What is an Adequate Standard of Living during Retirement?

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Abstract

Many economists and policy-makers argue that households do not save enough to maintain an adequate standard of living during retirement. However, there is no consensus on the answer to the underlying question about what this standard should be, despite the fact that it is crucial for the design of saving incentives and pension systems. We address this question with a randomized survey design, individually tailored to each respondent's financial situation, and conducted both in the U.S. and the Netherlands. Key findings include the following. Adequate levels of retirement spending exceed 80 percent of working life spending for a majority of respondents. Minimum acceptable replacement rates depend strongly on income. Households in the Netherlands are much more risk averse than U.S. households.

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1 Introduction

What level of spending during retirement do people consider desirable, given their lifetime budget constraints? How does this level compare to spending during working life? Is there a minimum level of retirement spending which people want to maintain at all costs? How much risk are individuals ready to bear in exchange for a higher expected standard of living during retirement? The answers to these questions allow us to take an informed stand on an important issue that many economists and policy makers are concerned with: that people may not prepare adequately for retirement (Banks et al., 1998; Bernheim et al., 2000; Fornero et al., 2009; Lusardi and Mitchell, 2007; Munnell et al., 2006; Skinner, 2007; Thaler, 1994). The answers to the above questions are furthermore important for several countries that are currently considering reforming their pension systems, since any pension reform plan requires information about adequate old-age consumption levels.

There are several existing approaches for determining adequate levels of old-age consumption. First, in a study that reports that a non-negligible fraction of the British population might be at risk of an inadequately low standard of living during retirement, Banks et al. (2005a) argue that a minimal requirement for an adequate old-age spending may be that it exceeds the poverty line. Second, an adequate spending level during retirement may be seen as one that does not fall short of a certain benchmark fraction of (annual) consumption during active life, such as 67 or 80 or 100 percent (Banks et al., 2005a; Moore and Mitchell, 1997; Palmer, 1994). The great advantage of these two approaches is that they are straightforward to operationalize. Furthermore, the meaning of both adequacy measures is very intuitive. The disadvantage is that they are not based on individual preferences.

This disadvantage is addressed by a further approach which we may dub the preference-based calibration approach. This approach postulates a particular utility function, typically a time-separable form of constant relative risk aversion (CRRA) utility. Making specific assumptions about the parameters of this function as well as about other rele-

vant variables such as interest rates and equity returns allows the analyst to calibrate optimal consumption choices during old age and during working life. According to the calibration approach, actually observed choices are considered adequate if they come sufficiently close to these calibrated choices. This approach is pursued in, for instance, the study of Scholz et al. (2006) which finds that many people appear to either save optimally for retirement or, in many cases, to over-save. The calibration approach is very compelling since it explicitly takes into account information about individual preferences when computing an adequate level of old-age consumption. However, this approach requires strong assumptions about the functional forms and parameter values of preferences, although solid information about appropriate functional forms and parameter values that best correspond to individuals' preferences is not available in many cases.[1,2]

In sum, there is no consensus about what constitutes an adequate level of retirement consumption. Rather, the identification of the most appropriate approach for determining a benchmark level for adequate retirement consumption remains an open issue (Banks et al., 2002).

In this paper, we aim to advance the existing literature by investigating the adequacy of old-age consumption based on a different approach, inspired by work on risk and time

[1]For instance, as pointed out by Poterba et al. (2003), "within the framework of parametric CRRA utility functions, there is little consensus on the 'correct' value of the relative risk aversion coefficient" (p. 26).

[2]Note that it may seem that this problem of the calibration approach could be avoided by a *revealed preference approach*. This would entail an econometric analysis of individuals' observed retirement preparation choices which, in turn, would allow for inference of their preferences. However, an inherent problem with this procedure is that people's actual retirement preparation choices may not be in their best self-interest. This may be due to the fact that individuals simply adopt defaults (Beshears et al., 2006; Madrian and Shea, 2001), lack important information about the availability and characteristics of retirement accounts (Duflo and Saez, 2002, 2003; Duflo et al., 2006), lack the willpower to save sufficiently (Thaler, 1994), or lack financial literacy (Lusardi and Mitchell, 2007; van Rooij et al., 2007a). In fact, as is demonstrated by Skinner (2007), the determination of an appropriate savings plan that implements a given life cycle consumption profile is highly complex, and inferring individuals' true preferences from their observed retirement preparation choices might be inappropriate. Furthermore, inferring people's true preferences from their actual choices would be difficult, even in the absence of this concern, since the actual choices may be constrained by the presence of a mandatory pension system. This is a particular concern for many European countries whose pension systems offer relatively high replacement rates (see OECD, 2007).

preference elicitation through surveys (Barsky et al., 1997; Kapteyn and Teppa, 2003). We elicit measures of intertemporal and risk preferences based on survey questions that are explicitly framed in terms of retirement preparation. This allows us to infer adequate ratios of old-age to working-life consumption, minimum absolute adequate consumption levels during retirement, as well as adequate levels of risk taking.

Two features of our novel survey design stand out. First, we tailor the survey questions individually to each respondent's financial situation, based on prior information about a respondent's socioeconomic characteristics, such as total household income. This makes our questions meaningful in the context of the respondent's personal situation. Second, none of our questions requires respondents to understand any technical aspects of retirement preparation, such as the concept of compound interest or inflation.

