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Conference Paper

Subjective Life Expectancy and Private Pensions

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2013: Wettbewerbspolitik und Regulierung in einer globalen Wirtschaftsordnung - Session: Subjective Longevity Risk and Life-Cycle Decision Making, No. E02-V3

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Subjective Life Expectancy and Private Pensions *

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Abstract

One important parameter in the decision process when buying a private annuity is individuals' subjective life expectancy, because it directly influences the expected rate of return. We examine the market for private annuities in Germany and evaluate potential selection effects based on subjective life expectancy. First individuals are pessimistic about their life span compared to the official life tables. Second we find a significant selection effect based on subjective life expectancy for women invested in private annuity contracts—so-called Riester pensions. For men there seems to be no difference in subjective life expectancy by Riester ownership. Comparing the size of this selection effect with the underlying mark ups in life expectancy that are charged by the insurance industry shows that the latter appears to be in line for women but too high for men. Our findings have strong policy implications. On the one hand miss-perceptions about longevity risk might prevent individuals from providing sufficiently for retirement, on the other hand mandated unisex tariffs appear to prevent men from investing in Riester pensions.

Keywords: Riester pensions, annuities, adverse selection, life-cycle saving
JEL Classification: D12, D91, G11

1 Introduction

The subjective expectation about the length of ones' life is an important parameter when analyzing saving behavior (see, e.g., Hamermesh (1985)), because, e.g., the length of time for which an annuity is expected to be received has an immediate impact on the value of the savings or investment plan. The markets for private annuities received growing attention in recent years because of an increase in private retirement savings and the need to spread the pay-outs over the retirement period. Due to demographic change pension systems around the world underwent substantial reforms. Frequently these reforms caused a shift in responsibility for retirement income from the state towards the individual level. Therefore, individuals do not only face the challenge of deciding about the accumulation of assets during working life but also the decumulation of assets during retirement. Most of the research on households' behavior so far has focused on the accumulation of assets. The contribution of this paper is to make some inferences about how households deal with the decumulation of assets and in particular how annuity choice is influenced by subjective survival expectations.

In his seminal contribution Yaari (1965) showed that for individuals with uncertain life time and no bequest motive it is optimal to annuitize all wealth if the annuity market is actuarially fair. Annuities are life-long payment streams which insure against longevity risk, i.e. the risk of outliving ones assets. Following up on Yaari's contribution Brown (2001) finds that indeed US households with higher annuity equivalent wealth are more likely to annuitize, however he also finds a substantial fraction of unexplained heterogeneity in annuity demand. Research on the structure of the markets for private annuities finds that these markets are underdeveloped in many developed economies (see, e.g., Friedman and Warshawsky (1990), Mitchell et al. (1999), v. Gaudecker and Weber (2004)). Common explanations for households' reluctance to annuitize their wealth are bequest motives, income from social security which is already paid as an annuity, precautionary savings, pooling of risks within the family, and behavioral responses.[1] One widely accepted explanation for the small size of annuity markets is market failure due to information asymmetries. More specifically, in the case of private annuities individuals have better knowledge of their own longevity risk than the insurer and "when observationally identical individuals are offered a choice from the same menu of insurance contracts, higher-risk individuals will buy more insurance" (Finkelstein and Poterba (2004), p.187). As a consequence those with high life expectancy will buy insurance whereas those with low risk of a long life will stay out of the market. This will result in increasing insurance

[1]For reviews of the literature on the "annuity puzzle" see, e.g., Brown (2007), Benartzi et al. (2011).

premiums and in the extreme case the markets will fail due to adverse selection (Akerlof (1970)). One crucial element in this argument is that individuals are well informed about their longevity risk.

