental or physical disability. For instance, the marginal utility of consumption would be pronouncedly higher in the absence of physical disability because physical disability requires costly adjustments. Likewise, a mental health decline may reduce the additional utility a senior derives from each subsequent consumption unit even more that the physical disability because of decline in cognitive ability. Given the availability of a wide range of the health problems and their degrees in our data, we would like to test heterogeneity in the health state dependence among wider diversity of health problems. Provided that our mental health measure is representative of gloominess, depression, peacefulness, and happiness, we expect a deterioration in mental health to lower the marginal utility of consumption as a more depressed person would be less happy with consumption of goods and services in general.

[10] For more examples of senior friendly technological developments, interested reader can refer to Economist, July 2017 issue.

The effect of the deterioration of physical health is expected to be stronger and positive since food at home and non-durables consumption are likely to be substitutes of good health. This expectation is also in line with positive health state dependence finding of Kools & Knoef (2017) for the European countries.

The studies available thus far have either substituted consumption with self-reported income figures (Finkelstein et al., 2013) or used pooled consumption data. However, we presume that health state dependence may be different for food consumption as compared to pooled consumption of non-durable goods. Individuals with mobility impairments might enjoy more eating at home than eating out, whereas, total consumption, including utilities, transportation, and housekeeping might be valued less as they cannot travel that often and become less considerate of housekeeping with decreasing health. Subsequently, we hypothesize that there is substantial heterogeneity across the two consumption baskets.

3.3.2. Bequest motive (Hypothesis 2)

In the presence of the bequest motive, the consumption path flattens as has been discussed in Section 2.3. As a result, we expect that the strength of the motive, as measured by the proportion of the wealth an individual is willing to bequeath in hypothetical scenarios of SSQs, has a negative relationship with the change in the consumption expenditures. Importantly, the given measure of the bequest motive controls for the precautionary saving as a mutually exclusive confounder. For example, if a person distributes 40% of wealth for the bequest motive, then 60% is allocated for the precautionary saving purposes. Hence, our hypothesis and empirical specification accounts for this essential confounder.

Besides, we expect to observe that in the presence of the bequest motive the health state dependence is lower in magnitude. The intuition behind is that if a person commits to bequeath, the changes in the preferences due to health might have lower impact on consumption changes as compared to the individuals without bequest motive: adjusting consumption for the latter is easier. Likewise, if the health deteriorated and the individuals committed to bequest ex-ante in exchange for informal care at home, they are also expected to dissave slower as compared to people with the bequest motive.

4. DATA AND DESCRIPTIVE STATISTICS

4.1. Data

We employ the LISS (Longitudinal Internet Studies for the Social sciences) panel data administered by CentERdata, Tilburg University, The Netherlands. Consisting of 9000 individuals in total, the data are representative of the Dutch speaking population based on a true probability sample of households documented in the population register. The refreshment samples are recruited on a regular basis to ensure the representativeness of the data. Besides, panel members also participate in one-time projects. For instance, measures of risk aversion, early life conditions, religiosity, and similar. The LISS panel contains detailed information on health and socio-economic characteristics. Yet, what makes it most useful for the purposes of our study is the availability of corresponding detailed consumption data and the latest Healthcare costs survey.

4.2. Sampling

The basis of sampling stems from the availability of data for the bequest motive from the Healthcare costs survey. In January 2016, Van Ooijen in collaboration with De Bresser, Knoef, and Van Megen surveyed LISS panel members of age 40 and above. The aim of the survey was to gain understanding about the desired long-term care spending of the elderly. Among 2,812 target participants, 2,412 (85.8%) completed the questionnaire. Van Ooijen et al. (2016) build the survey questions on the methodology of Ameriks et al. (2011). Specifically, Ameriks et al. (2011) address the identification problem by posing strategic survey questions, which represent "natural thought experiments concerning behavior in contingencies selected for their high information content."

We restrict our sample to individuals who participated in the Healthcare costs survey, and Background, Health, and Consumption modules in 2015 and 2017 waves. The two waves are closest in terms of timing to the date of the Healthcare costs survey, and allow constructing the corresponding dependent and independent variables of interest. Afterwards, we match the selected waves with the 2016 wave of the Healthcare costs survey. That makes up a full cross-sectional data set. We add the 2009, 2010, and 2012 waves of Health and Background modules to test and instrument for the endogeneity of the health measures in the empirical model in the later stages.

In order to ensure the consistency, the sample is restricted to only those household heads and their partners, which have non-missing observations on all variables of interest and the lagged health measures. The final working sample consists of 680 individuals, 525 household heads and 155

wedded and unwedded partners of the household heads. So, only 155 partners participated in the survey, although 493 household head reported to have a partner.

4.3. Consumption

We construct our main dependent variable, the change in logarithm of consumption, as a real[11] annual percentage change in household expenditure on non-durable non-medical goods. We exclude consumption of durable goods because reported expenditures might not translate into consumption flows, and thereby consumption of non-durable goods is a commonplace measure of changes in consumption in life-cycle models (Attanasio & Weber, 2010).

The recall data come from the Time Use Consumption module. Specifically, the wave 2015 asks each household head living with a partner the annual average for the past 12 months: "How many euros does your household spend on average each month on…?" The available categories for household expenditure in the 2015 wave are: 1) mortgage, 2) general utilities, 3) transportation, 4) insurances, 5) children's care, 6) alimony and financial support for children, 7) debts and loans, 8) daytrips and holidays with family, 9) expenditures on cleaning the house and maintaining the garden, 10) eating at home, 11) other household expenditures. However, individuals living in single households have not been offered item 8) daytrips and holidays with family, neither it is asked in any other section of the questionnaire. Therefore, for consistency of the analysis, we exclude this item from the total household expenditures. Besides, mortgage and rent are also excluded on the grounds that the data do not contain imputed rent for those owning private houses. The children's day care expenditure is also excluded as there are only 33 non-zero observations. Likewise, alimony and financial support for children, and debts and loans do not fall into the consumption expenditure basket.

The expenditures on the selected items are reported as monthly average, so I multiply them by 12 to align with the CPI and other variables in the dataset. Moreover, given the economies of scale obtained within a household, I scale the total expenditure per item using the OECD modified scale (Fesseau & van de Ven, 2014). Specifically, I scale the expenditure by dividing it by 1 if the household consists of the head only and by 1.5 for couples and add 0.3 to the scale for every additional family member. Finally, the amounts are log-transformed and differenced as follows from the standard estimation methods of the Euler equation (Banks et al, 1998). On the household level, there are 525 observations for both food and total consumption. We assumed that if a household member did not fill in any of the essential consumption items, but still reported at least one them, that item to be 0. For example,

[11] Here we mean CPI adjusted consumption changes. See Appendix F on CPI data from CBS (2018) used in the analysis.

an observation on insurance is missing, but food and other expenditures are filled in, then in the total consumption calculation the missing items are taken as zeros. The intuition behind is that it is more plausible that insurance expenditure is zero rather than missing as everyone is obliged to have insurance. Notably, we analyze changes in two different consumption categories, food and total, as changes in food consumption only may not fully reflect overall changes in consumption and marginality utility (Attanasio and Weber, 1995).

In addition to household level expenditure questions, the LISS panel contains the individual level expenditures on items such as food and drinks outside the house, cigarettes and other tobacco products, clothing, personal care products and services, and leisure time expenditure. It would be possible to include these items into our analysis and construct a more comprehensive consumption basket, however, the observations on partners are largely missing in the data set. As a result, the inclusion would significantly reduce the sample size and the power of our analysis.

Table 1. Household Consumption Descriptive Statistics.

	Food			
	Percentiles	*Smallest*		
1%	569.52	122.04	**Obs**	525
5%	8.717.143	203.4	**Sum of Wgt.**	525
10%	1220.4	381.375	**Mean**	3996.18
25%	2.161.125	488.16	**Std. Dev.**	3589.94
50%	3254.4	*Largest*	**Variance**	1.29e+07
75%	4881.6	24408	**Skewness**	5.253.468
90%	6.973.714	26848.8	**Kurtosis**	4.760.764
95%	9153	36612		
99%	15295.68	43527.6		
	Total Consumption			
	Percentiles	*Smallest*		
1%	2.892.348	1525.5	**Obs**	525
5%	4881.6	2.001.456	**Sum of Wgt.**	525
10%	5491.8	2034	**Mean**	12748.12
25%	7749.54	2169.6	**Std. Dev.**	12231.59
50%	10536.12	*Largest*	**Variance**	1.50e+08
75%	14522.76	119025.6	**Skewness**	7.154.131
90%	20177.28	129972.6	**Kurtosis**	6.610.488
95%	24082.56	130862.5		
99%	37466.28	134244		

Source: LISS panel, 2017.

Table 1 shows that the mean average food consumption per household in 2017 was around EUR 4000 with the average total household consumption around EUR 12,750. The figures are comparable to the

population wide statistics. For example, the average yearly per capita food consumption was at EUR 3,600 in 2017 in the Netherlands (Statista, 2018).[12] Moreover, there are notable differences at the upper end of the distribution. For instance, both food and total expenditures are significantly higher at the 99th percentile as compared to the 95th. Therefore, conventionally and in the light of the theoretical framework we log-transform the expenditures to smooth the effect of outliers.

Further, we plot the log-transformed household food and consumption expenditures over the age of the household head. At the individual level, one would expect that to observe a downward slope in the consumption-age profile as the survival probabilities decline with age[13]. However, Figure 4 suggests a slightly positive almost constant trend, which is still in line with the theoretical predictions of Ameriks et al. (2015) for consumption in the presence of a strong bequest motive.

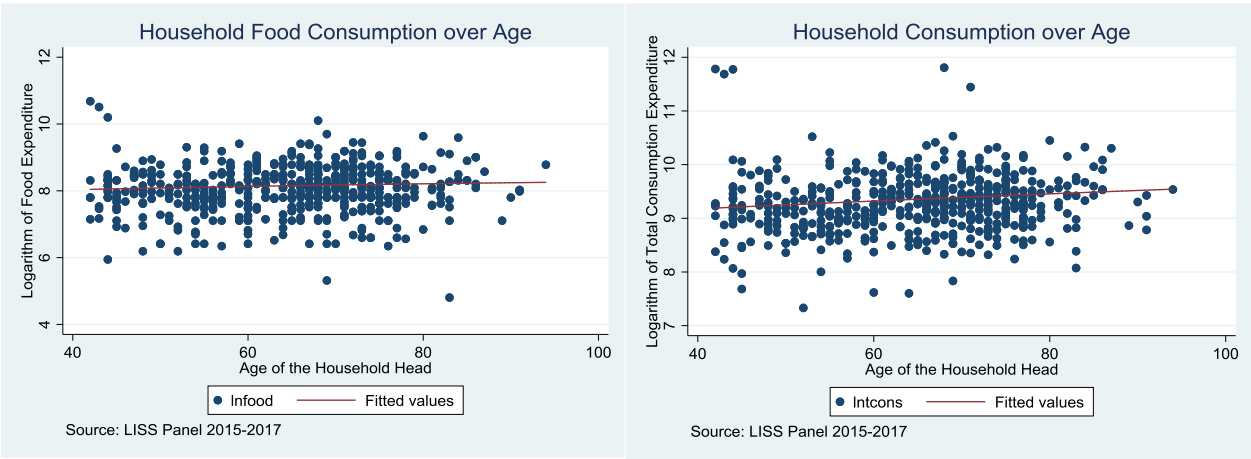

Figure 4. Household Food and Total Consumption Expenditure over Age.

[12] It is difficult to validate the total non-durable consumption due difference in computation of the national statistics and the included consumption basket.

[13] Indeed, the correlation between age of the household head and mortality in our sample is 46%.

4.4. Health

In terms of the general health state, 1.14% of the sample needs care at home, but does not receive it, 1.90% need the home care and receive it, 11.43% do not need care at the moment, but have a chronic disease, and 85.52% do not need care and do not receive it.

Table 2. Need for care and self-reported health

How is your health at this moment?	Freq.	Percent	Cum.
At this moment, I need homecare, but I don't receive it.	6	1.14	1.14
At this moment, I need homecare and receive it	10	1.90	3.05
At this moment, I do not need care, but I have a chronic disease	60	11.43	14.48
At this moment, I do not need care and do not receive it	449	85.52	100.00
Total	525	100	

Source: Healthcare costs survey, 2016

Given that health is one of our main independent variables of interest and we would like to observe if there is any heterogeneity in health state dependence across different health conditions, we go beyond the general health status and elaborate on the implementation of the subjective, mental, and physical health conditions.

Subjective health is a self-reported measure of general health. Individuals were asked to rate their health from 1 (poor) to 5 (excellent). Along with subjective health, we also estimate the subjective change in health, where respondents are asked: "Can you indicate whether your health is poorer or better, compared to last year?" To which the available answers ranged from "considerably poorer" to "considerably better". We take the minimum score per household. The reasoning behind this is that health problems experienced by one household member affect the whole family, and the more severe is the case, the greater is the impact.

Next, we measure mental health using the Mental Health Inventory (MHI-5) index, which is one of the subcomponents of the Short Form (SF-36) – proxy for the quality of life (Hoeymans *et al*., 2004). Mental health reflects an individual's ability to realize own potential, work efficiently, and contribute to the society (WHO, 2016). It has been documented that mental health disorders in one or another form bother around 20% of Dutch adults (Trimbos Instituut, 2016 cited in Keizer, 2017). We construct MHI-5 index in line with Hoeymans *et al.* (2004). First, we focus on the questions ch15h011-15 from the LISS Health Module, which are set as follows:

"This past month…

1=never, 2=seldom, 3=sometimes, 4=often, 5=mostly, 6=continuously…

- h11: I felt very anxious
- h12: I felt so down that nothing could cheer me up
- h13: I felt calm and peaceful
- h14: I felt depressed and gloomy
- h15: I felt happy."

Second, we reverse the scores of negative feelings, so that positive and negative scores are consistent and additive. Also, we rescale the scores from 0 to 5 instead of 1 to 6, sum them, and multiply by 4 to obtain an index ranging from 0 to 100 as has been done in Ware et al. (1993) and Keizer (2017). The higher the score, the better is the mental health state of the respondent. Similarly with the strategy used for the subjective health, instead of using only household head's mental health status, we take the lowest score at the household level.

Body Mass Index (BMI) is one of the first objective measures of health, which is obtained by dividing weight by square of height in meters. We observe that there are a number of misreported data points, which are corrected following the methodology of Orso (2017)[14]. Basically, any weight observation above 200 is divided by 10 and any height observation below 100 is added 100. In our case there was one observation with weight 800kg, we transform it to 80kg, and there were two observations with height below 50cm, they are added 100cm. Following the World Health Organization and RAND's benchmarks (WHO, 2018), we assign individuals to one of the BMI groups: underweight, normal, pre-obesity, obesity1, obesity2, or obesity3.

Table 3. Distribution of BMI

Variable	Obs	Mean	Std. Dev.	Min	Max
underweight	525	.0038095	0.0616624	0	1
normal	525	.4438095	0.4973064	0	1
pre_obesity	525	.3809524	0.4860841	0	1
obesity1	525	.1447619	0.3521962	0	1
obesity2	525	.0190476	0.1368228	0	1
obesity3	525	.007619	0.870369	0	1

Source: LISS Panel 2017.

[14] The methodology was demonstrated during the hands-on sessions with the framework of the Summer Institute of Healthy Ageing. Slides and do-files might be available upon request from the author.

Using this categorization, it appears from Table 3 that only around 40% of the sample has normal weight, with the rest depicting some degree of obesity, which corresponds to the population wide statistics that more than half of the Dutch citizens are overweight (CBS, 2014). However, Burkhauser & Cawley (2008) caution that BMI does not distinguish fat from lean mass. In fact, using the US National Health and Nutrition Survey, the authors find that the levels of obesity determined using BMI were significantly different from the classification derived using more objective measures of obesity such as waist circumference and body fat percentage. Unfortunately, the LISS panel has insufficient number of observations on the waist circumference as it was measured for testing the feasibility of such measures in the internet surveys. Nevertheless, knowing a priori that the BMI classification may lead to error, we measure the health state dependence using the continuous measure of BMI. Specifically, we conduct the analysis by maximizing the BMI score per household.