Our specifically designed internet survey module was conducted in two countries: with the American Life Panel (ALP) at RAND in the U.S.; and with the CentERpanel (CP) in the Netherlands. The U.S. embodies a country where individuals bear a substantial amount of responsibility for their own retirement preparation, while the Netherlands is a country with a typical European-style welfare state and a pension system that offers generous replacement rates.[3] In particular, the after-tax income replacement rate for an average earner amounts to about 85 percent in the Netherlands. In contrast, it amounts to only about 50 percent in the U.S. (OECD, 2007). Our paper, therefore, also sheds light on the question of whether notions of an adequate standard of living during retirement differ across such contrasting institutional setups and, if so, to what degree.

A main advantage of the survey approach is that it allows for learning directly about individual preferences since it does not impose specific functional forms or parameter values. Furthermore, the survey approach allows for testing whether the prescriptions of the calibration approach or any other approach are consistent with the preferences that

[3]See Gruber and Wise (1999, 2004) for a comprehensive overview of pension systems around the world. A replacement rate is defined as the ratio of income obtained from a mandatory pension system during retirement to the salary earned at the end of working life.

individuals express themselves. As for any other approach, the survey approach has its own disadvantages. Most notably, we need to assume that respondents understand our questions and are motivated to answer them properly.

Overall, our study presents a novel way to elicit policy-relevant preference information that is based on individually tailored surveys. Our claim is not that the survey approach dominates any other method of investigating the nature of adequate retirement consumption levels. Rather, we view our study as providing a new and complementary perspective on the ongoing discussion about adequate standards of living during retirement.

Our main findings are as follows. First, neglecting any risk associated with retirement spending, we find that ex-ante desirable ratios of old-age to working-life spending are surprisingly high; they exceed 80 percent for a majority of respondents in both the U.S. and the Netherlands. Second, we investigate the lower limits on old age spending below which individuals would not want to fall in any case, and we estimate minimum income replacement rates for each income quintile. For the U.S., these minimum replacement rates amount to about 95 percent for respondents in the lowest income quintile and gradually decrease to about 45 percent for respondents in the top income quintile. In the Netherlands, this gradient is weaker and minimum replacement rates range between 75 and 60 percent. Third, our results show that risk aversion, elicited within a retirement preparation context, is higher in the Netherlands than in the U.S., and there is a high degree of individual heterogeneity with respect to risk aversion.[4]

Our results about desirable ratios of old-age to working-age income, about lower bounds of old-age spending and about risk aversion are useful for inferring adequate wealth accumulation and portfolio strategies. The necessity of information about desir-

[4]There is one other existing study that has made use of survey techniques and the Dutch CP in the domain of retirement preparation: Van Rooij et al. (2007b) investigate whether respondents prefer a mandatory pension system over a privatized one with a free choice of contribution rates and asset allocation strategies. Furthermore, the authors explore whether respondents show a preference for a defined benefit system with income guarantees over a defined contribution system. The main difference to our study is that we examine various aspects of individual preferences over standards of living rather than preferences over features of pension design.

able old-age consumption levels has become increasingly important in many countries due to the shrinking number of people that are covered by defined-benefit pension schemes (Banks et al. 2005b), and it is forcefully underlined in a number of very recent studies (see, e.g., Fornero et al., 2009).

The rest of the paper is organized as follows. Section 2 provides information about our samples. Section 3 presents our results on ex-ante adequate old age spending in the absence of risk. Section 4 brings risk into play. Section 5 concludes.

2 The Data

The Dutch CentERpanel. The Dutch CentERpanel (CP) is hosted by the data collection agency CentERdata at Tilburg University, and the data used for the presented analysis is publicly available from CentERdata. The CP consists of a sample of members who regularly fill out internet-based questionnaires, typically on weekends. There are two types of questionnaires. First, panel members are regularly asked about socioeconomic characteristics of their household within the framework of the so-called DNB Household Survey. We use this information to tailor our questions to the respondent's personal financial situation. Second, panel members are invited to answer special-topic questionnaire modules such as ours from time to time.

An outstanding feature of the CP is that it is representative for the overall Dutch population. Since internet penetration may be systematically lower in some subgroups of the population, CentERdata provides households that do not own a computer or internet connection with an add-on device that allows them to access internet via television. It also provides a television if necessary.

Our questionnaire was conducted in March 2007. We presented the survey to panel members who were older than 25 and who were either the household's main breadwinner or his or her spouse. We did not exclude retired panel members. Based on these selection

criteria, 835 panel members answered our questionnaire. The actual number of responses per question varies between 590 and 835.

The American Life Panel. The American Life Panel (ALP) at the RAND institution was modeled after the CP, and grants public access to the data used in this paper. As in the case of the CP, ALP members regularly answer questions on general socioeconomic characteristics. There are two main differences between the ALP and the CP. First, the ALP is not fully representative of the overall U.S. population. Second, to provide respondents with a psychological incentive to answer the questions carefully, ALP members are paid an amount of $2 per interview minute. In contrast, CP-members are paid per completed survey module and the amount depends on the number of years a household has been a member of the panel and is lower than the amount paid to ALP members.

In the case of the ALP, our questionnaire was fielded in November 2007. Using the same selection criteria as in the case of the CP, 847 panel members answered our questionnaire. The actual number of responses per question varies between about 600 and 847.

Table 1 shows descriptive statistics for our two samples. The income variable refers to total household income per month after taxes. The respondents' highest degree of professional education is indicated by the two dummy variables "no vocational training" and "university degree". The excluded category is the middle one, i.e. if both dummy variables are zero, the corresponding respondent's highest professional degree is a vocational degree. The variable "children at home" indicates whether any children are living at the respondent's home. The figures in Table 1 show that ALP respondents are slightly richer and better educated than the average American. In contrast, the CP is – by construction – representative for the Dutch population along many socioeconomic characteristics.