The objective of this paper is to shed light onto the market for private annuities from an individual perspective. Thus, in contrast to previous literature we do not analyze the design of specific annuity contracts or the characteristics of those insured on the basis of administrative records from insurance companies but we analyze behavior of a representative sample of German households. We would like to know if we can observe (adverse) selection on the market for private annuities based on individuals' subjective life expectancies from an *ex ante* perspective. Most studies examining the effect of adverse selection in insurance markets rely on the comparison of insurance choice and so-called ex post risk, i.e. in the context of annuities they analyze actual mortality of the insured population. However, this is not necessarily informative about the fact if purchasers of certain insurance contracts have more information about their risk than the insurer. In their seminal contribution Finkelstein and McGarry (2006) point out that adverse selection in the market for long-term care insurance is related to individuals' perceived risk of needing long-term care in the future. In our data we have very specific information on the individuals, including their subjective life expectancy. This gives us the unique opportunity to test for asymmetric information *ex ante*, i.e. before the "risk" materializes.

One of the reasons why it is particularly interesting to study the behavior of German households lies in a special feature of the German annuity market. In Germany the need to accumulate private retirement savings for many households became apparent after the 2001 pension reform. In the reform it was not only decided to reduce pension income from the public system substantially for future generations but also to introduce state subsidies if individuals accumulate assets in certain private pension contracts—so called Riester pensions. Riester pensions are voluntary private pensions. Individuals contribute 4% of their gross income annually to receive a yearly lump sum subsidy of 154 Euros plus 185 Euros for each child born before 2008 and 300 Euros for those born after or a tax refund—which ever is larger. One special feature of these savings contracts is that at least 70% of the accumulated assets have to be converted into a lifelong payment stream; a maximum of 30% can be received as a lump sum. Payment streams cannot decrease over time.[2] This feature of Riester pensions makes them interesting to study from our point of view, because the savings and annuitization decision are taken jointly at the point in time when the contract is bought.[3]

[2]For more information see, e.g., v. Gaudecker and Weber (2006), Coppola and Reil-Held (2009), Coppola and Gasche (2011), Börsch-Supan and Gasche (2010a), Pfarr and Schneider (2011).

[3]I.e., only the decision how to invest 30% of the accumulated assets is taken at the point of retirement.

In this context we examine the relationship between subjective life expectancy and the demand for Riester annuities. More specifically we test the hypothesis that individuals with higher subjective life expectancy might be more inclined to buy Riester pensions. At the same time, government subsidies encourage individuals with high subsidy rates to buy annuities. Nevertheless, due to the voluntary nature of the Riester pensions we still expect a selection effect. There is an additional twist with respect to the Riester pensions as insurance companies are only allowed to offer so-called unisex tariffs, i.e. they are not allowed to calculate the pension payments using gender specific life expectancies. As women have on average higher life expectancy this makes Riester pensions less attractive for men. Therefore a Riester pension seems particular desirable for women because they benefit from the subsidies as well as from the underlying unisex life expectancy. For men the picture is less clear, the attractiveness of Riester pensions relative to an unsubsidized contract depends on the relative advantage of the subsidy and the disadvantage due to the unisex tariffs—the overall effect is unclear. Due to these differences we test our hypothesis separately for men and women.

After introducing the institutional context in Section 2 and developing our hypotheses in Section 3 our paper proceeds in three steps. First we examine the quality of subjective life expectancy data of our sample by comparing it to the official life tables and by linking it to individual risk factors and socioeconomic characteristics (Section 4). Second we test for selection in subjective life expectancy on the Riester market in a simple probit model (Section 5). Finally we compare the difference in mortality tables for the private annuity market as calculated by the German actuary association (DAV) and the official life tables for Germany to the spread on the Riester market that we detect in peoples' subjective life expectancy (Section 6). The motivation here is to estimate to what extent the loading charge of the annuity industry is justified compared to individual behavior. In section 7 we discuss our results and provide some robustness checks before concluding with some policy implications in Section 8.

Our main result are the following: Men and women substantially underestimate their longevity risk. On average women expect to live about 7 and men expect to live about 6.5 years shorter compared to the official life tables for Germany. Second, for women we find a small selection effect in the German market for Riester annuities based on their subjective life expectancy. Women who expect to live longer are more likely to hold a Riester pension. However for men, we do not find evidence for a selection effect on the Riester market. This could be driven by the presence of unisex tariffs on the market for Riester contracts that lead to disproportionately high loading charges for men compared to women. Finally, we calculate the loading charges of the insurance industry

by comparing the official life tables for Germany and the records of the German actuary association (DAV). Comparing the loading charges with the differences in subjective life expectancy for individuals with and without Riester pensions shows the following picture: for women the average difference of between 1 and 2 years in life expectancy appears to be in line with the mark up charged by the industry. However, for men the insurance industry seems to overcompensate the selection effect by far. While we find no selection effect based on subjective life expectancy the mark up by the industry ranges between 7 and 8 years discouraging men to invest in such contracts.