We proceed with ADLs (Activities of Daily Living), IADLs (Instrumental Activities of Daily Living), and mobility indices. ADL (Katz et al., 1970) includes ability in six domains such as bathing and showering, dressing, using the toilet, transferring from a bed to a chair, continence, and nutrition. ADL has a hierarchical structure, that is, losses do not happen at once and rather follow the reversed pediatric model from the first loss in washing to the last loss of autonomy in eating (LaPlante, 2010). Another measure is Instrumental Activities of Daily Living, the taxonomy for which was pioneered by Lawton and Brody (1969). The main components of IADLs are ability to use telephone, shopping, food preparation, housekeeping and laundry, transportation, responsibility for own medication and ability to handle finances. These activities require complex neuropsychological organization, and therefore are distinguished from the ADLs, which measure more severe vulnerability. There is a debate in the literature whether ADLs and IADLs can be combined into one single index. Some studies suggest that if ordered according to the neuropsychological organization it is possible (Lawton & Brody, 1969). Others argue that due to scalability issues and difference in the dimensions of the functionality measured, they should comprise distinct indices (Breithaupt & McDowell, 2001). We are interested in observing their individual relationship with consumption changes, therefore, the separate indices are constructed for ADLs and IALDs respectively.

The mobility index, MOB, pertains to ability to walk 100 meters, sit for extended periods and get up afterwards, walking a staircase, kneeling and crawling, stretching, moving or lifting large objects, or picking a small object lying on the table. These activities demand more physical strain and coordination, and are normally lost before ADL. Each index is calculated by summing the reported degree of specific limitations: “1= without any trouble, 2=with some trouble, 3=with a lot of trouble, 4=only with help of others, 5=not at all”. Unlike similar panel data sets, e.g. SHARE (The Survey of

Health, Ageing and Retirement in Europe), we can exploit the degree of each limitation, whereas, the SHARE panel provides only binary indicator. Similarly to previous health measures, we maximize the index at the household level.

Finally, we conclude with the number of chronic diseases. The respondents are asked if they have ever been diagnosed by a doctor with any disease in the list. Instead of following the common methodology employed by the literature and categorizing an individual into poor health group if he or she suffers from at least from one chronic disease (see e.g. Finkelstein et al., 2013), I construct an index by summing the number of chronic diseases an individual suffers from and computing the maximum per a household. This way it is easier to observe how the changes in the number of chronic diseases affect the consumption changes. For a general overview, Figure 4 provides the frequency of types of diagnoses. Evidently, the most prevalent among the respondents are hypertension (≈22%), uncategorized (≈20%), increased cholesterol (≈15%), and arthritis (≈12%).

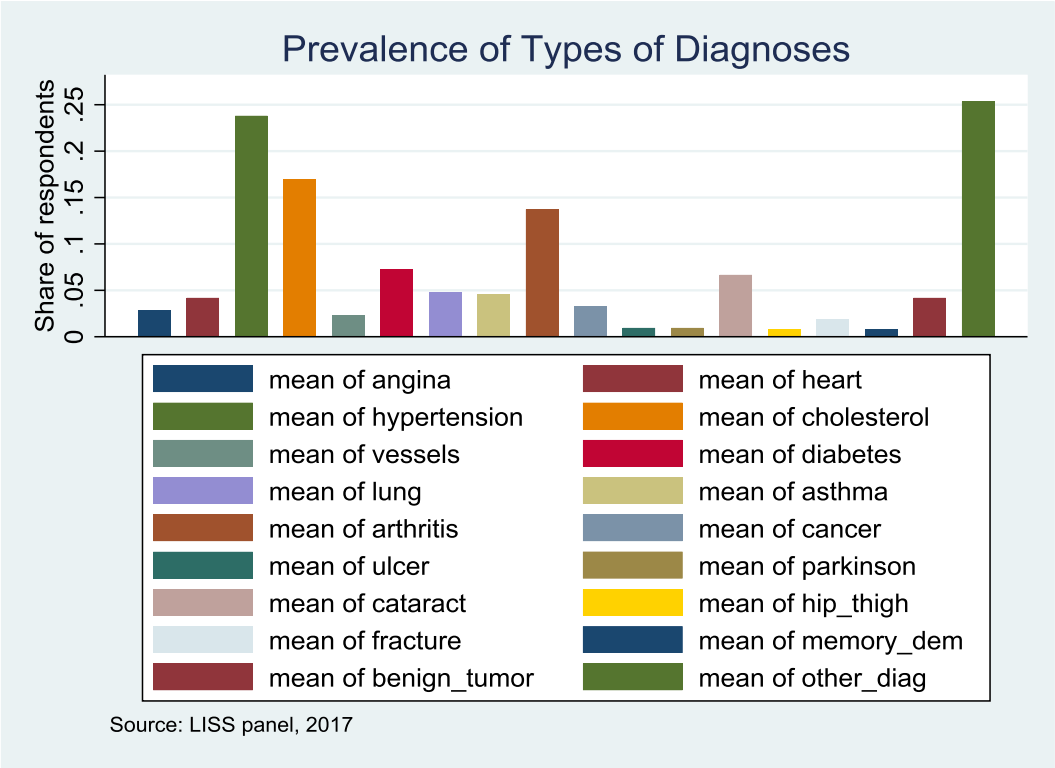

Figure 5. Prevalence of Self-reported Chronic Diseases

4.5. The Bequest Motive

4.5.1. The Immediate Prize Question

The immediate prize scenario involved the respondents winning a prize of EUR100K, which they would need to divide between an inheritance safe and a long-term care safe. The idea of "safes" or so called "lock boxes" provides a commitment device to control future impulsive behavior and limit choices to those pertaining to long-term goals. The point of this question is to overcome the identification problem as wealth is fungible between bequest and long-term care options. In our sample, 17 of 525 household heads are missing observations on bequest motive. Importantly, there were households where the household head did not participate, but the partner provided the answers to the immediate prize questions. In such cases, the observations were substituted by the level of the bequest motive of participating partners, restoring our sample back to 525 household heads.

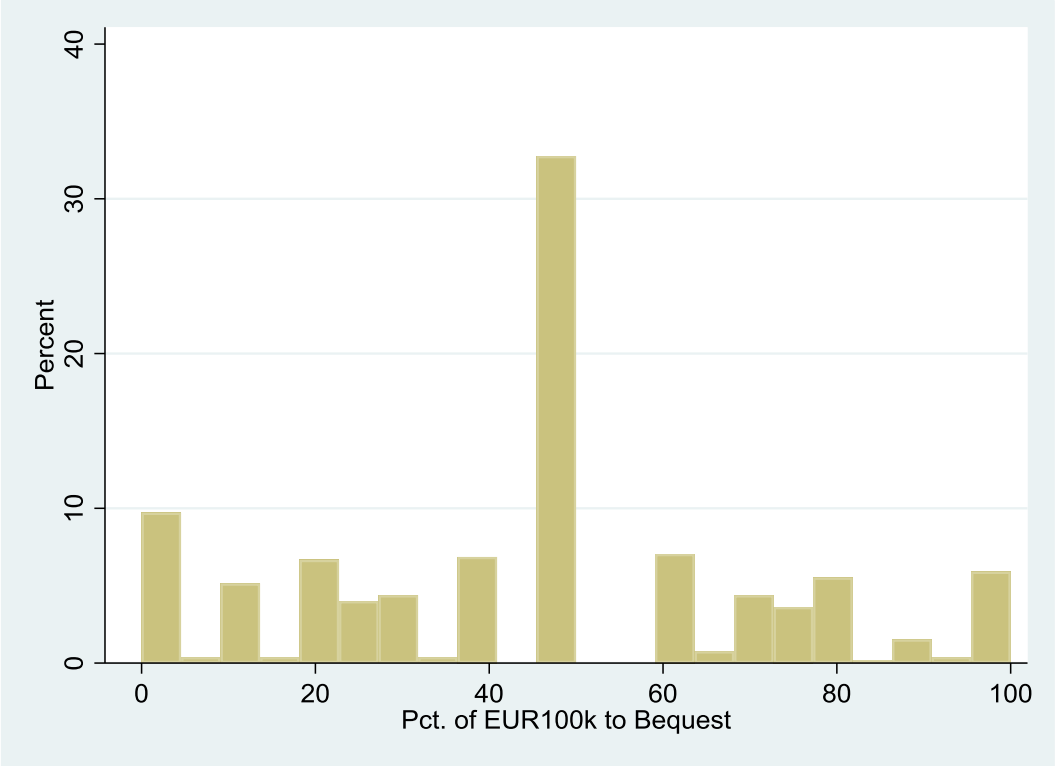

Figure 6. Distribution of the hypothetical lump sum prize.

Source: Healthcare costs survey, 2016.

Figure 6 portrays the preferred distribution of the hypothetical lump sum prize over bequest and long-term care. The first most common answer (33% of respondents) preferred to distribute the prize equally. The second most common distribution is bequeathing nothing (9%). Finally, the other

common options were 20% or 80% and 40% or 60%. These distributions suggest that both precautionary saving and bequest motives are important for a significant proportion of retirees. On the other hand, one should take the popularity of 50% option with caution, as respondents might have been opting for it as a safe option. Whereas in Ameriks et al. (2011) the distribution of preferred shares is more even, the prevalence of 50% answer is much more marked in our sample (17% in Ameriks et al., 2011).

Further, the respondents indicated how they would like the bequest to be distributed among the family members and acquaintances (see Table 4). Clearly, the respondents prefer to transfer the far largest share of the bequeathed wealth to partners and children (55% and 49% of respondents respectively). This observation, although motivated by family bonds, is also in line with the tax incentives[15]. Notably, a significant number of household heads did not respond to these questions.

Table 4. The distribution of hypothetical wealth bequeathed.

Variable	Obs[16]	Mean	St.dev.	Min	Max
Partner	388	54.38	34.63	0	100
Children	377	49.24	34.68	0	100
Charity	253	5.39	13.83	0	100
Siblings	233	8.91	22.23	0	100
Family	233	5.29	18.13	0	100
Friends	228	3.46	13.89	0	100
Other	222	2.14	13.46	0	100

Source: Healthcare costs survey, 2016

4.5.2. Validating the Bequest motive

Table 5 shows that although there is a preference to bequeath to children, the number of children does not seem to explain the variation in the willingness to leave bequest in general. In both specifications, with and without children, the presence of a partner and higher income level are associated with increases in the bequest motive. On the other hand, Dynan et al. (2004) suggests that lifetime income is a better predictor of the bequest motive. Although it is difficult to determine individual's income over life, one can approximate it with the level of education. Interestingly, Table 5 does not provide

[15] See Appendix A on Institutional Environment.
[16] The distribution of observations is uneven as not every household head responded to the respective question, i.e. only 411 household heads responded to the question on the share of the bequest they would leave to a partner.

any evidence to support the assertions of Dynan et al. (2004). We can also observe that the more patient is an individual, the higher is his/her bequest motive.

Table 5. The Determinants of the Bequest Motive

	Bequest	Bequest
Intermediate Secondary Educ (vmbo)	-1.38	-1.51
	(4.82)	(4.81)
Higher Secondary Educ (havo/vwo)	0.99	0.68
	(6.19)	(6.20)
Intermediate Vocational Educ (mbo)	2.63	2.28
	(4.75)	(4.79)
Higher Vocational Educ (hbo)	-1.64	-1.99
	(4.90)	(4.92)
University (wo)	1.39	1.18
	(6.34)	(6.37)
selfcontrol	-7.08	-7.13
	(5.68)	(5.69)
patience	9.71*	9.64*
	(5.41)	(5.43)
risk	-7.35	-7.37
	(5.11)	(5.10)
net income	0.002**	0.002**
	(0.001)	(0.001)
partner	7.09***	6.81***
	(2.46)	(2.49)
number of children		0.93
		(1.37)
cons	37.39***	37.62***
N	525	525
R2	0.0505	0.0514
F(p-val)	2.87(0.002)	2.75(0.002)

Source: LISS panel, 2016. Note: Robust Standard Errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01.

There is also evidence that based on various incentives (e.g. taxation), individuals might prefer donations or gifts (inter-vivos transfers) over bequests. However, we find no significant crowding out between bequest motive and motives for donations. This might be due to little difference in tax rates applied to inter-vivos transfers (gifts) and bequests in the Netherlands, except for the tax exempted amounts.[17]

[17] See Appendix A on Institutional Environment.

4.6. Socio-economic characteristics

Based on the theoretical modeling of utility of consumption with preference shifters within a household, the targeted empirical specification accounts for a row of socio-economic characteristics of the households, including mortality rates, education, real income and the household composition. This section discusses their construction.

4.6.1. Paid employment

In order to capture all available information in the Health Care Costs survey and improve the efficiency of the estimates by increasing the sample size, we do not restrict the sample to retired individuals. Thus, the empirical model needs to control for the working status of the household head. The latter is done by recoding the variable *job* available in the LISS panel, where those who have paid jobs are assigned a value of 1 and those who do not – 0. We then construct a variable *work_h* which indicates whether the household head is in the paid employment (51%, N=525) or not.

4.6.2. Mortality rates

Early studies testing life-cycle models would do calibrations based on average life table rate. Recently, subjective mortality rates have been replacing the life table measures. Subjective expectations have particularly high predictive power in cases an individual possess substantial private information. In our case, longevity expectations heavily depend on individual life style and risky behavior (e.g. smoking). Therefore, self-reported subjective expectation of longevity is said to better approximate the actual one (Salm, 2010).

We first infer individuals' self-reported probability of survival from the LISS panel, which asks the following question: *How would you rate your chance of living to be X years old or older?* The difference between the indicated age and the actual age of the respondent is conditioned to be at least 10 years. Specifically, it is 75 for age group 16-65, 80 for 16-70, 85 for 65-75, 90 for 70-80, 95 for 75-85 group. Thus, every respondent has two points on the distribution of the survival probabilities. For consistency, we restrict ourselves to one point which captures respondents at higher end of the age distribution curve, i.e. 75 for age group 16-65, 85 for 66-75, 95 for 76-85 group. Each individual rates the survival from 0 (no chance) to 10 (certain), we divide the reported probabilities by 10 and subtract from one to elicit the subjective mortality rates. Unlike other similar panels, the LISS panel does not ask the subjective survival question from the individuals above 85, attaching a value of 1 by default. Given that the empirical analysis is on a household level and the lack of observations on the partner, we approximate the household mortality using the responses of the household head.

The advantage of the LISS survey is that questions are already formulated in the probabilistic form (see Dominitz & Manski, 1997), which are more comparable between the respondents and easier to implement in the quantitative analysis than the Likert scale type of answers (Manski, 2004). Seemingly flawless, Manski (2017) suggests that probabilistic questions on subjective expectations may suffer from item non-response problem and rounding. Item non-response refers to inability of respondents to provide answers and rounding refers to prevalence of responses with 50% likelihood. Figure 10 shows that there is the mortality of the household head has sufficient variability and is not concentrated around the 50% benchmark.