3 Adequate Old Age Spending in the Absence of Risk

We address the question of what represents an adequate standard of living during retirement from an ex-ante anticipatory perspective. This perspective corresponds to a preference-based approach which basically underlies all of standard economic theory. From the ex-ante perspective, the question of what represents an adequate standard of living during retirement intrinsically relates to two key trade-offs. The first trade-off is between spending during working life and spending during old age. The second trade-off is between a safe but lower level of old age spending, and a more risky level of spending with a higher expected value. The importance of these trade-offs notwithstanding, there may also be a minimum level of retirement spending below which individuals would not want to fall even in exchange for very high levels of working life or *expected* old age spending. This is the case for habit formation or Stone-Geary type preferences over intertemporal consumption flows (see Binswanger, 2007).

This discussion highlights the three main topics of our questionnaire, namely the intertemporal trade-off, the risk-return trade-off, and the potential existence of a lower bound on acceptable old age spending levels. We start our discussion with the intertemporal trade-off, since this is the most basic aspect of retirement preparation from an economist's point of view.

In the interest of keeping our questionnaire as transparent and simple as possible, our survey questions on the intertemporal trade-off neglect any form of risk. Furthermore, we do not consider any variation of spending within working life or within retirement. This would lead to rather difficult questions and, as a consequence, would reduce the reliability of respondents' answers. Hence, we concentrate on how *average* spending levels during retirement compare to *average* spending levels during working life.

Specifically, we present each respondent i a total number of six options of *monthly* working-life and retirement spending levels $\left(c^k_{w,i}, c^k_{r,i}\right)$, $k = 1, 2, \ldots, 6$. The consumption levels $c^k_{w,i}$ and $c^k_{r,i}$ represent absolute amounts. Respondents are asked to indicate which

option they like most. The defining property of each option is the ratio $c^k_{r,i}/c^k_{w,i}$, which we set at 50, 64, 76, 88, 100, and 140 percent (up to rounding) for $k = 1, 2, \ldots, 6$, respectively. This includes the range of spending ratios that are commonly viewed as potentially adequate. All six options are characterized by an identical present value of lifetime consumption (see below).

It is important to stress that we show respondents *absolute amounts* of money, not percentages. We do so since respondents may find imagining exactly what these percentage numbers would mean for their personal situation difficult. We do not inform respondents that the ratios $c^k_{r,i}/c^k_{w,i}$ correspond to the particular percentage numbers mentioned above.

On a first screen, respondents only see four options corresponding to spending ratios of 64, 76, 88, and 100 percent, respectively (see Table 2 for an example). This is meant to avoid respondents having to process an excessive amount of information on one screen. Only if a respondent chooses a ratio of 64 or 100 percent do we ask on a follow-up screen if he or she would actually prefer the chosen option to that associated with a ratio of 50 or 140 percent, respectively.

The calculation of the individual spending profiles ($c^k_{w,i}$, $c^k_{r,i}$) is outlined in the Appendix. These profiles are determined according to the following requirements:

(i) All options are tailored to respondents' income. In particular, the option with the highest working-life spending level $c^k_{w,i}$ on the first screen approximately equals total household income after taxes.

(ii) The present value of all six presented spending profiles $\left(c^k_{w,i}, c^k_{r,i}\right)$ is identical (see Appendix).

These requirements ensure that all presented options appear realistic to the respondents in light of their personal financial situation. In particular, we rule out that any of the values of $c^k_{w,i}$ on the first screen exceeds the respondent's current household income in order to not alienate respondents to whom such options would appear infeasible. All

presented numbers are rounded to entire multiples of 50 or 20 units of the corresponding currency.[5]

The introductory text to our spending profile questions is as follows:[6]

> *Below you find four options of how you could spend your money over your lifetime. For each option the first column indicates how much your household could spend on average per month from age 25 until retirement. Thus, this refers to your total (working) age from age 25 until retirement, not just the remaining (working) age. The second column indicates how much your household could spend during retirement. Please think of all your expenditures, such as food, clothing, accommodation, insurance, traveling etc. Assume that the numbers below show what you can spend after having already paid for taxes. Assume also that prices of the things you spend your money on remain the same in the future as today (no inflation). If you had a choice, which option would you like most?*[7]

Table 2 shows an example of a table with the actual options appearing below the above introductory text. The numbers correspond to a monthly household income after taxes of 3,000 U.S. dollars. Table 2 refers to an interest rate of one percent.[8] After having indicated their favorite profile, respondents are presented with a second table, corresponding to an interest rate of six percent. In this second table, the ratios of the spending levels are identical. However, for a higher interest rate, achieving a given level of retirement

[5]We should also point out that the assumptions made for calculating the profiles $(c^k_{w,i}, c^k_{r,i})$ do not imply any assumptions about *actual savings behavior* of respondents. Our goal is only to show respondents feasible spending profiles in order to learn which of the profiles they would like most. Note further that our analysis neglects both a bequest motive and health expenditure shocks during retirement. We do so for two related reasons. First, it is of interest to know what spending profiles individuals prefer in the absence of other perturbing factors. Second, bringing bequests and unexpected health shocks into play would make our survey questions much more demanding.

[6]Here, we only report the English version of our survey questions. The Dutch version is available from the authors upon request.