2 Institutional Context

In the course of the German public pension reforms the standard pension level was decided to be reduced in order to avoid dramatic increases in contribution rates. Börsch-Supan and Gasche (2010a) estimate public pension income in 2030 to be between 14% and 16% lower compared to a situation without the reform. The so called Riester pensions, state subsidized private pension plans, are tailored to encourage private savings in order to close the gap arising in public pension income. Riester pensions are private savings plans, investment funds or private pension plans that are subsidized depending on individuals' income and number of children.[4] The contracts are offered by private firms—mainly insurance companies or banks—and have to be certified.[5] According to the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) more than 4,300 Riester products were certified between 2001 and 2009. The certification does not guarantee the economic stability of the provider or its cost effectiveness but is merely a check if certain criteria regarding the structure of the plan are fulfilled. For example, one of the central features of certification is that at least 70% of the accumulated sum have to be paid as annuity.

Another interesting feature are mandatory unisex tariffs for Riester pensions. As a result of a regulation by the European Union, that was implemented in the German law, since 2006 the providers of Riester contracts have only been able to offer the same unisex contract for men and women.[6] In other words this means that from the perspective of the annuity provider it is no longer allowed to distinguish a Riester contract by the risk factor gender.

Every individual mandatorily insured in Germany's public pension system and public

[4]In 2008 an additional scheme that subsidizes owner-occupied housing was introduced ("Wohn-Riester").

[5]Until June 2010 contracts were certified by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin), thereafter they are certified by the Bundeszentralamt für Steuern.

[6]see European directive 2004/113/EG section 14 and 1 section 2 of the German pension provision agreements certification act (Altersvorsorgeverträge-Zertifizierungsgesetz).

servants, as well as the eligible persons' spouses, are authorized to get Riester subsidies. The estimates of the number of eligible persons differ mainly due to the difficulties in estimating the number of indirectly eligible persons.[7] Most recent estimates by Fassauer and Toutaoui (2009) range between 38.2 and 39.0 million eligible individuals, i.e. more than 70% of all individuals aged between 15 and 64 can profit from the subsidy.

Subsidies are either payed as lump-sum or tax deduction. The lump-sum subsidies are particularly generous for low income earners and families with children, whereas the tax reduction is more beneficial for households with higher incomes. The current regulation is summarized in Table 1. Depending on the number of children low income earners can obtain a *Zulagenquote*—ratio of subsidies to total contribution—between 70 and 90% in 2008. The ratio of subsidies is reduced to between 30 and 40% for individuals with high income in 2008.[8]

Table 1: Riester Subsidies

This table summarizes the state subsidies for Riester products as applicable from 2008 onwards.

minimum percentage of income required to be saved to obtain full subsidies	4%
minimum own contribution in Euros per year	60
per capita subsidy in Euros per year	154
subsidies for children in Euros per year:	
- children born before 1.1.2008	185
- children born on 1.1.2008 and after	300
one-time bonus if the subsidized individual is younger than 25 in Euros	200
maximum tax deductible amount in Euros per year	2100

Source: based on Sommer (2007).

Evaluations of micro-data show that Riester contracts are popular among women and individuals living in east Germany. The coverage among individuals at the bottom of the income distribution is still relatively low, but reveals a high dynamic (see Coppola and Reil-Held (2009) and Geyer and Steiner (2009)). Generally, even nine years after the introduction, a vivid debate still rages about the effectiveness of Riester pensions, their distributional and macroeconomic effects.[9]

3 Literature and Hypotheses

There are two general problems in insurance markets related to asymmetric information: adverse selection and moral hazard. Empirically it is very hard or even impossible to

[7] See, e.g., Sommer (2007), Fassauer and Toutaoui (2009).