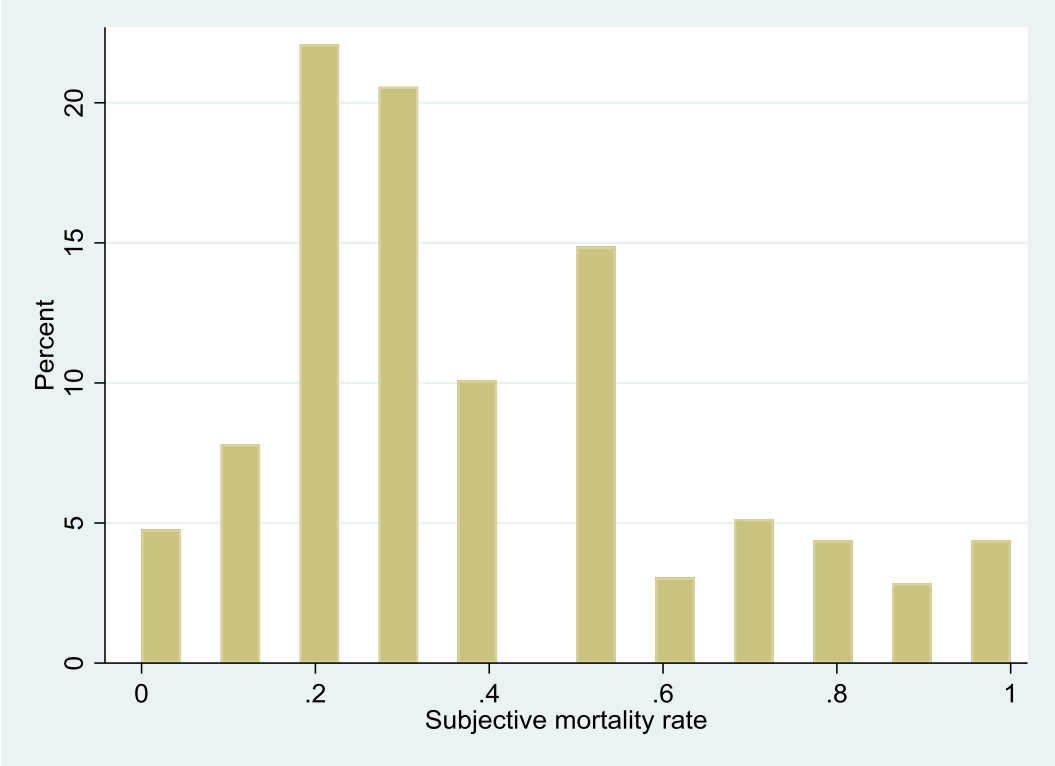

Figure 7. Distribution of the Subjective Mortality Rates.

Source: Healthcare costs survey, 2016.

Another critique of the subjective expectations is that little is known about the quality of subjective expectations as the precision might vary with a respondent's characteristics, e.g. cognitive ability (Hurd, 2009). Unfortunately, we cannot validate this claim. All we know, that on average, the subjective mortality expectations are strong proxies of the actual mortality rates (Salm, 2010).

4.6.3. Preference parameters

Another advantage of the Healthcare costs survey is that it provides information on the risk aversion and time preference of the respondents. These parameters enter the life-cycle model and need to be controlled for in the empirical specification.

The question on risk preferences is formulated as follows in the survey: "Are you generally a person who is willing to take risks or do you try to avoid risks?" The possible responses range from 1 (=always avoid risks) to 7 (=fully prepared to take risks). The question on time preferences is asked as follows: "Are you generally an impatient person or someone who always has a lot of patience?" And the possible answers range from 1 (=always patient) to 7 (=always impatient). The distribution of the parameters is represented in the histograms below. The parameters have been further normalized between 0 and 1 for the ease of comparison, implementation in the empirical specification, and interpretation.

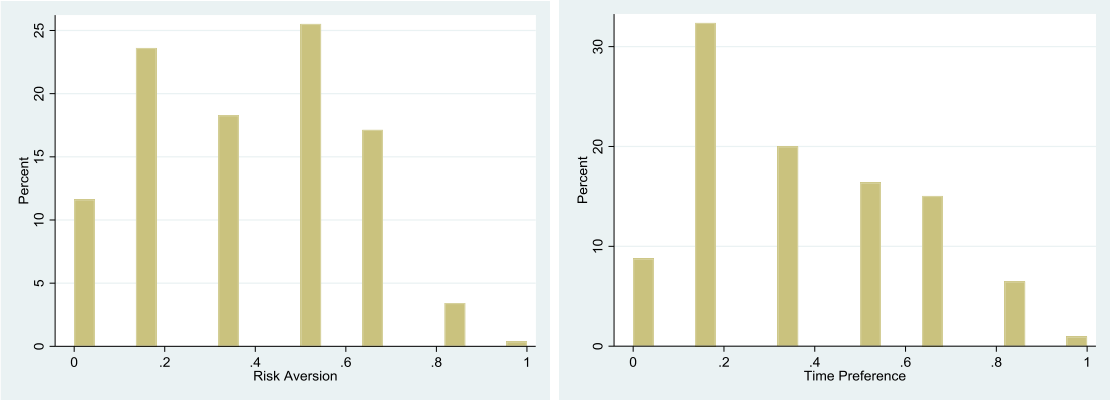

Figure 8. Risk aversion and Time preferences.
Source: LISS Healthcare costs survey, 2016

4.6.4. Other controls

To observe age effects, I include the age of a household head. Educational attainment is computed as the highest level attained by either of the partners. This approach is taken as education may have spill-over effects over the household. Household composition is also controlled for using the household size.

The real household income is obtained by computing the total net income per household and adjusting for CBS reported inflation rates (CBS, 2017). Then we take the change between 2015 and 2017 in the log-transformed levels.

5. RESULTS

5.1. Working Sample Description

Table 6 present the descriptive statistics for the final working sample of 525 household heads. With respect to consumption, the average food inflation adjusted food consumption was EUR3,996 in 2017, which is on average 6.8% higher than in the previous period, 2015 as measured by Δln(FoodExpenditure). Likewise, the average total inflation adjusted consumption was EUR12,748 in 2017, which is on average 4.8% higher than in 2015 as measured by Δln(TotalConsumption).

For health, on average, the subjective health was around 3 –"good" and between 2015 and 2017, the average change was -0.083, i.e. it deteriorated. The highest drop was -2 levels and the largest gain in subjective health was +1 point. To compare, we observe some deterioration in health using the self-reported subjective change in health. Likewise, the average mental health index (MHI5) of 75.146 also decreased on average by 2.08 points from 2015 to 2017 with a notable variability. Per objective health measures, an average largest number of chronic conditions per household was 1.422, which slightly increased between 2015 and 2017 as shown in Table 6. We can also observe that the average number of ADL, IADL, and mobility limitations also increased between the two periods. The same applies to BMI changes over between the two waves.

Speaking of socio-economic controls, an average sampled household head is aged 64 in a household of 2 persons. The average subjective mortality expectation is at 38.7%. Around 30% of the sampled household heads have complete only secondary education (Intermediate and Higher), 56% completed vocational education (Intermediate and Higher) and 10% completed university education. The average inflation adjusted yearly income was at EUR 29,213 with a notable variation.

An average household head would also bequeath 46% of their wealth, given the level of standardized risk aversion of 0.374 and time preference of 0.366.

Table 6. Working Sample Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Consumption Panel					
Δln(FoodExpenditure)	525	0.068	0.685	-3.202	2.761
Food Consumption	525	3996.18	3589.94	122.04	43527.6
Δln(TotalConsumption)	525	0.048	0.533	-4.202	3.061
Total Consumption	525	12748.12	12231.59	1525.5	134244
Health Panel					
ΔSubjective Health	525	-0.083	0.573	-2	1
Subjective Health_min	525	2.918	0.706	1	5
Subjective Change in Health_min	525	2.742	0.660	1	5
ΔNumber of Chronic Conditions	525	0.243	0.757	-3	3
Number of Chronic Conditions_max	525	1.422	1.421	0	8
ΔMHI5	525	-2.08	12.396	-72	52

MHI5_min	525	75.146	17.475	0	100
ΔBMI	525	0.314	2.227	-11.773	36.197
BMI_max	525	26.808	4.426	17.708	57.995
ΔADL	525	0.209	1.129	-6	10
ADL_max	525	6.866	1.790	6	20
ΔIADL	525	0.272	1.374	-6	14
IADL_max	525	8.649	2.838	7	28
ΔMobility	525	0.615	2.310	-14	18
Mobility_max	525	14.468	5.281	10	46
Socio-economic Characteristics					
Age_Household Head	525	64.464	11.19	42	94
Δlog(HouseholdIncome)	525	0.067	0.201	-1.398	1.137
Household Income	525	29213.03	14230.1	2623.86	122040
Subjective Mortality Expectation of Household Head	525	0.387	0.250	0	1
ΔHousehold Size	525	-0.044	0.320	-3	1
Household Size	525	2.08	1.054	1	8
Highest level of Education per Household					
Intermediate Secondary Educ (vmbo)	525	0.211	0.408	0	1
Higher Secondary Educ (havo/vwo)	525	0.081	0.274	0	1
Intermediate Vocational Educ (mbo)	525	0.264	0.441	0	1
Higher Vocational Educ (hbo)	525	0.297	0.457	0	1
University (wo)	525	0.106	0.308	0	1
Risk-Aversion and Time Preference Parameters					
RiskAversion_Household Head	525	0.374	0.232	0	1
TimePreference_Household Head	525	0.366	0.243	0	1
Bequest					
Bequest_Household Head	525	46.226	26.736	0	100

Source: LISS panel, 2015-2017. Subscript min or max means that minimum or maximum level of the measure were taken per household to identify the largest negative health shock.

5.2. Baseline Results

Since it is a common practice in the empirical literature to use variability in food consumption expenditure to approximate the total consumption expenditure, in this study we report the results for both food and total consumption. By doing so, we would also like to shed some light on the heterogeneity of state dependence across the two consumption measures. For the baseline analysis we employ the OLS regression approach, reporting two specifications with and without the bequest motive for each consumption measure.

5.2.1. Food Consumption

From both specifications, we observe robust health state dependence of the food consumption in the ADL and MHI5 measures. Specifically, a point increase in the change in the ADLs is associated with a decrease in the food consumption growth by 5.97%. By construct, a point increase signifies either change in the adversity of the loss of any of the included activities or a partial loss of a new activity. Since the food consumption decreases in the sick state, according to the life cycle theory, an optimizing consumer would have a lower marginal utility. Following this assumption, the regression results suggest negative health state dependence of the food consumption with respect to ADLs. The result is statistically significant at 1% significance level. Adding the bequest motive, contrary to our Hypothesis 2, increases the magnitude of the state dependence to -6.07%. The standard errors do not change in spite of the statistically significant correlation between ADL and the bequest motive.[18] With respect to mental health measure, MHI5, there is also evidence for negative health state dependence. Thus, a point increase in the change in MHI5 increases the food consumption growth by 0.499%. When the bequest motive is taken into the account, the magnitude only slightly decreases, but the sign of the association is robustly negative. Interestingly, in the presence of the bequest motive the confidence level for MHI5 decreases from 95% to 90%. This might be due to the slight increase in the standard error of MHI5 coefficient in the specification with the bequest motive, which might in turn be driven by the correlation between the bequest motive and MHI5.

The coefficients for the bequest motive is positive across specifications, i.e. a point increase in the bequest motive, brings from 0.057% to 0.075% growth in consumption. However, the result is statistically indifferent from zero. Otherwise, it would contradict the economic sense and our hypothesis, i.e. it is implausible that people with intentions to bequeath their wealth increase consumption. It might also be the case that the effect of the bequest motive is more pronounced for the changes in consumption levels but less so for the change in consumption growth.

[18] In the light of correlated controls, the standard errors are expected to inflate and affect the precision of the estimates. However, the significance of the ADL is not affected. See Appendix I for the results of conditional and unconditional correlation between the health changes and the bequest motive.

Table 7. OLS Regression Results.

Health measure	Change in Subjective Health	Subjective Change in Health	Number of Chronic Diseases	**MHI5**	BMI	**ADL**	IADL	MOB
Food Consumption without Bequest Motive								
Coefficient	0.0299	0.0290	0.0243	**0.00499****	0.00280	**-0.0597*****	-0.0286	-0.0201
SE	(0.0507)	(0.0450)	(0.0390)	**(0.00253)**	(0.00966)	**(0.0231)**	(0.0212)	(0.0134)
N	525	525	525	**525**	525	**525**	525	525
R2	0.0178	0.0180	0.0179	**0.0250**	0.0173	**0.0266**	0.0204	0.0216
Food Consumption with Bequest Motive								
Coefficient	0.0296	0.0283	0.0248	**0.00497***	0.00325	**-0.0607*****	-0.0286	-0.0200
SE	(0.0508)	(0.0452)	(0.0391)	**(0.00254)**	(0.00973)	**(0.0231)**	(0.0211)	(0.0134)
Coefficient (Bequest Motive)	0.000599	0.000584	0.000621	**0.000570**	0.000621	**0.000748**	0.000610	0.000587
SE	(0.00106)	(0.00107)	(0.00106)	**(0.00106)**	(0.00107)	**(0.00106)**	(0.00106)	(0.00106)
N	525	525	525	**525**	525	**525**	525	525
R2	0.0184	0.0184	0.0185	**0.0255**	0.0179	**0.0274**	0.0210	0.0221
Total Consumption without Bequest Motive								
Coefficient	-0.0108	0.0374	0.00862	-0.000761	0.00218	**-0.0387***	-0.0132	-0.00694
SE	(0.0418)	(0.0398)	(0.0271)	(0.00196)	(0.00573)	**(0.0197)**	(0.0158)	(0.0118)
N	525	525	525	525	525	**525**	525	525
R2	0.0216	0.0235	0.0217	0.0218	0.0216	**0.0280**	0.0227	0.0224
Total Consumption with Bequest Motive								
Coefficient	-0.0106	0.0380	0.00825	-0.000747	0.00187	**-0.0383***	-0.0132	-0.00699
SE	(0.0420)	(0.0403)	(0.0273)	(0.00196)	(0.00582)	**(0.0196)**	(0.0160)	(0.0119)
Coefficient (Bequest Motive)	-0.000439	-0.000469	-0.000435	-0.000436	-0.000431	**-0.000350**	-0.000438	-0.000447
SE	(0.000806)	(0.000815)	(0.000807)	(0.000805)	(0.000811)	**(0.000799)**	(0.000804)	(0.000806)
N	525	525	525	**525**	525	**525**	525	525
R2	0.0221	0.0240	0.0221	0.0223	0.0220	**0.0283**	0.0231	0.0229

Source: LISS panel, 2015-2017. Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

5.2.2. Total Consumption

We observe that total consumption exhibits robust health state dependence in terms of ADL only. Specifically, a point increase in ADL change decreases the growth in total consumption by 3.87% without the bequest motive and by 3.83% in the presence of the bequest motive. The coefficients are statistically significant at 10% significance level. This finding suggest a negative health state dependence. Importantly, in line with our hypothesis, in the presence of the bequest motive, the decrease in consumption due to health deterioration in terms of ADL is more gradual as compared to the case when the bequest motive is omitted from the specification.

Interestingly, in contrast to the food consumption growth, Table 7 suggests that the total consumption growth is less sensitive to the bequest motive, as the estimated coefficients are lower in magnitude, and range from -0.0350% to -0.0469%. Although the signs are in line with the literature and our

hypothesis, the OLS results do not provide enough evidence to claim that they are statistically different from zero.

Further, it is clear from both food and total consumption results that there are obvious heterogeneities in health state dependence across the health measures and consumption measures. To summarize, food consumption growth is responsive to ADLs and MHI5 measures, while the total consumption growth is responsive to ALDs only. Another noticeable observation is that the health state dependence is sensitive to the presence of the bequest motive, and the sensitivity is in turn dependent on the consumption measure and the health measure.

5.3. Causal Identification Issues

Inferences of the health state dependence from the survey data might be misleading in the presence of endogeneity and identification problems. Thus, an attempt to quantify the effect of health changes on consumption changes as outlined in our specification might be complicated by reverse causality, omitted variables, or measurement errors in the data. Each of the latter violates one of the fundamental Gauss-Markov assumptions – regressors are independent from the error term in the regression model and their estimator is no longer consistent or unbiased (Verbeek, 2012).