[7]For single households the text is adapted accordingly. If a respondent was retired, then we added as a first sentence to the above text: *Please suppose for a moment that you were not yet retired.*

[8]See the appendix for how $c^k_{w,i}$ and $c^k_{r,i}$ depend on the interest rate.

spending requires giving up less working-life spending. As a result, the distances between the numbers in the first column are smaller and the distances in the second column are larger, compared to Table 2.

It is important to stress that a respondent choosing her most-preferred profile $\left(c_{w,i}^k, c_{r,i}^k\right)$ from Table 2 need not have an understanding of compound interest rate calculations, inflation or any other technical detail. Our inference based on respondents' answers only depends on the assumption that individuals have well-defined preferences over spending profiles such as shown in Table 2. The assumption that individuals have well-defined preferences is much weaker than the assumption that individuals are able to make utility maximizing choices. People may well know what spending profile they would like to achieve, but they may not be able to *implement* it, due to, e.g., financial illiteracy.

As mentioned in the introduction, the seminal papers on the elicitation of time preferences through survey questions are Barsky et al. (1997) and Kapteyn and Teppa (2003). In principle, the setup in these two papers is similar to ours[9], but there are two key differences. First, the questions in Barsky et al. (1997) and in Kapteyn and Teppa (2003) are neither worded nor framed in the context of retirement preparation. Second, our questions are substantially less difficult since they are individually tailored to a respondent's personal financial situation and since the information we provide is easy to process. This makes the questions more meaningful to respondents and reduces cognitive load.

Our results about desired consumption profiles are shown in Table 3. The upper panel shows the result for the subsample of non-retirees whereas the lower panel shows the result for the subsample of retired respondents. We find that the distribution of chosen

[9]Barsky et al. (1997) ask respondents to imagine that their current age is 50 and that there is a guaranteed income stream of \$3000 per month from age 50 to 80. They then present individuals with different profiles of monthly consumption. Each profile consists of a pair of numbers where the elements of the pair are (*i*) monthly spending from age 50 to 65, and (*ii*) monthly spending from age 65 to 80. All pairs have a present value which is equal to the present value of earning \$3000 per month. Kapteyn and Teppa (2003) show respondents a table with various consumption profiles that differ in terms of the rate at which consumption increases over time. On a typical screen, respondents see five consumption profiles, each consisting of consumption levels at nine consecutive ages. This format involves about 45 numbers per screen, thus the cognitive load is substantially higher than in the case of our questions.

spending ratios does not differ between the two subsamples for both the ALP and the CP.[10]

The key observations are the following. First, irrespective of the sample and the level of the interest rate, only very few respondents prefer a spending profile corresponding to a ratio of 50 or 64 percent. Second, there is substantial mass concentrated on the options corresponding to spending ratios of 76, 88, and 100 percent. Third, the 140 percent option is very popular in the U.S., but not in the Netherlands, at an interest rate of one percent. Finally, consistent with economic theory, the 140 percent option is much more popular for an interest rate of six percent than for an interest rate of one percent in both countries.

It is noteworthy that economic theory predicts that, for a given individual, the spending ratio should not be lower for the 6 percent scenario than for the 1 percent scenario. We find that, in both samples, only 12 percent of the respondents violate this prediction. This compares favorably to Barsky et al. (1997) where 21 percent changed the slope of the desired consumption path in the wrong direction.[11]

The differences in the distributions of preferred spending ratios between the U.S. and the Dutch sample are statistically significant.[12] This mainly reflects the fact that the 140 percent option is much more popular in the U.S. The pattern that a substantial fraction of Americans desire an upward sloping consumption profile is consistent with the finding in Hurd and Rohwedder (2008) that a similar fraction of individuals in their U.S.-based sample exhibit de-facto increasing spending profiles around retirement. This may be explained by the fact that Americans may find postponing consumption (e.g. in the form of traveling) until retirement as a complement to leisure more desirable. This is in line with the fact that the number of vacation days is typically much lower in the U.S. than in the Netherlands.[13] As a result, people working in the U.S. may find delaying spending

[10]This is based on Kolmogorov-Smirnov tests for the equality of distributions (all p-values are larger than 0.30).

[11]The correlation coefficient between the chosen ratios for the two interest rate scenarios is 0.66 ($p < 0.01$) for the ALP and 0.61 ($p < 0.01$) for the CP.

[12]Based on a Kolmogorov-Smirnov test, equality is rejected at the 1-percent significance level.

[13]In 2005, the number of annual hours worked per worker amounted to about 1,900 in the U.S. and

power until retirement – when they have the time to enjoy leisure and traveling – more valuable relative to their Dutch colleagues.

In order to explore the reliability of the elicited data, we randomized the order of the response options. Respondents were randomly assigned to one of two treatments. Half of the respondents saw the numbers arranged in the order as in Table 2, where the order of the spending ratios is decreasing. The other half saw the numbers arranged with an increasing order of spending ratios. We do not find any evidence that our results differ across randomization treatments.

The main conclusion drawn from the results discussed in this section is that a substantial fraction of the population prefers spending ratios that exceed 80 percent of working life spending. This applies to both the Netherlands and the U.S. In the case that old age spending is exposed to risk, our finding would apply to certainty equivalence values of old age spending.