[8] For further details on the structure of the subsidies, eligibility rules and the dynamics of the Riester plans see, e.g., Börsch-Supan et al. (2008), Coppola and Reil-Held (2009) and Sommer (2007).

[9] See, e.g., Börsch-Supan et al. (2010), Börsch-Supan and Gasche (2010b,a), Coppola and Reil-Held (2009), Corneo et al. (2009), Gasche and Ziegelmeyer (2010), Pfarr and Schneider (2011), Sommer (2007).

differentiate the two (see Chiappori and Salanie (2000)). However, it is widely agreed that moral hazard, i.e. changes in behavior because of insurance uptake, is not a major problem in the market for private annuities while the problem of adverse selection is present (see, e.g., Finkelstein and Poterba (2004)). Individuals who want to insure against longevity risk by buying an annuity have better knowledge of their own longevity risk than the insurer. They might have private information on their own health and life-style or the longevity of relatives. Thus, especially individuals with a high risk of living a long life have an incentive to buy insurance. Empirical evidence of adverse selection in the market for life-annuities is, for example, provided by Mitchell et al. (1999) for the United States, by Finkelstein and Poterba (2002, 2004) and Rothschild (2009) for the United Kingdom, and by v. Gaudecker and Weber (2004) for Germany.

In order to determine the value of any given annuity the calculation of the money's worth ratio (MWR) has proven to be a useful concept (Mitchell et al. (1999)). The MWR is the expected benefit of an annuity divided by the expected premium to be paid. In order to derive our hypotheses we use the MWR developed by Mitchell et al. and make some adjustments to take account of the Riester subsidies. Thus, we define the MWR of an annuity from the perspective of individual j in the following way:

$$MWR_j = \frac{benefit_j}{premium_j} = \frac{\sum_{t=T_R}^{T} \frac{p_{jt} \times A_t}{(1+i_t)^t}}{\sum_{t=0}^{T_R-1} (1+i_t)^{T_r - t} \times Z_{jt}}, \tag{1}$$

where T_R is the time of retirement entry, i_t is the interest rate at time t. Individual j pays contributions Z_{jt} per period during the accumulation phase which are comprised of own contributions plus subsidies and receives payment A_t per period during the decumulation phase. p_{jt} is the survival probability of individual j until t. Actuarially fair annuities have a MWR equal to one. Administrative cost, taxes and adverse selection can cause MWRs below one. However, it can still be attractive to buy an annuity with a value below one if individuals are risk averse and face life time uncertainty (Mitchell et al. (1999)).

In general, the probability to own an annuity increases if the MWR increases. From an individual perspective the MWR of a given annuity with a given price increases with an increase in the number of periods for which the payment A_t is received, i.e. MWR increases in individual life expectancy p_{jt}. This link holds conditional on the pricing of the annuity, i.e. conditional on the insurers' risk classification. Thus, in line with Chiappori and Salanie (2000) we propose, that adverse selection in the German market for private pensions is present if there is a positive correlation between coverage and individual survival risk *conditional* on observables used for pricing. The pricing of private pension contracts in Germany largely varies by contract characteristics like, e.g., how

assets are invested, and whether a survivor benefit is included. For Riester contracts at the individual level the contract's price only varies according to age/cohort; no gender discrimination is allowed due to mandatory unisex tariffs and no adjustments based on health or socioeconomic status are made.

When individuals decide about buying a private pension contract, they do not know their individual survival risk, but rather form an expectation about their life span depending on private information. Thus, from an individual perspective subjective life expectancy is driving pension ownership. Thus, conditional on all the characteristics of the individual that the insurer can use to set the price (i.e. age), we would expect individuals with higher subjective life expectancy to own Riester pensions.

We propose that conditional on all the characteristics of the individual that the insurers (can) use to set the price (i.e. age) we expect individuals with higher life expectancy to be more likely to own Riester contracts.