We cannot rule out endogeneity of health due to reverse causality or simultaneity because the effect of consumption on health has been widely documented in the literature within the socio-economic gradient literature. Because the changes in consumption might influence the changes in health, the OLS estimator might be invalid and inferences are no longer reliable. Second, a health measure might correlate with an error term in the presence of variables omitted from the empirical specification for reasons such as unavailability in the data set or impossibility to extract them in surveys. Time-differencing in our specification allows alleviating the bias from the omitted time-invariant variables, however, the bias from the disregarded time-variant preference shifter might still persist, particularly if the correlation with the included regressors is high. Third, self-reported survey data maybe rife with measurement errors. Finally, due to availability of the Healthcare costs survey for only one year, our working sample allows only cross-sectional as opposed to panel data analysis. Consequently, the OLS is only suggestive of associations.

Considering the above outlined issues, following Banks et al. (1998) we instrument all differences in health measures with their corresponding one and two-year lagged level (as opposed to difference) values. The lagged levels provide more information on variability in health as compared to the lagged differences.

5.4. Instrumental Variables Regression Results

Table 8 reports the IV regression results for the food and total consumption changes. On the surface, starting with the food consumption, we observe no statistically significant results for any of the health conditions. This finding goes against the OLS results reported previously.

At a closer look, Table 8 reports a very low F-statistic for ADL from the first stage regression, implying that the instruments are not relevant for both food and total consumption expenditure. Using instead the second and the third lagged levels of health measures do not improve the results. In this regard, we can only conclude that the health dependence in ADL is observed in terms of associations, but we do not have sufficient evidence for claiming causality. As for the MHI5, another statistically significant result from the OLS analysis, the first stage F-statistic(18.98) passes the standard threshold of 10, with the Sargan test suggesting that the instruments are valid. However, when it comes to the Endogeneity test, it appears very close to the cut-off point of 5% significance level. So, if one applies a strict rule of 5%, there is a lack of evidence to reject the exogeneity of MHI5 and we can rely on the OLS results for both food and total consumption.

Interestingly, the results in Table 8 also suggest that there is no health state dependence in subjective health measure and in BMI. Specifically, the first stage F-statistics pass the threshold, so the instruments used are relevant. Relying on the Sargan test, the validity of instruments cannot be rejected. Lastly, Subjective Health and BMI seem to be exogenous according to the Endogeneity test. In that case, we can rely on the OLS coefficients. The latter were not statistically different from zero for both specifications with food and total consumption. This suggests that there is no health state dependence in these health measures.

Finally, due to the lack of any associational relationship from the OLS regression results and low relevance of the instruments, we cannot determine health state dependence for such health measures as the number of chronic conditions, subjective change in health, IADL and mobility limitations. One would expect that the subjectively reported change in health would yield results consistent with the computed change in subjective health. However, at the standard threshold of 10 for the first stage F-statistics, our instrument does not pass the relevance test. Although quite conventional (Finkelstein et al., 2013), the number of chronic conditions is a complex measure of health. It encompasses a wide variety of different diseases, which in themselves might drive the individual behavior in different directions. For example, suffering from the chronic back pain is entirely different from the consequences of cancer. Therefore, it is not surprising that we cannot make any conclusions for the health state dependence measured in terms of the number of chronic conditions.

Table 8. IV Regression Results.

Health measure	*Change in Subjective Health*	Subjective Change in Health	Number of Chronic Diseases	MHI5	*BMI*	**ADL**	IADL	MOB
			Food Consumption					
Coefficient	*0.0842*	-0.0506	-0.247	**-0.00671**	*0.0353*	**-0.291**	0.321	-0.00868
SE	*(0.166)*	(0.232)	(0.344)	**(0.00755)**	*(0.0446)*	**(0.236)**	(0.390)	(0.0744)
N	*525*	525	524	**525**	*525*	**525**	525	525
1st stage F-test	*21.239*	8.620	2.620	**18.981**	*13.822*	**1.252**	0.596	4.156
Sargan test χ^2(p-value)	*0.0975*	0.8677	0.3951	**0.5079**	*0.3163*	**0.6623**	0.2020	0.7739
Endogeneity test (p-value)	*0.6859*	0.7239	0.3586	**0.0644**	*0.4566*	**0.2644**	0.1872	0.8836
			Total Consumption					
Coefficient	*-0.00827*	-0.123	-0.0960	**-0.00832**	*0.0424*	**0.00578**	0.0401	0.00811
SE	*(0.111)*	(0.172)	(0.235)	**(0.00633)**	*(0.0342)*	**(0.142)**	(0.151)	(0.0682)
N	*525*	525	524	**524**	*524*	**524**	524	559
1st stage F-test	*21.239*	8.620	2.620	**18.724**	*13.830*	**1.258**	0.592	3.181
Sargan test χ^2(p-value)	*0.6325*	0.9322	0.3686	**0.6656**	*0.9531*	**0.0778**	0.6313	0.3691
Endogeneity test (p-value)	*0.9482*	0.3368	0.6255	**0.1570**	*0.1958*	**0.7641**	0.7072	0.8332

Source: LISS panel, 2015-2017. Standard errors in parentheses. Employed instruments are one-period and two-period lagged levels of corresponding health indicator. * p<0.10, ** p<0.05, *** p<0.01. 1st stage F-test shows the relevance of the instruments and tests for underidentification under H0. Sargan test χ^2(p-value) has H0: instrument is valid. Rejection of the null hypothesis means that one or both instruments are invalid. Endogeneity test under H0: specified regressors are exogenous. Rejection of H0 suggests treating the variable tested as endogenous.

Table 9 provides a comprehensive overview of the main results. One of the main conclusions is that there is indeed marked heterogeneity in health state dependence across the health measures and consumption measures. However, the observed heterogeneity in sensitivity to the bequest motive contradicts our hypothesis that the bequest motive would uniformly decrease the magnitude of health state dependence. Bequest motive is statistically insignificant in all specifications.

Table 9. Overview of Results.

Health measure	Food Consumption	Total Consumption	Bequest Motive
Change in Subjective Health	no state dependence	no state dependence	not applicable
Subjective Change in Health	undetermined	undetermined	not applicable
ΔNumber of Chronic Diseases	undetermined	undetermined	not applicable
ΔMHI5	negative state dependence	no state dependence	reduces the magnitude of the state dependence of food consumption
ΔBMI	no state dependence	no state dependence	not applicable

ΔADL	negative state dependence	negative state dependence	Increases the magnitude of state dependence for food consumption, reduces for the total consumption
ΔIADL	undetermined	undetermined	not applicable
ΔMOB	undetermined	undetermined	not applicable

Source: LISS Panel, 2015-2017.

5.5. Robustness check

In this section we attempt to validate the above findings using the alternative measures where possible. One such measure of interest is the measure of ADL as it yielded interesting results in the earlier section.

Given that we know that ADL has a hierarchical structure, that is, losses do not happen at once and rather follow the reversed pediatric model from the first loss in washing to the last loss of autonomy in eating (LaPlante, 2010), it would be logical to assign respective weights depending on their importance. For example, loss of ability to eat is last and most important as compared to the ability to walk across the room. Therefore, we compute the weighted ADL and compare the results to the conventional ADL measure. The weighting is conducted using an ad-hoc approach as there is no empirical literature yet which employed it in the empirical literature:

- I order them according to a pediatric development model of Katz & Akpom (1976 cited in LaPlante (2010) from the most severe loss to the least: eating, getting in and out of the bed[19], transferring, toileting, dressing, and bathing;
- Each of the activities is assigned a score in an increasing order from 1 to 6 and solve for the corresponding weight: w+2w+3w+4w+5w+6w=1 => w=1/21;

Scale each activity and sum.

Besides, we also compare the conventional results with the Disability index, which is computed by summing ADL, IADL, and Mobility components into one measure. This might provide more variation in the measure and improve the IV results.

[19] I replace “continence” with the ability “to get in and out of a bed” as the Health module is missing that item.

Table 9 shows the IV regression results with initial ADL, weighted ADL, and Disability measure. Contrary to our expectations, the first stage F-statistics do not improve when using either of the alternative measures of ADL. Consequently, we cannot draw conclusions about the respective results.

Table 10. IV Regression Results - Alternative Measures of ADL.

Health measure	ADL	WADL	Disability
Food Consumption			
Coefficient	-0.291	-2.374*	0.143
SE	(0.236)	(1.414)	(0.240)
Clusters(individuals)	525	525	525
1st stage F-test	1.252	2.014	0.336
Sargan test χ^2(p-value)	0.6623	0.4453	0.8839
Endogeneity test (p-value)	0.2644	0.1237	0.3711
Total Consumption			
Coefficient	0.00578	0.377	-0.0950
SE	(0.142)	(0.937)	(0.191)
Clusters(individuals)	524	559	559
1st stage F-test	1.258	2.456	0.261
Sargan test χ^2(p-value)	0.0778	0.0395	0.6736
Endogeneity test (p-value)	0.454	0.5359	0.5913

Source: LISS panel, 2015-2017.Robust standard errors in parentheses. Employed instruments are one-period and two-period lags of corresponding health indicator. * p<0.10, ** p<0.05, *** p<0.01. 1st stage F-test shows the relevance of the instruments and tests for underidentification under H0. Sargan test (p-value) has H0: instrument is valid. Rejection of the null hypothesis means that one or both instruments are invalid. Endogeneity test under H0: specified regressors are exogenous. Rejection of H0 suggests treating the variable tested as endogenous.

6. DISCUSSION AND LIMITATIONS

6.1. Discussion

Our results show that there are significant heterogeneities in health state dependence across health measures and consumption measures. Our finding of a negative health state dependence in mental health (MHI5) and basic physical health (ADL) in food and total consumption are in line with studies of Finkelstein et al. (2013) and Brown et al. (2016), but surprisingly contradict the findings for the European population by Kools & Knoef (2017).

However, our study focuses on measuring health state dependence in the presence of the bequest motive. To our knowledge this is the first study to account for such an important decision-making factor in the health state dependence framework. Moreover, while we focus on a narrowly defined sample of households with the household head aged 40 and above, we capitalize on the availability of broad consumption, health, and bequest measures to identify any heterogeneities in health state dependence. This allows us to extend the current literature in a number of different directions. First of all, we measure and compare the health state dependence of consumption across eight different measures of health, mental (MHI5, Subjective Health, Subjective Change in Health) and physical (ADL, IADL, BMI, Number of Chronic Conditions, Mobility). For example, the health state dependence observed in MHI5 is lower in magnitude as compared to the ADL health state dependence. This might be due to the differences in value households attach to the components of MHI5 vs ADL, where an increase in ADL comes with a loss of basic functionality and more severe health deterioration, e.g. loss of ability to get up from the bed. This finding is in line with the conclusions of Brown et al. (2016), who studied the heterogeneities in health state dependence across mental and physical health. Secondly, we measure and compare the state dependence between two consumption baskets, food and total. Thirdly and most importantly, we show that the bequest motive is not associated with the consumption growth, yet it modifies the observed health state dependencies, mostly attenuating them. This might imply that in the presence of the bequest motive, consumption and saving are less sensitive to changes in health.

Earlier literature acknowledges the lack of studies on health state dependence (Finkelstein et al., 2009). Consequently, it is omitted from health insurance and optimal life-cycle savings models. The health state dependence has been also omitted in the models studying the effects of bequest motive on consumption and savings, whereas, health is at least an important counterfactual. In this context, our paper is the first one to study the heterogeneities in health state dependence in the presence of the bequest motive. Hereby, we aim to improve the existing optimal saving, consumption and health insurance models by accounting for the commonly omitted interplay of factors, health and bequest.

6.2. Limitations & Future Avenues

There are a number of limitations of our project arising from the employed theoretical framework, data, and econometric approach, which may serve as a ground for future refinement and extension.

First of all, we employ the expanded theoretical framework which accounts for the life-cycle consumption and the bequest motive with health measures as preference shifters. Due to the lack of information on the partners, we could not employ Hurd's (1997) model for couples. Instead, we

modify the individual's model using the information on the partners where available by constructing synthetic household measures of health or approximating some other characteristics by ones of the household head as is often done in the literature. Yet, this approach does not allow the direct test of the theoretical model and might inhibit some of the important inter-household mechanisms.

By the design of the survey, our second limitation is that the results are subject to sample selection on age. The LISS survey on Healthcare costs collected responses only from individuals aged 40 and above. Therefore, the results cannot be generalized to the rest of the age groups. On the other hand, the survey would be irrelevant to such participants and could suffer from noisy answers. For example, the concerns over the bequests and long-term care preferences are less relatable for 18-year olds rather than for 40-year old, who are on the eve of retirement.

Due the missing data on SSQs, health and consumption measures, we had to drop about 32% of our sample. Where it was possible, we substituted the missing characteristics of the household head with the characteristics of the participating partner. We also check for statistical differences between the working sample and the sample with the missing observations.[20] Among the dependent variables, the change in total consumption is slightly higher in the working sample. For health variables, there is a statistically significant difference in the number of chronic diseases and MHI5 score between the two samples, where both are higher in the working sample. However, the strength of the bequest motive is lower in the working sample by about 5 points. These differences might complicate the generalizability of our results.

Our fourth limitation is the lack of relevant instruments, due to which we could not make conclusive statements in terms of causal relationship between health preference shifters and the consumption. Despite the diversity of health measures available in the LISS panel, these are still self-reported survey data. Therefore, one possible improvement would be to use early life health and socio-economic conditions as instruments (Case et al., 2005) as well as the parental health status. The LISS panel does not have the data on early life or parental health, but it has started collecting life history data on early life circumstances and intra-family relationships. Selected questions, such as what was the economic situation of the family like could instrument the health status as they are relevant and exogenous. We left this extension for future work as using this instrument would largely reduce the sample size. The next possible extension of the project would be the use of biomarkers[21] for measuring health. Biomarkers have been recently introduced to household surveys such as Health

[20] See Appendix K for full statistics.
[21] A biomarker is a measurable substance in an organism the presence of which indicates specific disease, infection, or environmental exposure (Das et al., 2010).

and Retirement Study in the USA with the aim to "validate and add nuance to self-reported health indicators capturing the aspects of health unknown to survey participants" (Weir, 2008). The LISS team piloted the collection of biomarkers, including waist circumference, blood cholesterol, and saliva cortisol targeting 200 respondents and aiming to assess the possibility of collecting biomarkers in internet surveys (Das *et al*., 2010). Although the response rates were low in the pilot study, the collected measures were within the standard ranges. The LISS team published the data on the subsequent waist circumference study, however, the data on the rest of biomarkers have not been made available yet. We believe that at least testing the waist circumference as an alternative health measure might help validate our conclusions as long as the sample on which the data is collected becomes sufficiently large.

Finally, although our bequest motive measure allows disentangling the effects from the pre-cautionary saving motives, it does not precisely reveal specific incentives behind the motive. Neither, have we included such modeling into the theoretical framework. Future work can be done to determine how specific types of bequest motive, e.g. altruistic or strategic, modify the health state dependence of consumption.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. Main Conclusions

To our knowledge, this study is the first to investigate the health state dependence of consumption expenditure in the presence of the bequest motive and the associated heterogeneities. Individuals with more limitations in activities of daily living (ADL) seem to value food and total consumption less than those with fewer limitations. Likewise, individuals with lower mental health score (MHI5) also exhibit negative health state dependence, but only in terms of food consumption. The presence of the bequest motive modifies the strength of these relationships, but does not alter the direction of the health state dependence. Further, our results reveal notable heterogeneities in the health state dependence in the presence of the bequest motive. For one, the magnitude of the health state dependence differs between physical (ADL) and mental (MHI5) health measures. Secondly, for some health measure we do not observe any health state dependence or the results could not be determined to the weak instrumental variables problem. Thirdly, the health state dependence also varies between the consumption measures for the same health measures.