4 Bringing Risk into Play

We consider risk from two different perspectives. First, we conceptualize risk from the perspective of a lower limit on old age spending below which an individual would not want to fall in almost any case. This represents a particularly simple framework for thinking about risk since it does not require evaluating any risk-return trade-off. Such a framework corresponds to the logic of poverty thresholds as well as to preferences with habit formation or Stone-Geary utility functions.[14] Information on such a minimum acceptable level of old age spending is very useful for thinking about adequate retirement preparation. It specifies a benchmark spending level that an individual may want to exceed, from an ex-ante point of view, with a very high probability. Thus, such a benchmark helps to identify adequate asset allocation strategies for individual retirement accounts. It also

about 1,400 in the Netherlands (OECD, 2008).

[14] See Binswanger (2007).

implies an overall lower bound on adequate savings for retirement.

Second, we are interested in how respondents evaluate potential risk-return trade-offs. We therefore also include a standard set of questions in our survey for identifying coefficients of relative risk aversion. While several existing studies have used survey methods to elicit this parameter (Barsky et al., 1997; Dohmen et al., 2005; Holt and Laury, 2002), the novel aspect here is that we elicit this parameter strictly in the context of retirement preparation and that the options respondents choose between are again tailored to their personal financial situation.

We start with the analysis of lower bounds on old age spending.

4.1 Lower Limits on Adequate Old Age Spending

We present respondents the following question.

> *This question refers to the overall level of spending that applies to you and your partner during retirement. What is a minimal level of monthly spending that you never want to fall below during retirement, at all costs? Please think of all your expenditures, such as food, clothing, accommodation, insurance etc. Assume that prices of the things you spend your money on remain the same in the future as today (no inflation).*

The question is framed in a way that we should expect answers to differ across different countries if they are characterized by different institutions. For instance, the answers to this question may differ between countries with different health insurance schemes.[15]

[15]In contrast to the U.S., health insurance is compulsory for everyone in the Netherlands. It is supplied by private insurance companies and premiums are paid by each insured individual herself. Health insurance pays for most doctor visits and pharmaceuticals as well as for hospital stays up to one year. Furthermore, every resident is covered by a public long-term care insurance scheme (dubbed AWBZ) that covers nursing homes and long-term hospital stays. The U.S. Medicare system requires a 20 percent copayment for hospital stays, a feature that has no counterpart in the Netherlands. Covering this copayment requires an extra (non-mandatory) so-called Medigap insurance. (The requirement of a copayment drops if Medicaid covers care costs.)

For the ALP, the 25th, 50th and 75th percentile of the answers amount to 2,000, 3,000, and 4,000 year-2007 U.S. dollars per month, respectively. The 25th, 50th and 75th percentiles of the ratio of the answers to total monthly household income after taxes amount to .48, .73, and .95, respectively. For the CP, the respective absolute numbers are 1,200, 1,600, and 2,000 year-2007 euros per month. The respective ratios of the answers to total household income after taxes are .56, .72, and .88.

Table 4 shows median regressions with the answers to the above question as the dependent variable.[16] Our estimation results show that income primarily determines the minimally acceptable spending level.[17] In particular, minimum spending levels do not depend in a statistically significant way on age, regardless of the order of the age polynomial. This means that the current age does not systematically affect the way respondents anticipate their minimum retirement needs. This is exactly what we should expect if respondents anticipate these needs in a rational manner.

Interestingly, retired respondents are more conservative with respect to their minimum needs in the Netherlands. Everything else equal, a retired respondent in the Dutch sample indicates a minimum spending level that is higher by 230 Euros, compared to a non-retired respondent. There is no such effect for the U.S. It is noteworthy that the regression results in Table 4 are robust across many different specifications that we have estimated.

The regression results in Table 4 allow for calibrating minimum acceptable spending levels for any combination of household characteristics we may be interested in. Since our results show income to be clearly the most important determinant for minimum spending levels, we calibrate such spending levels for each income quintile. We do so for a non-single household aged 50 that is not retired.[18] Furthermore, we set the values of the dummy

[16]Given the skewness of the data, we use median regressions, since a median regression is a more robust estimation method than OLS.

[17]For the ALP, the dummy variables indicating income quintiles do not refer to the quintiles according to our sample but according to the Current Population Survey. Since the ALP is not representative for the U.S. population, this makes it easier to interpret the results. For the CP, the quintiles refer to our sample.

[18]Similar results are obtained for ages of 40 or 60.

variables for children, home ownership, no vocational training, and for having a university degree to zero.

The calibration results are shown in Table 5. The upper panel refers to the ALP and the measurement units are year-2007 U.S. dollars. The lower panel refers to the CP and the units are year-2007 euros. The first column in each of the two panels shows the calibrated *monthly* minimum spending levels. The second column simply reports the monthly median after-tax incomes in our samples for each income quintile. The striking pattern in Table 5 is that the increments in minimum spending levels are smaller than the increments in income. This pattern is particularly pronounced for the U.S., which is reflected in the strongly decreasing ratios of spending levels to incomes, as shown in the third column of Table 5.

For the U.S., the ratio of the minimally desired spending level to income for the first quintile is as high as 95 percent. For all other quintiles in case of the U.S., and for all quintiles in the Netherlands, the calibrated ratios are markedly smaller than one. This suggests that people anticipate that they would be able to cut back if necessary. This result is consistent with the recent finding of Aguiar and Hurst (2007) that the elderly spend less money for a given amount of "consumption intake".

What do we further learn from Table 5? Our calibrations are useful in two further respects. First, they prove helpful in designing adequate asset allocation strategies, since any asset allocation strategy maps into a distribution of available resources during retirement. Our calibrations help identify adequate portfolio strategies in that, say, the 10th percentile of the resulting distribution of monthly spending should exceed the values in the first column of Table 5. Second, the numbers in Table 5 may be useful for thinking about adequate benefit levels in a mandatory pension system.

4.2 Relative Risk Aversion

Our final question elicits the coefficient of relative risk aversion. Experimental and survey research in economics and social psychology (e.g., Weber et al., 2002) suggests that risk preferences differ across domains or that individuals may anticipate to be more risk averse during old age. Therefore, it is not a priori clear how appropriate it may be to apply results from existing preference elicitation studies to the domain of old age provision. We thus believe that it is of interest to elicit the parameter of relative risk aversion by using a question format framed strictly in terms of retirement preparation.

In order to elicit the parameter of relative risk aversion, we employ the widely-used multiple price list design of Holt and Laury (2002). Specifically, respondents are presented with the following question.

> *In the following table we present five choices to you. You can always choose between two different types of income during retirement, income of type A and of type B. Please assume that these incomes include all sources of money available to you during retirement. In particular, there is no additional money available from spending down your wealth. If you choose income type A, the total income during retirement for you and your partner will always be [Z_i^s] per month, independent of the performance of the economy. If you choose type B, the total income during retirement for you and your partner depends on the performance of the economy (e.g. on returns in financial markets). If the economic performance is unfavorable it will always be [Z_i^{rl}] per month. If the performance is favorable it will always be [Z_i^{rh}] per month. The five choices differ only in terms of the chance that the favorable or unfavorable economic performance will materialize. Which income type would you choose?*
>
> *A: [Z_i^s] Euros, or*
> *B: [$1-\pi$] percent chance of [Z_i^{rl}], and [π] percent chance of [Z_i^{rh}].*

(...)

The probability π is set to 50, 60, 70, 80, and 90 percent for the five choice situations, respectively. We set Z_i^s to 85 percent of a respondent's current monthly income, Z_i^{rl} to 70 and Z_i^{rh} to 100 percent of her current monthly income. However, it is important to stress that, as in the case of risk-free spending ratios in Section 3, respondents see absolute money values and are not made aware that these values correspond to particular replacement rates. All values are again rounded to entire multiples of 50 or 20 units of the corresponding currency, depending on their magnitude.

Under CRRA preferences, expected utility of a random prospect $\tilde{x}$ is defined as

$$U(\tilde{x}) = E\left[\frac{1}{1-\theta}\tilde{x}^{1-\theta}\right],$$

where θ denotes the parameter of relative risk aversion and E the mathematical expectation operator. We identify the value of θ for each respondent by using information on her switching point. Specifically, respondents indicate whether they would prefer the safe option (A) or the risky option (B) when the probability for the high realization associated with the risky option amounts to 50, 60, 70, 80, or 90 percent, respectively. If, for instance, a respondent prefers the safe option in the case of 60 percent and the risky option in case of 70 percent, his switch point is given by the 70-percent prospect. We then know that $1/(1-\theta)\left(Z_i^s\right)^{1-\theta} \geq 0.4/(1-\theta)\left(Z_i^{rl}\right)^{1-\theta} + 0.6/(1-\theta)\left(Z_i^{rh}\right)^{1-\theta}$ but $1/(1-\theta)\left(Z_i^s\right)^{1-\theta} \leq 0.3/(1-\theta)\left(Z_i^{rl}\right)^{1-\theta} + 0.7/(1-\theta)\left(Z_i^{rh}\right)^{1-\theta}$. This allows us to identify the highest value of θ that is consistent with the respondent's switching point.[19]

Table 6 shows that, for the ALP, the 25th, 50th and 75th percentiles of the observed distribution of θ are 2, 4 and 7, respectively. For the CP they amount to 4, 7, and 12. Clearly, the Dutch respondents are far more risk averse than the U.S. respondents. How-

[19]Identical with Holt and Laury (2002), we use the (last) point where a subject switches from option A to option B. The vast majority of our respondents (95 percent for the CP, and 94 percent for the ALP) only switches once. As in Holt and Laury (2002), we find that the analysis reported here does not change if we drop respondents who switch from B back to A.

ever, there is also considerable heterogeneity within each country. This is an important result for calibration studies aiming to identify optimal retirement saving and asset allocation strategies as well as an optimal design of a mandatory pension system. It indicates the importance of taking individual preference heterogeneity into account.

It is of interest to compare our results to the ones reported by Barsky et al. (1997). They infer relative risk aversion from questions framed in terms of hypothetical "lotteries" over jobs. The 25th, 50th and 75th percentiles of the distribution for relative risk aversion in their sample are 4, 7, and 14, respectively.[20] Respondents in the Barsky et al. (1997) study were Americans, hence we compare their results to our findings from the American data (ALP). Since the 25th, 50th and 75th percentile amount to 2, 4 and 7, respectively, for the ALP, we measure a lower level of risk aversion. One potential reason for this is that risk aversion may be context-specific and higher in the domain of job search than for retirement preparation.

As before, we also investigate the reliability of our responses. To this end, the order of the response options was randomized. Again, we do not find any evidence that our results differ across randomization treatments.