7.2. Implications for Policy

There are a number of policy-relevant reasons to explore the effect of distinct health problems on the consumption preferences of older people. According to Finkelstein et al. (2009), the features of any health state dependence may affect the optimal composition of health insurance policy. In turn, such findings may contribute to reforming the social security and long-term care programs and to designing goods and services for older people with specific health problems. As health problems change the level of satisfaction the older adults receive from consumption of goods and services, there is a need for better insurance products to sustain consumption smoothing and protect the older population from risks implied by worsening health and ageing or accommodate the changes in tastes and preferences.

Importantly, in this study, we show how the bequest motive modifies the health state dependence and hence the required optimal insurances and the life-cycle savings. Consequently, one could argue that the policies affecting the strength of the bequest motive, e.g. inheritance taxation, might indirectly affect the health state dependence and thus the optimal life-time savings and health insurance levels. Although, this implication needs further empirical evidence, our study sheds light on the broader consequences of policies other than health care related.

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APPENDICES

Appendix A – Institutional Environment

Our sample of interest consists of individuals at the age of 40 years and above. This an important stage of life when decisions about retirement, bequest and long-term care are to be made. Hence, it is important to account for the institutional environment, which influences the decision making of the older adults. Besides, this information is important when placing the data and results into context. Therefore, in this section we review the Dutch social security, long-term care, and inheritance regulations.

A1. Social Security System

The Dutch older population are entitled to pension benefits based on three pillars: publicly provided social security, occupational pensions, and private annuities, making the Dutch pension system comparatively better funded than the rest of the world (Kremers, 2002).

In 1957, the Netherlands established the Social Security system to provide for older people (aged 65+) under the General Old Pension Law. Following the debates over the affordability of the state old age pension due to demographic pressures (SVB, 2008), in 2013 it was decided to gradually increase the pension age and eventually tie it to life expectancy. Eligibility and the replacement rate depend on the number of years worked in the Netherlands and residence. Every additional year of a person not being enrolled into the public pension policy, reduces his/her final benefit by 2 per cent (SVB, 2008). Ageing population and increasing life expectancy have led to revisions of the financing mechanism of the Social Security from a Pay-As-You-Go (PAYG) until 2001 to partially government subsidized since then as the PAYG system became unsustainable (Kremers, 2002). However, the net replacement rate is quite high, at 70% of the net minimum wage for single retirees and 50% for couples.

Unlike social security benefits, the occupational pensions are fully funded, offered by employers and participation is usually mandatory (Van Ewisk, 2005). The contributions are used for investing in assets and can be only withdrawn in retirement. The type of benefit varies across plans and providers. There are defined benefit schemes, where years of work and salary determine the final benefit. Also, there are defined contribution plans, which levy less risk on pension funds and cause more uncertainty for beneficiaries. The amount of benefits reach about 70% of the before tax final wage after contributing for 40 years. Recently, the final salary base has been changed to average salary schemes, redistributing income from highly educated to lower educated beneficiaries. Despite the generosity

of the benefits, Van Santen *et al.* (2012) document a gradual reduction in the expected average replacement rates

The third pillar of pensions is founded on the private funding such as annuity insurance with tax deductible annuity contributions before accumulating to 70% of final wage as at statutory pension age. Due to substantial coverage, the first two pillars are relatively more important in the Dutch pension provision (Knoef *et al.*, 2013) and thus demand for private annuities is relatively insignificant.

The reforms of the pension system since 1990s were mainly driven towards individual freedom of choice and efficiency and affordability as summarized by Kremers (2002). The reforms with respect to individual choice consider providing individuals with a choice between the occupational pensions or annuities in the private markets, or changing their relative shares in financing the pensions (Kremers, 2002). Another stream of reforms in the pension provisions addressed the wage and price indexations from full indexation to partial indexation (Van Ewisk, 2005).

The above regulations imply that the variability in the real income of the Dutch pensioneers stems from not only changes in the price levels, but also in their eligibility and use of the three pillars of the pension system. Hence, we might expect more variability between individuals rather than within individuals in the data, which might in turn manifest itself in the consumption paths of the seniors.

A2. Long-term care

As of 2015, the Dutch government was among the highest spenders (2.4%) on Long Term Care (LTC) across the OECD countries as measured by the share of GDP. More than that, the voluntary out of pocket contribution to the LTC by Dutch residents was among the lowest (0.3% of GDP) as reported by OECD (2015) (See the figure below). Spending on the LTC also constitutes one third of the total public health care expenditures and there is a comprehensive and compulsory coverage of medical costs (Bakx *et al*., 2016). Bakx *et al.* (2016) provide recent evidence on the distribution of health and long-term care spending and their respective concentration. They find that average expenditures increase with age and the one per cent of residents with the highest expenses comprise more than 50 per cent of the total LTC expenditures with older people topping the distribution.

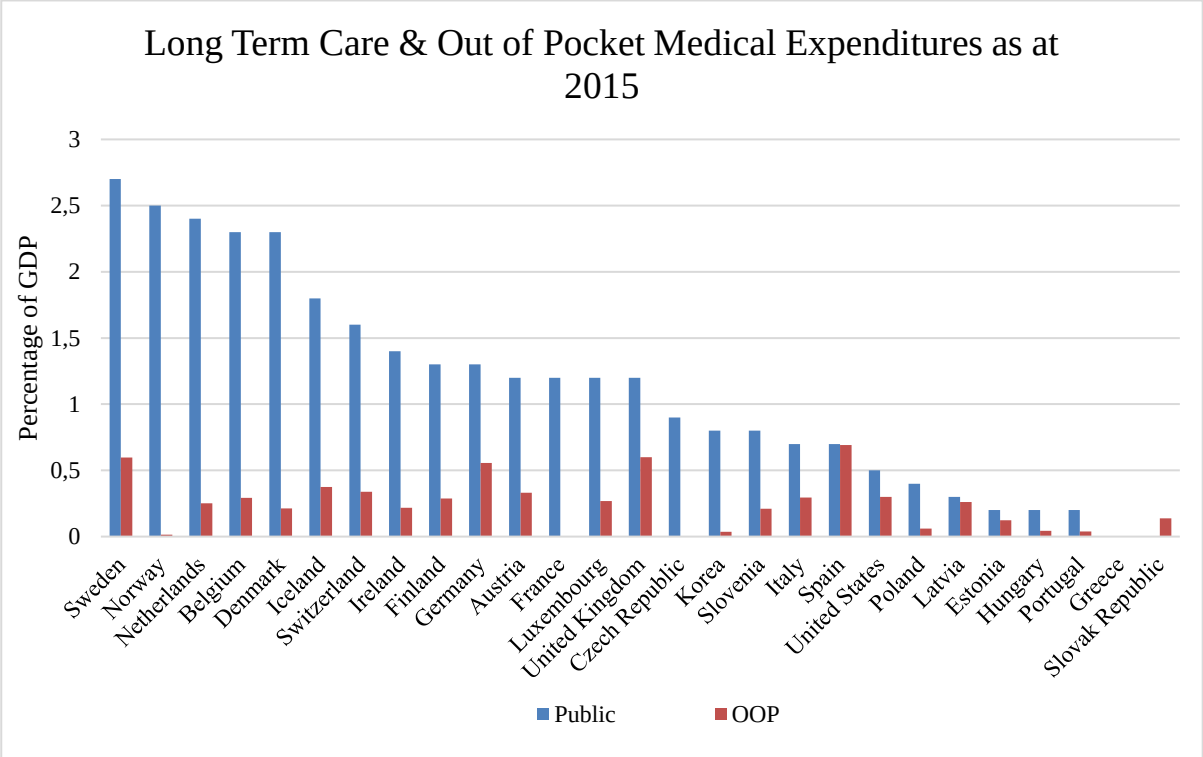

Figure 9. Long Term Care and Out of Pocket Expenditures. Source: OECD Health Statistics, 2015

The Netherlands first established the LTC program in 1968 aiming to cover the institutional and home care of the older, or physically or mentally disabled residents and currently financed by income contributions (73.4%), government subsidies (17.6%), and co-payments (9%) (Zorgcijfers, 2015, cited in Bakx, 2016). Similar to out of pocket medical expenditures, the contribution of the citizens to the co-payments is quite low.

The Dutch long-term care system has important implications for our study. As the Dutch seniors are fully insured and face minimal out of pocket health expenditure risk, precautionary saving and impact of the health changes on consumption growth can be relatively safely attributed to changes in preferences across health state. Otherwise, it would be very difficult to identify the health state dependence within the Dutch context within our framework.

A3. Inheritance

In order to better understand the country specific motives behind donations and bequests, we further scrutinize the Dutch inheritance law and draw relevant implications. Book 4 ("Law of Succession") of the Dutch Civil code details the Dutch inheritance law. As stated in the 1989 Hague Inheritance Treaty, one is obliged to comply with the law if he or she holds Dutch citizenship or has been residing in the Netherlands for 5 years prior to death. There are slight differences between the regulation of bequests and gifts/donations.

When it comes to accidental bequests, e.g. a person passes away without drafting the will, the assets are distributed as follows: 1) between the surviving spouse and children, 2) between parents and siblings, 3) grandparents, 4) great grandparents (Kolkman, 2015). In the first case, the 'statutory provision' states that the surviving spouse inherits the estate and children preserve their monetary claim on the assets in the amount equivalent to their share. The latter becomes accessible in case that surviving spouse dies, remarries or faces bankruptcy (Kolkman, 20150. If both spouses pass away, the assets are divided equally between the children.

Irrespective of whether accidental or not, the worldwide assets bequeathed by the Dutch national, including donations and gifts made within 180 days before the occurrence of death and proceeds of a life insurance contract, are subject to government taxation (*recht van sucessie*), which are payable by beneficiaries (www.globalpropertyguide.com, 2016). The amount of inheritance tax collected by the Dutch government every year comprises around EUR 2 billion (Kolkman, 2015). The Law of Succession (*Successiewet*) has been last amended in 2009, lowering the bequest and gift taxes and granting higher exemptions (Zeldin, 2009). The most recent rates are as follows:

Table 11. Inheritance and Gift Taxation

Category	**Bequest < EUR 118,000**	**Bequest > EUR 118,000**
I: Spouses, cohabitants, and children	10%	20%
II: Direct descendants of 2nd and above degree, e.g. grandchildren	18%	36%
III: Parents, brothers, and sisters, and others	30%	40%
Charities & Social Welfare communities	0%	0%

Sources: www.globalpropertyguide.com, www.loc.gov

The same tax rates apply to gifts and inheritance. However, the main difference stems from the exemptions precluded for each category. The exemption for inheritance comprises around EUR 643,194 for partners depending on pension receipts, and EUR 20,371 for children. The exemptions for gifts are 5,363 EUR for children and 2,147 for others (Meijburg & Co, 2018).

The above regulations suggest that there is little incentive for Dutch individuals to prefer gift or so-called inter-vivos transfers over bequeathing. However, the tax rates clearly incentivize leaving a bequest, in case intentional, to persons in Category 1 or to charities as compared to Category 2 or 3.

Appendix B – Explanations of the Bequest Motive

One of the conventional taxonomies of the bequest motive identifies three broad classes of bequests: accidental, voluntary, and capitalist. Accidental bequests take place when the wealth from parents is transferred to children due to unexpected death of a parent. Voluntary bequests are further classified into altruistic, paternalistic, retrospective, pure exchange, and strategic (Masson & Pestieau, 1997). If parents leave bequest because they care about the well-being and preferences of their grown up children, this qualifies as an altruistic motive for bequest. Conversely, in paternalistic motive, parent leave bequest based on their own understanding of the needs of children. This definition is closest to the "warm glow" motive, where parents derive pleasure from making transfers to their adult children independently of the children's utility gain or need (Blinder, 1974). The pure exchange motive manifests itself when traditionally parents exchange, through non-market means, education and bequests for the care received from children when their health deteriorates (Kotlikoff and Spivak, 1981; Cox, 1987, 1990).

The strategic bequest motive is different from the pure exchange in that the exchange agreement might be legally binding (Bernheim et al., 1985). Transferring bequests in a similar way from generation to generation characterises the retrospective bequest motive (Bevan & Stiglitz, 1979; Masson & Pestieau, 1997). The third category's 'capitalist bequests' main feature is that wealth is accumulated from generation to generation with the purpose of increasing the family line's wealth over time (Moore, 1979; Masson & Pestieau, 1997). Since we do not model specific types of motive and rather focus on the willingness to leave any bequest, we refer an interested reader for a more comprehensive summary and modelling behind each motive to studies by Masson & Pestieau (1997) among others.

Appendix C – Life-Cycle Hypothesis of Consumption for Couples

A couple gains utility of consumption when both spouses are alive, when only one is alive, and a utility from leaving bequests. There is uncertainty about the time of death. The setup is as follows:

The continuous time expected lifetime utility of a retired couple is given by:

$$\int_0^T U(C_t)e^{-\rho t}a_t dt + \int_0^T M(w_t)e^{-\rho t}\, p_{mt} dt + \int_0^T F(w_t)e^{-\rho t}\, p_{ft} dt$$
$$+ \int_0^T V(w_t)e^{-\rho t}\, m_t dt \text{ Error! No sequence specified.}$$

Where $U(C_t)$ is the couple's utility of consumption, ρ is the subjective discount rate, a_t – probability that both spouses are alive at t, $M(w_t)$ and $F(w_t)$ are the widower's and widow's utility of wealth respectively, p_{mt} is the probability of becoming a widower and p_{ft} is the probability of becoming a widow. $V(w_t)$ is the couples utility of bequest outside the household (e.g. to children and others). w_t is wealth and m_t is the probability that the surviving spouse dies.

Assuming a CRRA utility function and discrete time version, which is closer to the data, the difference equation fort consumption takes the following form:

$$\Delta \ln(C_{t+1}) \approx \frac{r-(\rho+m_{t+1}^1)}{\gamma} + \frac{\phi_{t+1}^t M'\big((1+r)A_t\big) + \mu_{t+1}^t F'\big((1+r)A_t\big)}{\gamma U'(C_t)}, \mathbf{(9)}$$

where $U'(C_t)$ – marginal utility of consumption by the couple, m_{t+1}^1 – the couples mortality risk measured as a sum of the mortality risk of each spouse, $M'\big((1+r)A_t\big)$ – widower's marginal utility of wealth, $F'\big((1+r)A_t\big)$ – widow's marginal utility of wealth, ϕ_{t+1}^t – mortality risk of the wife, μ_{t+1}^t – mortality risk of the husband, ρ – subjective discount rate of time of the couple.

Appendix D – Linear approximation of the Consumption Life-Cycle model with Bequest Motive and Taste Shifters in Discrete Time.

In this section, we show derivations of the linear approximation of the Life-Cycle model following the Lecture notes of Van Ooijen (2017).

Formally, entering the retirement at $t = 1$, individuals maximize the expected life-time utility function,

$$\sum_{t=1}^{L}(1+\rho)^{1-t}a_t^1 u(c_t) + \sum_{t=1}^{L}(1+\rho)^{-t}m_{t+1}^1 V\big((1+r)A_t\big), \qquad \mathbf{(10)}$$

subject to the intertemporal budget constraint,

$$A_t = (1+r)A_{t-1} + y - c_t, \qquad t = 1, \dots, L, \qquad \mathbf{(11)}$$

and the liquidity constraint,

$$A_t \geq 0, t = 1, \dots, L, \qquad \mathbf{(11)}$$

Where A_t – net worth at the end of period t, y – annuity income, ρ – the rate of time preference, r – real interest rate, c_t – consumption in period t, a_t^1 – survival rate, m_{t+1}^1 – mortality rate. Expression $\sum_{t=1}^{L}(1+\rho)^{-t}m_{t+1}^1 V\big((1+r)A_t\big)$ formalizes the bequest motive V which depends on the

net worth A_t. In the presence of the liquidity constraints, the model predicts that the consumption should never become smaller that the annuity income, i.e. $c_t \geq y$.