Overall, our results indicate substantial heterogeneity in risk aversion, even within one country. This means that, in terms of risk management, adequate old age provision may entail different strategies (e.g., equity shares) for different individuals. Moreover, the general levels of risk aversion differ between countries. Thus, a mandatory pension system aiming at adequate risk management may provide different safety levels in different countries. Our elicited values of relative risk aversion may help to gauge the amount of heterogeneity in risk preferences between individuals as well as the differences between countries. They may provide a starting point for the calibration of desirable risk management strategies for individual portfolios as well as for entire (potentially mandatory) pension systems. The availability of information about desirable risk levels for old-age

[20]See their footnote 18 on p. 548. When comparing these values with ours, note that the authors report values for relative risk *tolerance* on p. 548, i.e. the inverse of relative risk aversion.

consumption has become increasingly important due to the shrinking number of people that are covered by defined-benefit pension schemes (Banks et al. 2005b).

5 Conclusion

In this paper we use a specifically designed internet survey, conducted in the U.S. and the Netherlands, to address the question of what represents an adequate standard of living during old age. We address this question from an ex-ante point of view, consistent with the perspective suggested by economic theory.

We find that a large majority of individuals aims to achieve a spending profile where, under normal circumstances, old-age spending exceeds 80 percent of working-life spending. Bringing risk into play, there is clear evidence that individuals do not want to fall below a certain lower limit of old-age spending. We use respondents' answers to calibrate minimum income replacement rates for each income quintile. For the U.S. sample, these range between 95 percent for the lowest income quintile and 45 percent for the highest. For the Netherlands, these rates fall between 75 and 60 percent. Turning to the question of how respondents evaluate risk-return trade-offs, we find considerable heterogeneity of risk aversion within and between samples.

Taken together, our elicited values of minimally desirable spending levels and of values of relative risk aversion may be used for calibrating desirable risk management strategies. For this, one may proceed along the line of Binswanger (2007) who provides a simple framework for the analysis of risk management strategies in the domain of old age provision and pension design. In particular, one may infer critical lower bounds on wealth accumulation and estimate optimal contribution and benefit levels for a pension system.

In future research, our approach using an individually tailored and randomized survey design for eliciting information on preferences could be combined with data on further dimensions of individuals' circumstances – ranging from physical to mental and psycho-

logical circumstances – in order to understand the heterogeneity of retirement preferences better (see, e.g., Banks, 2006). Furthermore, our approach can be applied in various other domains that are important for policy. For example, consider information on individual preferences with respect to the trade-off between lower contributions to the welfare state and higher levels of risk borne by private individuals. Such information is relevant for the identification of a desirable design of social policy as well as of desirable macroeconomic policies. Carefully elicited information on people's preferences will stimulate the interaction between theoretical and empirical researchers, will make the policy discourse richer, and may ultimately lead to better policies.

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Table 1: Descriptive Statistics

	ALP			*CP*		
	Mean	*Median*	*Standard deviation*	*Mean*	*Median*	*Standard deviation*
Age	51.04	52	14.29	50.40	51	16.10
Income	5,000	4,521	6,001	2,419	2,250	1,612
Single	0.21	0	0.41	0.21	0	0.40
Children at home	0.25	0	0.44	0.36	0	0.48
Home ownership	0.80	1	0.40	0.71	1	0.45
Retired	0.27	0	0.44	0.22	0	0.41
No vocational training	0.17	0	0.38	0.31	0	0.46
University degree	0.47	0	0.50	0.11	0	0.31

Note: Total number of respondents is 847 for the ALP and 835 for the CP. Income refers to monthly income and is measured in year-2007 U.S. dollars for the ALP and in year-2007 euros for the CP.

Table 2: Options of expenditures profiles (example)

	Monthly spending during working life (age 25 until retirement) in U.S. dollars	*Monthly spending during retirement in U.S. dollars*
Option A	2,650	2,650
Option B	2,750	2,400
Option C	2,850	2,150
Option D	2,950	1,900

Note: The numbers refer to a monthly income of 3,000 U.S. dollars.

Table 3: Distribution of preferred spending ratios for non-retirees and retirees

Panel A: Non-retirees

Spending ratio	*ALP* *Interest rate of*		*CP* *Interest rate of*	
	1 percent	*6 percent*	*1 percent*	*6 percent*
50 percent	5	7	4	7
64 percent	11	6	5	4
76 percent	16	13	23	14
88 percent	24	22	36	33
100 percent	17	11	23	22
140 percent	25	41	8	20

Panel B: Retirees

Spending ratio	*ALP* *Interest rate of*		*CP* *Interest rate of*	
	1 percent	*6 percent*	*1 percent*	*6 percent*
50 percent	7	8	2	2
64 percent	9	10	9	3
76 percent	18	16	19	14
88 percent	25	19	34	35
100 percent	20	13	28	26
140 percent	20	34	7	19

Note: The numbers indicate percentages of observations. The total number of non-retirees are 576 for the ALP and 539 for the CP. The total number of retirees are 211 for the ALP and 169 for the CP.

Table 4: Median regressions for minimum acceptable old age spending levels

	ALP	*CP*
Income quintile 2	784.56**	437.63**
	(273.53)	(82.09)
Income quintile 3	1481.72**	587.37**
	(267.83)	(87.08)
Income quintile 4	2343.20**	937.03**
	(251.82)	(92.31)
Income quintile 5	3073.94**	1452.12**
	(316.10)	(96.95)
Age	-80.38	-108.19
	(135.02)	(61.70)
Age^2 / 100	206.51	213.78
	(272.33)	(119.07)
Age^3 / 1000	14.61	-13.37
	(17.24)	(7.23)
Single	-271.19	76.39
	(189.90)	(78.47)
Children at home	130.75	54.05
	(185.68)	(71.60)
Home ownership	36.72	42.13
	(197.71)	(57.88)
Retired	311.96	232.17*
	(236.45)	(92.90)
No vocational training	-169.53	-0.00
	(231.45)	(61.68)
University degree	304.92*	-144.60
	(163.34)	(82.55)
Constant	1689.05	2649.31**
	(2029.41)	(982.95)
Pseudo R^2	0.24	0.28
Number of observations	591	576

Note: The dependent variable is measured in year-2007 U.S. dollars for the ALP and in year-2007 euros for the CP. One and two asterisks denote significance at the five and one percent level, respectively. Robust standard errors are indicated in parentheses.