So, the Lagrangian is set as follows:

$$\mathcal{L} = \sum_{t=1}^{L} (1+\rho)^{1-t} a_t^1 u(c_t) + \sum_{t=1}^{L} (1+\rho)^{1-t} m_t^1 V\big((1+r)A_t\big) + \sum_{t=1}^{L} \lambda_t [(1+r)A_{t-1} + y - c_t - A_t]. \ (\mathbf{12})$$

The F.O.C. are:

$$\frac{\partial \mathcal{L}}{\partial c_t} = (1+\rho)^{1-t} a_t^1 u'(c_t) - \lambda_t = 0 \ (\mathbf{13})$$

$$\frac{\partial \mathcal{L}}{\partial c_{t+1}} = (1+\rho)^{-t} a_{t+1}^1 u'(c_{t+1}) - \lambda_{t+1} = 0 \ (\mathbf{14})$$

$$\frac{\partial \mathcal{L}}{\partial A_t} = (1+\rho)^{-t} m_{t+1}^1 V'\big((1+r)A_t\big) - \lambda_t + \lambda_{t+1}(1+r) = 0 \ (\mathbf{15})$$

Combining the above yields the Euler equation as follows:

$$u'(c_t) = \frac{1+r}{1+\rho}\left(\frac{a_{t+1}^1}{a_t^1} u'(c_{t+1}) + \frac{m_{t+1}^1}{a_t^1} V'\big((1+r)A_t\big)\right) \text{ where } \frac{a_{t+1}^1}{a_t^1} = \mathrm{a}_{\mathrm{t+1}}^{\mathrm{t}}, \frac{m_{t+1}^1}{a_t^1} = m_{t+1}^t. \ (\mathbf{16})$$

Knowing that $\mathrm{a}_{\mathrm{t+1}}^{\mathrm{t}} + m_{t+1}^t = 1$, we rewrite the Euler equation as follows:

$$u'(c_t) = \frac{1+r}{1+\rho}\Big((1-m_{t+1}^t) u'(c_{t+1}) + m_{t+1}^t V'\big((1+r)A_t\big)\Big). \ (\mathbf{17})$$

Dividing both sides of the above equation by $u'(c_t)$, yields:

$$\frac{(1+r)}{(1+\rho)}(1-m_{t+1}^t)\frac{u'(c_{t+1})}{u'(c_t)} + m_{t+1}^t \frac{(1+r)}{(1+\rho)} \frac{V'\big((1+r)A_t\big)}{u'(c_t)} = 1. \ (\mathbf{18})$$

The above result can be further rewritten as

$$\frac{(1+r)(1-m_{t+1}^t)}{(1+\rho)} \frac{u'(c_{t+1})}{u'(c_t)} = 1 - m_{t+1}^t \frac{(1+r)}{(1+\rho)} \frac{V'\big((1+r)A_t\big)}{u'(c_t)}. \ (\mathbf{19})$$

Assuming the utility function with a constant relative risk aversion, $u(c_t) = \frac{c_t^{1-\gamma}}{1-\gamma}$ and taking expectations from both sides, the resulting log-linearized Euler equation for the above maximization problem is as follows:

$$\Delta lnc_{t+1} \approx \frac{r_{t+1} - (\rho + m_{t+1}^t)}{\gamma} + \frac{m_{t+1}^t}{\gamma}\left(\frac{1 + r_{t+1}}{1+\rho}\right)\left(\frac{V'\big((1+r_{t+1})A_t\big)}{u'(c_t)}\right), \qquad (\mathbf{20})$$

where Δlnc_{t+1} is the log-transformed change in consumption.

Following Banks *et al.* (1998), we allow the Constant Relative Risk Aversion (CRRA) form of additively separable utility of consumption (c_t) function for an individual household with taste shifters:

$$u(c_t, \boldsymbol{z_t}, h_t) = exp(\theta_0 + \boldsymbol{\theta_1'}\boldsymbol{z_t} + \theta_2 h_t)\frac{c_t^{1-\gamma}}{1-\gamma} \text{ Error! No sequence specified. } (\mathbf{21})$$

Adjacent to the consumption c_t are the vector of preference shifters $\boldsymbol{z_t}$ such as age and similar socio-demographic characteristics of a individual with $\boldsymbol{\theta_1'}$ is the vector of multipliers corresponding the preference shifters, health status indicator h_t, and γ is the coefficient of relative risk aversion. With this formulation, the previous Euler equation takes the following form:

$$E_t\left\{\frac{(1+r)(1-m_{t+1}^t)}{(1+\rho)}\left(\frac{c_{t+1}}{c_t}\right)^{-\gamma} exp(\Delta\boldsymbol{\theta_1'}\boldsymbol{z_{t+1}} + \Delta\theta_2 h_{t+1}) + m_{t+1}^t\frac{(1+r)}{(1+\rho)}\frac{V'\big((1+r)A_t\big)}{u'(c_t)}\right\} = 1 \ (\mathbf{22})$$

Or

$$\left\{\frac{(1+r)(1-m_{t+1}^t)}{(1+\rho)}\left(\frac{c_{t+1}}{c_t}\right)^{-\gamma} exp(\Delta\boldsymbol{\theta_1'}\boldsymbol{z_{t+1}} + \Delta\theta_2 h_{t+1}) + m_{t+1}^t\frac{(1+r)}{(1+\rho)}\frac{V'\big((1+r)A_t\big)}{u'(c_t)}\right\} = 1 + \epsilon_{1+t}, \quad \text{where } E_t\epsilon_{1+t} = 0. \ (\mathbf{23})$$

Using the mathematical properties of the natural logarithm, $\ln(1+\varepsilon) \approx \varepsilon$ and the first-order Taylor approximation rule: $f(x) \approx f(a) + f'(a)(x-a)$,

we can rewrite the Euler equation in the linear approximation form:

$$E_t\left\{\frac{(1+r)(1-m_{t+1}^t)}{(1+\rho)}(1-\gamma\Delta lnc_{t+1})exp(\Delta\boldsymbol{\theta_1'}\boldsymbol{z_{t+1}} + \Delta\theta_2 h_{t+1}) + m_{t+1}^t\frac{(1+r)}{(1+\rho)}\frac{V'\big((1+r)A_t\big)}{u'(c_t)}\right\} \approx 1 \ (\mathbf{24}) \Rightarrow$$

When taken the logarithm,

$$E_t\left\{\ln(1+r)+ln(1-m_{t+1}^t)-\ln(1+\rho)+ln(1-\gamma\Delta lnc_{t+1})+(\Delta\boldsymbol{\theta_1'z_{t+1}}+\Delta\theta_2 h_{t+1})+\ln\left[m_{t+1}^t\frac{(1+r)}{(1+\rho)}\frac{V'\big((1+r)A_t\big)}{u'(c_t)}\right]\right\}\approx 0\ (\mathbf{25})\Rightarrow$$

$$E_t\{r-m_{t+1}^t+\rho-\gamma\Delta lnc_{t+1}+\Delta\boldsymbol{\theta_1'z_{t+1}}+\Delta\theta_2 h_{t+1}+\ln\left[m_{t+1}^t\frac{(1+r)}{(1+\rho)}\frac{V'\big((1+r)A_t\big)}{u'(c_t)}\right]\}\approx 0.(\mathbf{26})$$

With the forecast error, $\varepsilon_{t+1}=\Delta lnc_{t+1}-E_t(\Delta lnc_{t+1})$, the empirical specification takes the following form:

$$\Delta lnc_{t+1}=\frac{1}{\gamma}r+\frac{1}{\gamma}\rho-\frac{m_{t+1}^t}{\gamma}+\frac{\Delta\boldsymbol{\theta_1'}}{\boldsymbol{\gamma}}\boldsymbol{z_{t+1}}+\frac{\Delta\theta_2}{\gamma}h_{t+1}+\frac{1}{\gamma}E_t\left\{ln\left[m_{t+1}^t\frac{(1+r)}{(1+\rho)}\frac{V'\big((1+r)A_t\big)}{u'(c_t)}\right]\right\}+\varepsilon_{t+1},(\mathbf{27})$$

To simplify further for the empirical estimation, we move the coefficient of the risk aversion to the left and obtain:

$$\gamma\Delta lnc_{t+1}=r+\rho-m_{t+1}^t+\boldsymbol{\theta_1'}\Delta\boldsymbol{z_{t+1}}+\theta_2\Delta h_{t+1}+E_t\left\{ln\left[m_{t+1}^t\frac{(1+r)}{(1+\rho)}\frac{V'\big((1+r)A_t\big)}{u'(c_t)}\right]\right\}+\varepsilon_{t+1}.(\mathbf{28})$$

Since we have data on the coefficient of time preference ρ and the mortality rate, we rewrite model as below. In addition, we cannot control for the interest rate as the difference form boils down to the cross-sectional model and it is constant in that case. The resulting log-linearized Euler equation for the household maximization problem with utility function dependent on taste shifters accounting for the presence of the bequest motive in line with Hurd (1997) for each household is as follows:

$$\gamma_i*\Delta lnc_{it+1}=\theta_0+\boldsymbol{\theta_1'}\Delta\boldsymbol{z_{t+1}}+\theta_2\Delta h_{t+1}+\theta_3\rho_i+\theta_4 m_{it+1}^t+\theta_5 bequest_i+\varepsilon_{t+1},(\mathbf{29})$$

where $\theta_0=r$, $\theta_4<0$, and $bequest_i=E_{it}\left\{ln\left[m_{it+1}^t\frac{(1+r)}{(1+\rho_i)}\frac{V'\big((1+r)A_{it}\big)}{u'(c_{it})}\right]\right\}$ – the expectation of a bequest given the time preference, mortality rate, and the accumulated assets of the household, Δlnc_{it+1} is the log-transformed change in consumption, $\Delta\boldsymbol{z_{it+1}}$ – change in time-variant taste shifters, Δh_{it+1} – change in the health status for household i.

Appendix E – Sampling

Specifically, first, I append all available waves for each module used: Health, Time Consumption, and Background. The next step involved merging the datasets in such a way that the final one would allow regressing a difference in consumption on differences in health measures controlling for household characteristics and bequest. Since the bequest motive measure is available only for 2016, we need the dataset which would take the differences of interest around the same period.

Therefore, I match the health data set with the background, all waves from 2007 to 2017. In total, 52,693 observations matched of 52,695 contained in the health module.

Next, I match the output with the consumption dataset, 25,329 observations matched. I appended the health and background for 2007 and 2008, because while matching the all modules they were dropped due to absence of the corresponding observations in the consumption module. So, the full data set without the sampling restrictions has the following distribution of observations over the years:

From here on, I keep only matched observations for year 2017 from the dataset and merge them with

Table 12.The sample size distribution over the LISS waves.

2007	6,698	17.63	17.63
2008	5,961	15.69	33.32
2009	5,072	13.35	46.68
2010	4,909	12.92	59.60
2012	5,085	13.39	72.98
2015	5,491	14.45	87.44
2017	4,772	12.56	100.00
Total	37,988	100.00	

the Healthcare costs survey. Out of 4,772 observations, 1733 match. This drop is partially explained by the fact that the Healthcare costs survey involved respondents older than 40, and only the household head and the partner were interviewed. There were 3460 individuals meeting these criteria in the master data set reduced to year 2017. The rest, I assume, is due to sampling in the Healthcare costs survey. I merge the 2017 wave with the Healthcare costs so that when the difference is taken, the bequest motive data is preserved.

Next, I append the 2015 wave of master data containing consumption, health and background variables. Besides, I also append the health and background data prior to 2015 for the construction of instrumental variables later in the analysis. Finally, I restrict the sample to allow for two lag

differences and keep the individuals which participated in waves 2009, 2010, 2012, 2015, 2017. This amounts to 1,153 observations per year at the iindividual level.

Further, considering the family status of the individuals, we keep household heads and wedded and unwedded partners, leaving parents in law, children living at home, and housemates.

Appendix F – External Data

Table 13. Consumer prices; price index 2015=100

Subjects_1	Expenditure categories	Periods	Value
CPI	000000 All items	2009	90,44
CPI		2010	91,59
CPI		2012	96,04
CPI		2015	100
CPI		2017	101,7

Source: CBS, 2017

Appendix G – Validation of Bequest Motive

The figure below suggests that bequest motive is highest among individuals belonging to upper income group. The distribution is more monotonic starting from the second income group.

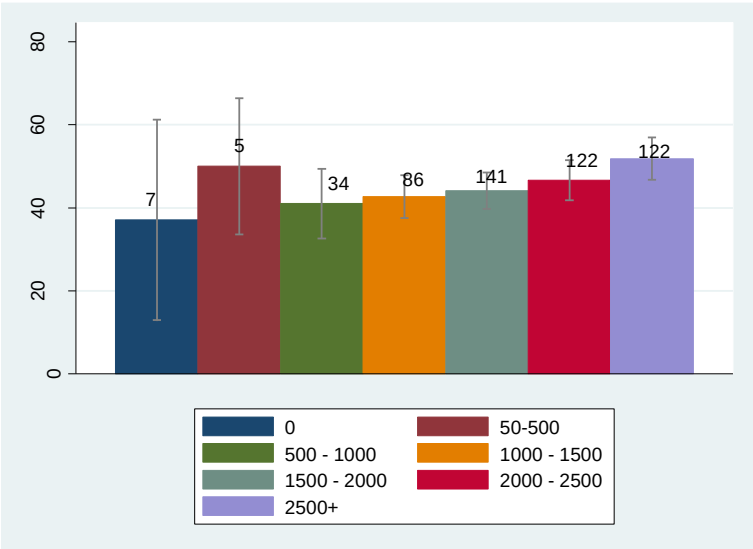

Figure 10. Distribution of bequest over income groups.

Source: Healthcare costs survey, 2016.

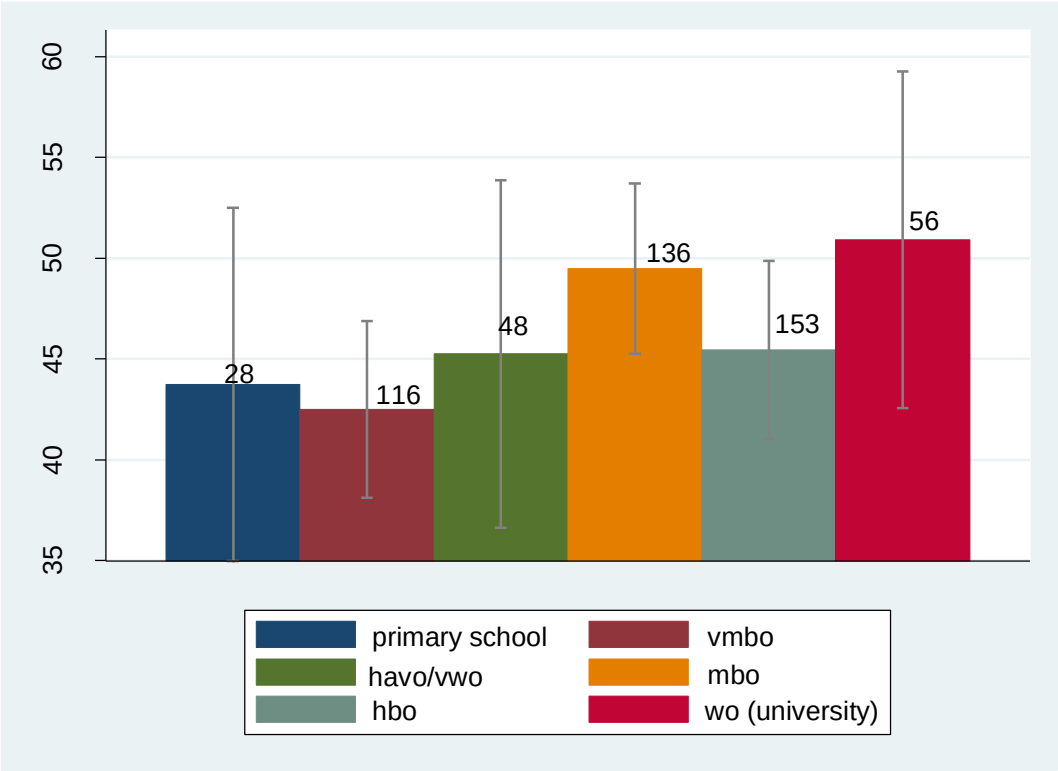

Figure 11. Distribution of Bequest Motive by Education.