Table 5: Minimum acceptable old age spending levels and minimum replacement rates

	ALP		
	Minimum spending	*Median income*	*Ratio*
Quintile 1	1005	1058	0.95
Quintile 2	1794	2344	0.77
Quintile 3	2485	3215	0.77
Quintile 4	3349	6384	0.52
Quintile 5	4080	9054	0.45
	CP		
	Minimum spending	*Median income*	*Ratio*
Quintile 1	911	1359	0.67
Quintile 2	1347	1835	0.73
Quintile 3	1501	2300	0.65
Quintile 4	1850	2875	0.64
Quintile 5	2364	3765	0.62

Note: Minimum spending levels per month are calculated setting age to 50. In case of the ALP, income quintiles refer to the Current Population Survey, not the ALP itself. Numbers in the upper panel represent year-2007 U.S. dollars. Numbers in the lower panel represent year-2007 euros.

Table 6: Relative Risk Aversion

	ALP	*CP*
Mean	5.0	7.8
Median	4	7
Std. dev.	4.1	4.2
25^{th} percentile	2	4
50^{th} percentile	4	7
75^{th} percentile	7	12

Appendix:

Derivation of Spending Profiles of Section 3

We discuss here the calculation of the spending profiles $\left(c^k_{w,i}, c^k_{r,i}\right)$ that underly the analysis in Section 3. For the derivation of these profiles we make a number of simplifying assumptions. A respondent's working life is assumed to start at the age of 25. Furthermore, we assume that respondents retire at age 65 in case of the ALP and at 61 in case of the CP.[21] We neglect mortality risk and assume that death occurs with certainty after age 85.[22]

The present value of the profile $\left(c^k_{w,i}, c^k_{r,i}\right)$ for respondent i is then given by

$$\sum_{t=25}^{R-1} \left(\frac{1}{1+r}\right)^{t-25} 12\, c^k_{w,i} + \sum_{t=R}^{85} \left(\frac{1}{1+r}\right)^{t-25} 12\, c^k_{r,i} = PVY_i.$$

R denotes the retirement age and amounts to either 65 or 61. r denotes the real risk-free interest rate. (Respondents are first asked to choose their favorite spending profile for an interest rate of one percent and then for an interest rate of six percent.) PVY_i denotes a hypothetical present value of lifetime income for respondent i. It is determined according to

$$PVY_i = \sum_{t=25}^{R-1} \left(\frac{1}{1+r}\right)^{t-25} 0.98\, Y_i + \sum_{t=R}^{85} \left(\frac{1}{1+r}\right)^{t-25} 0.64\ (0.98\, Y_i)\,. \tag{1}$$

Y_i represents respondent i's total annual household income after taxes and after deduction of contributions to existing mandatory pension systems. We do observe Y_i from previous survey modules.

[21] In the U.S., Social Security benefits can be claimed beginning at age 62. The normal retirement age varies between 65 and 67 depending on the year of birth. In the Netherlands, first-pillar benefits can be claimed from the age of 60 on, while the normal retirement age is 65. Effective retirement ages are 64 and 61 for the U.S. and the Netherlands, respectively (OECD, 2006).

[22] According to the 2008 OASDI Trustees Report (OASDI, 2008), life expectancy at age 65 currently amounts to 81.7 for men and 84.2 for women. It is expected to increase to 84.3 for men and to 86.4 for women in 2050.

Two features of (1) require explanation. First, we use 98 Y_i instead of Y_i for the calculation of the hypothetical present value of income. This is done to assure that the number corresponding to the highest $c^k_{w,i}$ on the first screen does not exceed Y_i even after rounding (which may mean upward rounding). Second, we need to explain the presence of the number 0.64. Our calculation of PVY_i implicitly assumes that retirement income equals 64 percent of working-life income. This assumption is hypothetical. It implies that if $c^k_{w,i}$ is equal to current income, then $c^k_{r,i}/c^k_{w,i}$ is equal to 0.64. This is thus the case for the option with the highest $c^k_{w,i}$ on the first screen, where $c^k_{w,i}$ is approximately equal to Y_i. Our implicit reasoning behind this is that the observed income Y_i is net of contributions to currently existing mandatory pension systems. These contributions may be sufficient to achieve an income replacement rate of 64 percent in a fully-funded pension system.[23]

We should point out that the assumptions made for calculating the profiles $\left(c^k_{w,i}, c^k_{r,i}\right)$ do not imply any assumptions about *actual savings behavior* of respondents. Our purpose is uniquely to show respondents spending profiles that are feasible under the above assumptions in order to learn which of the feasible profiles they would like most.

[23]The average current U.S. Social Security replacement rate is only around 40 percent due to the very low implicit returns of the Social Security system. When fully phased in, a fully-funded system would allow to finance much higher replacement rates (see Feldstein and Ranguelova, 2001). The Dutch mandatory pension system depends heavily on a funded component. A typical income replacement rate after taxes for a full employment history is 85 percent. We suspect that this number will decrease due to aging and increases in longevity.

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