Source: Healthcare costs survey, 2016.

To validate the argument that there is no crowding out between the bequest and donation motives, we observe if there is any correlation in the preferences of respondents to donate to specific individuals or bequeath. Significant negative correlations would suggest substitution between the two, however, from the correlations reported below we do not observe as such.

Table 14. Unconditional correlation between donations and bequest motive.

Donation↓/Bequest→	Child who takes care	Another caretaker	Child in need	Another person in need	No conditions
Planning none	-0.04	-0.00	-0.04	-0.01	0.01
Child who takes care	0.41	0.05	0.08	-0.01	-0.19
Another caretaker	0.09	0.36	-0.03	0.21	-0.19
Child/person in need	0.21	0.11	0.24	0.09	-0.21
No conditions	-0.28	-0.15	-0.11	-0.05	0.27

Source: LISS Healthcare survey, 2016, N=378.

Appendix H – Full OLS Results

Table 15. Full OLS - Food Consumption without Bequest Motive

	(1) dlnfood	(2) dlnfood	(3) dlnfood	(4) dlnfood	(5) dlnfood	(6) dlnfood	(7) dlnfood	(8) dlnfood
subhdmin	0.0299							
	(0.0507)							
age_h	-0.000877	-0.00100	-0.00145	-0.000563	-0.00125	-0.000878	-0.00134	-0.000499
	(0.00462)	(0.00458)	(0.00455)	(0.00454)	(0.00456)	(0.00452)	(0.00457)	(0.00451)
dhincome	0.0423	0.0471	0.0496	0.0627	0.0508	0.0378	0.0408	0.0589
	(0.145)	(0.143)	(0.144)	(0.137)	(0.144)	(0.143)	(0.143)	(0.143)
m_head	-0.0455	-0.0311	-0.0505	-0.0514	-0.0488	-0.0295	-0.0448	-0.0285
	(0.128)	(0.128)	(0.128)	(0.129)	(0.128)	(0.130)	(0.129)	(0.129)
dhhsize	-0.152**	-0.152**	-0.148**	-0.146**	-0.150**	-0.153**	-0.159**	-0.155**
	(0.0697)	(0.0700)	(0.0701)	(0.0705)	(0.0697)	(0.0693)	(0.0697)	(0.0696)
1.educmax	0	0	0	0	0	0	0	0
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
2.educmax	-0.0617	-0.0595	-0.0762	-0.0287	-0.0677	-0.0438	-0.0588	-0.0515
	(0.199)	(0.198)	(0.201)	(0.192)	(0.200)	(0.196)	(0.198)	(0.193)
3.educmax	-0.0423	-0.0338	-0.0536	-0.0200	-0.0491	-0.0215	-0.0444	-0.0335
	(0.212)	(0.212)	(0.213)	(0.207)	(0.215)	(0.210)	(0.212)	(0.207)
4.educmax	-0.0623	-0.0557	-0.0743	-0.0317	-0.0666	-0.0407	-0.0614	-0.0531
	(0.201)	(0.200)	(0.204)	(0.196)	(0.203)	(0.198)	(0.201)	(0.195)
5.educmax	-0.0799	-0.0741	-0.0891	-0.0509	-0.0832	-0.0510	-0.0749	-0.0703
	(0.200)	(0.198)	(0.202)	(0.194)	(0.201)	(0.196)	(0.199)	(0.193)
6.educmax	-0.100	-0.0939	-0.107	-0.0625	-0.100	-0.0821	-0.104	-0.0843
	(0.210)	(0.209)	(0.211)	(0.203)	(0.210)	(0.206)	(0.209)	(0.203)
work_h	-0.110	-0.111	-0.116	-0.113	-0.114	-0.115	-0.118	-0.101
	(0.0910)	(0.0908)	(0.0904)	(0.0900)	(0.0907)	(0.0904)	(0.0909)	(0.0907)
partner	-0.0747	-0.0760	-0.0826	-0.0583	-0.0791	-0.0686	-0.0735	-0.0713
	(0.0647)	(0.0643)	(0.0643)	(0.0627)	(0.0642)	(0.0632)	(0.0637)	(0.0641)
risk_head	-0.119	-0.122	-0.113	-0.112	-0.118	-0.132	-0.119	-0.129
	(0.129)	(0.129)	(0.128)	(0.127)	(0.129)	(0.126)	(0.128)	(0.128)
patience_h~d	0.112	0.109	0.118	0.113	0.116	0.0887	0.102	0.100
	(0.114)	(0.116)	(0.114)	(0.113)	(0.114)	(0.114)	(0.114)	(0.115)
subdhealth~n		0.0290						
		(0.0450)						
dnchronic			0.0243					
			(0.0390)					
mhi5dmin				0.00499**				
				(0.00253)				
bmidmax					0.00280			
					(0.00966)			
adldmax						-0.0597***		
						(0.0231)		
iadldmax							-0.0286	
							(0.0212)	
mobdmax								-0.0201
								(0.0134)
_cons	0.311	0.229	0.355	0.258	0.339	0.305	0.350	0.280
	(0.382)	(0.409)	(0.381)	(0.372)	(0.383)	(0.374)	(0.382)	(0.369)
N	525	525	525	525	525	525	525	525
r2	0.0178	0.0180	0.0179	0.0250	0.0173	0.0266	0.0204	0.0216

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 16. Full OLS - Food Consumption with Bequest Motive

	(1) dlnfood	(2) dlnfood	(3) dlnfood	(4) dlnfood	(5) dlnfood	(6) dlnfood	(7) dlnfood	(8) dlnfood
subhdmin	0.0296							
	(0.0508)							
age_h	-0.000829	-0.000960	-0.00140	-0.000517	-0.00121	-0.000810	-0.00129	-0.000452
	(0.00462)	(0.00457)	(0.00454)	(0.00453)	(0.00455)	(0.00451)	(0.00456)	(0.00451)
dhincome	0.0396	0.0444	0.0466	0.0600	0.0478	0.0340	0.0379	0.0561
	(0.146)	(0.143)	(0.144)	(0.137)	(0.144)	(0.144)	(0.144)	(0.143)
m_head	-0.0503	-0.0362	-0.0555	-0.0560	-0.0539	-0.0352	-0.0497	-0.0333
	(0.129)	(0.129)	(0.128)	(0.129)	(0.129)	(0.130)	(0.130)	(0.129)
dhhsize	-0.150**	-0.150**	-0.146**	-0.144**	-0.148**	-0.150**	-0.157**	-0.153**
	(0.0702)	(0.0705)	(0.0706)	(0.0710)	(0.0702)	(0.0698)	(0.0702)	(0.0700)
1.educmax	0	0	0	0	0	0	0	0
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
2.educmax	-0.0638	-0.0616	-0.0786	-0.0308	-0.0703	-0.0460	-0.0609	-0.0535
	(0.199)	(0.199)	(0.201)	(0.193)	(0.201)	(0.196)	(0.199)	(0.193)
3.educmax	-0.0468	-0.0385	-0.0585	-0.0244	-0.0545	-0.0267	-0.0490	-0.0379
	(0.213)	(0.213)	(0.214)	(0.208)	(0.216)	(0.211)	(0.213)	(0.208)
4.educmax	-0.0673	-0.0607	-0.0797	-0.0365	-0.0722	-0.0465	-0.0665	-0.0580
	(0.202)	(0.201)	(0.205)	(0.197)	(0.203)	(0.199)	(0.201)	(0.196)
5.educmax	-0.0836	-0.0779	-0.0931	-0.0545	-0.0873	-0.0552	-0.0786	-0.0740
	(0.200)	(0.199)	(0.202)	(0.195)	(0.201)	(0.197)	(0.199)	(0.194)
6.educmax	-0.107	-0.100	-0.114	-0.0688	-0.107	-0.0899	-0.110	-0.0907
	(0.210)	(0.209)	(0.211)	(0.203)	(0.210)	(0.206)	(0.209)	(0.203)
work_h	-0.110	-0.111	-0.115	-0.112	-0.114	-0.114	-0.117	-0.101
	(0.0912)	(0.0910)	(0.0905)	(0.0902)	(0.0908)	(0.0905)	(0.0910)	(0.0909)
partner	-0.0801	-0.0813	-0.0883	-0.0634	-0.0848	-0.0751	-0.0789	-0.0766
	(0.0656)	(0.0653)	(0.0653)	(0.0637)	(0.0651)	(0.0641)	(0.0646)	(0.0649)
risk_head	-0.115	-0.118	-0.108	-0.108	-0.113	-0.127	-0.114	-0.125
	(0.128)	(0.129)	(0.128)	(0.127)	(0.128)	(0.126)	(0.128)	(0.128)
patience_h~d	0.109	0.106	0.114	0.109	0.112	0.0835	0.0981	0.0966
	(0.114)	(0.115)	(0.114)	(0.113)	(0.114)	(0.114)	(0.114)	(0.114)
bequest_head	0.000599	0.000584	0.000621	0.000570	0.000621	0.000748	0.000610	0.000587
	(0.00106)	(0.00107)	(0.00106)	(0.00106)	(0.00107)	(0.00106)	(0.00106)	(0.00106)
subdhealth~n		0.0283						
		(0.0452)						
dnchronic			0.0248					
			(0.0391)					
mhi5dmin				0.00497*				
				(0.00254)				
bmidmax					0.00325			
					(0.00973)			
adldmax						-0.0607***		
						(0.0231)		
iadldmax							-0.0286	
							(0.0211)	
mobdmax								-0.0200
								(0.0134)
_cons	0.289	0.210	0.332	0.237	0.317	0.277	0.328	0.259
	(0.383)	(0.407)	(0.382)	(0.373)	(0.384)	(0.374)	(0.383)	(0.369)
N	525	525	525	525	525	525	525	525
r2	0.0184	0.0184	0.0185	0.0255	0.0179	0.0274	0.0210	0.0221

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 17. Full OLS - Total Consumption without Bequest Motive

	(1) dlntcons	(2) dlntcons	(3) dlntcons	(4) dlntcons	(5) dlntcons	(6) dlntcons	(7) dlntcons	(8) dlntcons
subhdmin	-0.0108							
	(0.0418)							
age_h	-0.00494	-0.00459	-0.00492	-0.00492	-0.00488	-0.00463	-0.00490	-0.00459
	(0.00367)	(0.00363)	(0.00359)	(0.00356)	(0.00360)	(0.00357)	(0.00359)	(0.00361)
dhincome	-0.0703	-0.0783	-0.0738	-0.0752	-0.0734	-0.0819	-0.0780	-0.0706
	(0.0744)	(0.0740)	(0.0748)	(0.0760)	(0.0751)	(0.0753)	(0.0749)	(0.0745)
m_head	0.0487	0.0717	0.0488	0.0502	0.0492	0.0618	0.0512	0.0565
	(0.0900)	(0.0908)	(0.0903)	(0.0906)	(0.0906)	(0.0906)	(0.0912)	(0.0881)
dhhsize	-0.138**	-0.141**	-0.138**	-0.139**	-0.139**	-0.140**	-0.143**	-0.140**
	(0.0648)	(0.0654)	(0.0649)	(0.0643)	(0.0646)	(0.0642)	(0.0647)	(0.0644)
1.educmax	0	0	0	0	0	0	0	0
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
2.educmax	-0.119	-0.110	-0.121	-0.123	-0.120	-0.104	-0.115	-0.113
	(0.131)	(0.129)	(0.130)	(0.129)	(0.132)	(0.125)	(0.131)	(0.126)
3.educmax	-0.107	-0.0919	-0.109	-0.110	-0.109	-0.0909	-0.106	-0.102
	(0.155)	(0.154)	(0.153)	(0.154)	(0.156)	(0.149)	(0.154)	(0.149)
4.educmax	-0.0763	-0.0652	-0.0795	-0.0807	-0.0779	-0.0607	-0.0746	-0.0720
	(0.134)	(0.131)	(0.133)	(0.132)	(0.134)	(0.127)	(0.133)	(0.128)
5.educmax	-0.0945	-0.0852	-0.0970	-0.0987	-0.0958	-0.0747	-0.0913	-0.0904
	(0.135)	(0.132)	(0.134)	(0.132)	(0.135)	(0.128)	(0.134)	(0.129)
6.educmax	-0.0984	-0.0928	-0.102	-0.104	-0.100	-0.0882	-0.101	-0.0940
	(0.140)	(0.137)	(0.138)	(0.136)	(0.139)	(0.133)	(0.139)	(0.133)
work_h	-0.149**	-0.145**	-0.149**	-0.148**	-0.149**	-0.149**	-0.150**	-0.144**
	(0.0654)	(0.0647)	(0.0645)	(0.0646)	(0.0647)	(0.0645)	(0.0648)	(0.0658)
partner	-0.0717	-0.0679	-0.0721	-0.0735	-0.0714	-0.0644	-0.0684	-0.0682
	(0.0497)	(0.0494)	(0.0492)	(0.0486)	(0.0493)	(0.0492)	(0.0493)	(0.0497)
risk_head	-0.0714	-0.0778	-0.0702	-0.0728	-0.0719	-0.0811	-0.0725	-0.0759
	(0.102)	(0.102)	(0.101)	(0.102)	(0.102)	(0.101)	(0.102)	(0.102)
patience_h~d	-0.000437	-0.0104	-0.00105	-0.00131	-0.00158	-0.0195	-0.00825	-0.00724
	(0.0987)	(0.0999)	(0.0992)	(0.0988)	(0.0993)	(0.0984)	(0.0994)	(0.0980)
subdhealth~n		0.0374						
		(0.0398)						
dnchronic			0.00862					
			(0.0271)					
mhi5dmin				-0.000761				
				(0.00196)				
bmidmax					0.00218			
					(0.00573)			
adldmax						-0.0387*		
						(0.0197)		
iadldmax							-0.0132	
							(0.0158)	
mobdmax								-0.00694
								(0.0118)
_cons	0.588*	0.448	0.588*	0.591**	0.586*	0.563*	0.589*	0.562*
	(0.305)	(0.335)	(0.301)	(0.298)	(0.304)	(0.295)	(0.301)	(0.294)
N	525	525	525	525	525	525	525	525
r2	0.0216	0.0235	0.0217	0.0218	0.0216	0.0280	0.0227	0.0224

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 18. Full OLS - Total Consumption with Bequest Motive

	(1) dlntcons	(2) dlntcons	(3) dlntcons	(4) dlntcons	(5) dlntcons	(6) dlntcons	(7) dlntcons	(8) dlntcons
subhdmin	-0.0106							
	(0.0420)							
age_h	-0.00497	-0.00463	-0.00495	-0.00496	-0.00491	-0.00466	-0.00493	-0.00463
	(0.00367)	(0.00363)	(0.00359)	(0.00357)	(0.00361)	(0.00358)	(0.00359)	(0.00361)
dhincome	-0.0682	-0.0761	-0.0717	-0.0730	-0.0714	-0.0801	-0.0759	-0.0684
	(0.0751)	(0.0748)	(0.0757)	(0.0768)	(0.0759)	(0.0761)	(0.0757)	(0.0754)
m_head	0.0523	0.0758	0.0524	0.0537	0.0527	0.0645	0.0547	0.0601
	(0.0907)	(0.0920)	(0.0910)	(0.0912)	(0.0913)	(0.0914)	(0.0919)	(0.0889)
dhhsize	-0.139**	-0.142**	-0.140**	-0.141**	-0.140**	-0.142**	-0.144**	-0.142**
	(0.0645)	(0.0652)	(0.0646)	(0.0640)	(0.0643)	(0.0639)	(0.0644)	(0.0641)
1.educmax	0	0	0	0	0	0	0	0
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
2.educmax	-0.117	-0.109	-0.120	-0.121	-0.118	-0.103	-0.113	-0.111
	(0.130)	(0.128)	(0.129)	(0.128)	(0.131)	(0.124)	(0.130)	(0.124)
3.educmax	-0.103	-0.0882	-0.106	-0.106	-0.106	-0.0884	-0.103	-0.0987
	(0.153)	(0.153)	(0.152)	(0.153)	(0.154)	(0.148)	(0.153)	(0.148)
4.educmax	-0.0726	-0.0611	-0.0757	-0.0769	-0.0740	-0.0580	-0.0710	-0.0683
	(0.132)	(0.129)	(0.132)	(0.130)	(0.133)	(0.126)	(0.132)	(0.127)
5.educmax	-0.0918	-0.0821	-0.0942	-0.0959	-0.0929	-0.0727	-0.0886	-0.0876
	(0.134)	(0.131)	(0.133)	(0.131)	(0.134)	(0.127)	(0.133)	(0.128)
6.educmax	-0.0936	-0.0876	-0.0969	-0.0996	-0.0952	-0.0845	-0.0965	-0.0891
	(0.138)	(0.135)	(0.136)	(0.134)	(0.138)	(0.132)	(0.137)	(0.131)
work_h	-0.149**	-0.145**	-0.149**	-0.148**	-0.149**	-0.149**	-0.150**	-0.144**
	(0.0654)	(0.0647)	(0.0645)	(0.0646)	(0.0646)	(0.0645)	(0.0648)	(0.0658)
partner	-0.0678	-0.0637	-0.0682	-0.0696	-0.0674	-0.0614	-0.0645	-0.0642
	(0.0499)	(0.0497)	(0.0494)	(0.0487)	(0.0495)	(0.0493)	(0.0494)	(0.0499)
risk_head	-0.0746	-0.0813	-0.0735	-0.0759	-0.0751	-0.0836	-0.0757	-0.0792
	(0.101)	(0.101)	(0.0999)	(0.101)	(0.101)	(0.100)	(0.100)	(0.101)
patience_h~d	0.00229	-0.00760	0.00165	0.00141	0.00110	-0.0171	-0.00549	-0.00448
	(0.0973)	(0.0984)	(0.0978)	(0.0974)	(0.0979)	(0.0968)	(0.0980)	(0.0966)
bequest_head	-0.000439	-0.000469	-0.000435	-0.000436	-0.000431	-0.000350	-0.000438	-0.000447
	(0.000806)	(0.000815)	(0.000807)	(0.000805)	(0.000811)	(0.000799)	(0.000804)	(0.000806)
subdhealth~n		0.0380						
		(0.0403)						
dnchronic			0.00825					
			(0.0273)					
mhi5dmin				-0.000747				
				(0.00196)				
bmidmax					0.00187			
					(0.00582)			
adldmax						-0.0383*		
						(0.0196)		
iadldmax							-0.0132	
							(0.0160)	
mobdmax								-0.00699
								(0.0119)
_cons	0.604*	0.463	0.604**	0.607**	0.601*	0.576*	0.605**	0.578*
	(0.308)	(0.334)	(0.304)	(0.302)	(0.307)	(0.299)	(0.305)	(0.298)
N	525	525	525	525	525	525	525	525
r2	0.0221	0.0240	0.0221	0.0223	0.0220	0.0283	0.0231	0.0229

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Appendix I – Health Changes and the Bequest Motive

Table 19. Health changes and Bequest Motive

	Bequest_Household Head	Bequest_Household Head	Bequest_Household Head
ΔADL	1.585**	1.644**	2.980**
	(0.775)	(0.774)	(1.191)
Net income		0.00339***	0.00276**
		(0.00106)	(0.00123)
ΔSubjective Health			-0.0870
			(2.345)
Subjective Change in Health_min			0.0491
			(1.955)
ΔNumber of Chronic Conditions			-0.489
			(1.551)
ΔMHI5			0.0263
			(0.0929)
ΔBMI			-0.658*
			(0.385)
ΔIADL			-0.568
			(1.085)
ΔMobility			-0.616
			(0.670)
Intermediate Secondary Educ (vmbo)			-1.306
			(4.944)
Higher Secondary Educ (havo/vwo)			1.214
			(6.322)
Intermediate Vocational Educ (mbo)			2.381
			(4.908)
Higher Vocational Educ (hbo)			-2.276
			(5.051)
University (wo)			1.165
			(6.487)
TimePreference_Household Head			7.483
			(4.898)
RiskAversion_Household Head			-8.036
			(5.135)
Partner			7.639***
			(2.515)
Constant	45.89***	38.68***	35.90***
	(1.195)	(2.435)	(7.713)
N	525	525	525
r2	0.00448	0.0219	0.0587

Source: LISS Panel 2015-2017. Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Appendix J – Full IV Results

Table 20. Full IV - Food Consumption

	(1) dlnfood	(2) dlnfood	(3) dlnfood	(4) dlnfood	(5) dlnfood	(6) dlnfood	(7) dlnfood	(8) dlnfood
subhdmin	0.0842							
	(0.166)							
age_h	-0.000568	-0.00149	0.00171	-0.00246	-0.00268	0.000459	0.000709	-0.000892
	(0.00485)	(0.00435)	(0.00558)	(0.00453)	(0.00465)	(0.00481)	(0.00538)	(0.00511)
dhincome	0.00337	0.0543	0.0730	0.0326	0.0671	-0.0139	0.177	0.0520
	(0.150)	(0.150)	(0.155)	(0.155)	(0.141)	(0.159)	(0.202)	(0.144)
m_head	-0.0347	-0.0825	-0.0228	-0.0415	-0.0569	0.0248	-0.0795	-0.0418
	(0.127)	(0.189)	(0.141)	(0.127)	(0.128)	(0.156)	(0.158)	(0.143)
dhhsize	-0.157**	-0.147**	-0.171**	-0.156**	-0.139**	-0.157**	-0.0464	-0.151**
	(0.0714)	(0.0696)	(0.0756)	(0.0689)	(0.0692)	(0.0692)	(0.152)	(0.0714)
1.educmax	0	0	0	0	0	0	0	0
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
2.educmax	-0.0455	-0.0810	0.0492	-0.119	-0.148	0.0344	-0.105	-0.0629
	(0.193)	(0.198)	(0.240)	(0.202)	(0.198)	(0.210)	(0.259)	(0.199)
3.educmax	-0.0356	-0.0716	0.0425	-0.0821	-0.147	0.0666	-0.0260	-0.0489
	(0.208)	(0.223)	(0.238)	(0.217)	(0.223)	(0.232)	(0.246)	(0.208)
4.educmax	-0.0470	-0.0865	0.0368	-0.112	-0.144	0.0382	-0.0873	-0.0663
	(0.196)	(0.208)	(0.246)	(0.205)	(0.200)	(0.216)	(0.246)	(0.198)
5.educmax	-0.0634	-0.102	0.0102	-0.130	-0.155	0.0557	-0.113	-0.0812
	(0.195)	(0.198)	(0.222)	(0.202)	(0.196)	(0.228)	(0.255)	(0.196)
6.educmax	-0.0826	-0.116	-0.0317	-0.157	-0.183	-0.0325	-0.0201	-0.0996
	(0.206)	(0.211)	(0.226)	(0.214)	(0.202)	(0.213)	(0.247)	(0.208)
work_h	-0.110	-0.117	-0.0762	-0.119	-0.133	-0.120	-0.0595	-0.106
	(0.0910)	(0.0888)	(0.0949)	(0.0908)	(0.0927)	(0.0937)	(0.123)	(0.101)
partner	-0.0659	-0.0879	-0.0298	-0.110	-0.102	-0.0416	-0.144	-0.0811
	(0.0686)	(0.0658)	(0.0841)	(0.0707)	(0.0661)	(0.0732)	(0.0964)	(0.0682)
risk_head	-0.116	-0.108	-0.147	-0.129	-0.101	-0.172	-0.0978	-0.117
	(0.128)	(0.133)	(0.139)	(0.129)	(0.127)	(0.135)	(0.150)	(0.139)
patience_h~d	0.0958	0.125	0.0788	0.111	0.113	-0.0266	0.273	0.104
	(0.112)	(0.117)	(0.114)	(0.114)	(0.112)	(0.154)	(0.222)	(0.127)
bequest_head	0.000612	0.000615	0.000250	0.000673	0.000659	0.00133	0.000343	0.000614
	(0.00106)	(0.00102)	(0.00111)	(0.00107)	(0.00107)	(0.00123)	(0.00130)	(0.00104)
subdhealth~n		-0.0506						
		(0.232)						
dnchronic			-0.247					
			(0.344)					
mhi5dmin				-0.00671				
				(0.00755)				
bmidmax					0.0353			
					(0.0446)			
adldmax						-0.291		
						(0.236)		
iadldmax							0.321	
							(0.390)	
mobdmax								-0.00868
								(0.0744)
_cons	0.255	0.497	0.0662	0.446	0.492	0.148	0.0837	0.292
	(0.384)	(0.812)	(0.465)	(0.382)	(0.386)	(0.392)	(0.466)	(0.405)
N	525	525	524	525	525	525	525	525

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 21. Full IV - Total Consumption

	(1) dlntcons	(2) dlntcons	(3) dlntcons	(4) dlntcons	(5) dlntcons	(6) dlntcons	(7) dlntcons	(8) dlntcons
subhdmin	-0.00827							
	(0.111)							
age_h	-0.00508	-0.00566*	-0.00382	-0.00582	-0.00576	-0.00378	-0.00444	-0.00576
	(0.00377)	(0.00332)	(0.00414)	(0.00369)	(0.00364)	(0.00364)	(0.00367)	(0.00419)
dhincome	-0.0688	-0.0545	-0.0603	-0.0904	-0.0720	-0.0557	-0.0508	-0.157
	(0.0811)	(0.0822)	(0.0799)	(0.0869)	(0.0777)	(0.0815)	(0.0928)	(0.110)
m_head	0.0592	-0.0185	0.0569	0.0659	0.0485	0.0166	0.0535	0.00914
	(0.0889)	(0.145)	(0.0912)	(0.0904)	(0.0911)	(0.0885)	(0.0945)	(0.114)
dhhsize	-0.134**	-0.134**	-0.153**	-0.148**	-0.140**	-0.156**	-0.128	-0.188***
	(0.0617)	(0.0595)	(0.0651)	(0.0621)	(0.0639)	(0.0632)	(0.0790)	(0.0651)
1.educmax	0	0	0	0	0	0	0	0
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
2.educmax	-0.101	-0.137	-0.0563	-0.176	-0.156	-0.0758	-0.114	0.0845
	(0.122)	(0.134)	(0.163)	(0.137)	(0.124)	(0.119)	(0.144)	(0.188)
3.educmax	-0.0971	-0.147	-0.0460	-0.150	-0.170	-0.0328	-0.0976	0.165
	(0.147)	(0.160)	(0.166)	(0.159)	(0.149)	(0.142)	(0.152)	(0.205)
4.educmax	-0.0558	-0.106	-0.0141	-0.129	-0.112	-0.0470	-0.0707	0.142
	(0.124)	(0.143)	(0.165)	(0.135)	(0.126)	(0.122)	(0.138)	(0.188)
5.educmax	-0.0758	-0.118	-0.0389	-0.131	-0.119	-0.0531	-0.0905	0.0943
	(0.126)	(0.135)	(0.147)	(0.135)	(0.127)	(0.125)	(0.148)	(0.186)
6.educmax	-0.0748	-0.114	-0.0564	-0.157	-0.115	-0.0648	-0.0797	0.126
	(0.130)	(0.144)	(0.150)	(0.141)	(0.127)	(0.127)	(0.131)	(0.193)
work_h	-0.153**	-0.156**	-0.137**	-0.144**	-0.161**	-0.132**	-0.134**	-0.143*
	(0.0652)	(0.0627)	(0.0675)	(0.0640)	(0.0676)	(0.0627)	(0.0678)	(0.0823)
partner	-0.0658	-0.0753	-0.0359	-0.0976*	-0.0828	-0.0576	-0.0700	-0.0689
	(0.0512)	(0.0483)	(0.0581)	(0.0549)	(0.0521)	(0.0508)	(0.0555)	(0.0544)
risk_head	-0.0721	-0.0518	-0.0772	-0.0679	-0.0685	-0.0490	-0.0702	-0.0535
	(0.0997)	(0.0956)	(0.105)	(0.0997)	(0.100)	(0.105)	(0.0999)	(0.120)
patience_h~d	-0.00874	0.0276	-0.0132	-0.00469	-0.00172	0.0288	0.0159	0.0503
	(0.0954)	(0.102)	(0.0966)	(0.0950)	(0.0952)	(0.107)	(0.126)	(0.112)
bequest_head	-0.000465	-0.000347	-0.000575	-0.000452	-0.000291	-0.000504	-0.000510	-0.00141
	(0.000795)	(0.000818)	(0.000818)	(0.000806)	(0.000828)	(0.000846)	(0.000809)	(0.000919)
subdhealth~n		-0.123						
		(0.172)						
dnchronic			-0.0960					
			(0.235)					
mhi5dmin				-0.00832				
				(0.00633)				
bmidmax					0.0424			
					(0.0342)			
adldmax						0.00578		
						(0.142)		
iadldmax							0.0401	
							(0.151)	
mobdmax								0.00811
								(0.0682)
_cons	0.598**	1.025*	0.486	0.707**	0.687**	0.468	0.546*	0.458
	(0.305)	(0.577)	(0.344)	(0.319)	(0.300)	(0.295)	(0.307)	(0.372)
N	525	525	524	524	524	524	524	559

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Appendix K – Sample Difference Statistics

Table 22. Working and Original Sample Differences

Sample Characteristics	Δln(FoodExpenditure)	Δln(Total Consumption)	ΔSubjective Health	Sub. Change in Health_min	ΔNumber of Chronic Conditions	ΔMHI5	ΔBMI	ΔADL	ΔIADL
finalsample	0.118	0.239***	-0.00754	-0.0555	0.154***	-1.317	-0.230	0.108	0.154
	(0.0723)	(0.0699)	(0.0456)	(0.0507)	(0.0589)	(0.980)	(0.341)	(0.0688)	(0.0981)
_cons	-0.0499	-0.191***	-0.0763**	2.798***	0.0894*	-0.763	0.545*	0.102**	0.119
	(0.0658)	(0.0659)	(0.0381)	(0.0417)	(0.0488)	(0.817)	(0.327)	(0.0479)	(0.0776)
N	643	687	761	763	760	761	761	761	761
Sample Characteristics	**ΔMobility**	**Age_Household Head**	**Δln(HouseholdIncome)**	**Sub. Mortality Expectation of Household Head**	**ΔHousehold Size**	**Educational Attainment**	**RiskAversion_Household Head**	**TimePreference_Household Head**	**Bequest_Household Head**
finalsample	0.289	-0.308	-0.00514	0.0179	0.00280	0.537***	-0.00444	-0.0176	-5.130**
	(0.229)	(0.861)	(0.0307)	(0.0206)	(0.0280)	(0.122)	(0.0187)	(0.0188)	(2.612)
_cons	0.326	64.77***	0.0728**	0.369***	-0.0466*	3.354***	0.379***	0.384***	51.36***
	(0.206)	(0.709)	(0.0294)	(0.0175)	(0.0242)	(0.106)	(0.0157)	(0.0155)	(2.336)
N	761	763	720	763	761	762	762	762	654

Source: LISS Panel 2015-2017. Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.