We test this hypothesis separately for men and women, because mandatory unisex tariffs change the demand structure for Riester pensions depending on gender as men have lower average life expectancy compared to women. V. Gaudecker and Weber (2006) predict a large efficiency loss for men based on this policy; they find that this reform lowered payouts for men by about 7 percent while changing almost nothing for women. Based on this they expect men to buy more traditional annuity contracts that are still offering gender specific rates and not opt for Riester pensions. The overall effect is hard to predict, because it depends on the relative size of the subsidy-effect (which encourages individuals to buy Riester pensions compared to non subsidized contracts) and the unisex tariffs encouraging only men with very high subjective life expectancy to buy Riester contracts. As a result conditional on the subsidies the difference in life expectancy between individuals with a Riester and without an annuity contract should be even more pronounced for men than for women.

As participation in private pensions is voluntary in Germany and in our population data set we do not have information on the specific contract details we focus on reactions at the extensive margin.[10]

One potential problem of our test for adverse selection is that individual preferences which are simultaneously related to mortality expectations and pension ownership and which are unknown to the insurer might have an effect on the market equilibrium. For example risk preferences might have a positive effect on longevity and on annuity ownership because risk averse individuals both live longer and buy insurance. Furthermore,

[10]See Finkelstein and Poterba (2002) for a discussion of the possibilities of individuals to also react on the intensive margin, i.e. select annuities with different designs.

wealthier individuals are more inclined to buy annuities and at the same time there is a well established link between life expectancy and wealth (see, e.g. Attanasio and Hoynes (2000)). Finkelstein and Poterba (2002) term this kind of selection "passive selection" as opposed to "active selection" where the annuity is purchased due to private information on mortality. We try to tackle this problem by providing regression analyses where we control for a large set of individual preference parameters and socioeconomic controls. From the perspective of the insurer it does not matter whether households select coverage on the basis of wealth and thus have higher life expectancy due to that or whether they select on the basis of better subjective information on life expectancy. Even though active and passive selection can have similar effects on welfare (Finkelstein and Poterba (2002)) they might lead to rather different policy conclusions.

4 The Data

We make use of the waves 2007-2009 of the German SAVE panel collected by the Munich Center for the Economics of Aging.[11] The SAVE survey is a representative longitudinal study of German households' financial behavior, with a specific focus on saving and old-age provisions. Our main sample contains 3,676 observations of non-retired respondents between age 26 and 60 who are eligible for a Riester contract. Riester eligibility is determined by employment status and marital status. Every individual contributing to the German public pension system and the spouses of these persons are eligible for Riester subsidies.[12] As the complete SAVE panel is representative for households in Germany, our reduced sample should be representative for those German households eligible for a Riester pension. We find an almost equal share of male (49.0%) and female (51.0%) participants. For our analysis we use information regarding individual subjective life expectancy, individual old age provision as well as socio-demographic characteristics.[13] More details about these variables are provided below.

4.1 Subjective Life Expectancy

Our central variable of interest is subjective life expectancy (SLE). In contrast to previous work individuals are not asked for survival probabilities (as for example in similar work by Hurd and McGarry (1995, 2002), Teppa (2011)) but rather for the age that they expect to reach. The survey question proceeds in three steps. First, participants have to state

[11] For for details on the data set see Börsch-Supan et al. (2009).

[12] More specifically, we include employees and their spouses in the sample, but exclude homemakers, self-employed persons and pensioners as long as they are not married to an eligible person.

[13] See Table 1 for the description of all variables and sample characteristics.

their belief about the average life expectancy of their cohort. Second, they are asked if they believe their life will be shorter, as long as or longer compared to their cohort. After that respondents have to express their relative life expectancy in years. The wording of the questions is as follows:

- *What do you think, which age will men/women of your age reach on average? (answer expressed in years)*
- *If you think about your own situation and health status, what do you think, how long will you live compared to the average person of your age and gender. Shorter, by [ ] years; About as long as the average; Longer, by [ ] years.*

We label the results from the first question subjective cohort life expectancy. The second question gives the subjective relative life expectancy (RLE). We can calculate subjective absolute life expectancy by adding the respondents' subjective cohort life expectancy and their subjective relative life expectancy.[14] Table 2 summarizes the answers given to the questions above and subjective life expectancy calculated from the answers separately for men and women.[15] Apart from our main sample consisting only of individuals that are eligible for a Riester contract we made the same calculations for a larger sample that includes all non-retired respondents between 26 and 60. Furthermore the table shows the corresponding age-weighted statistical life expectancies separately for the period and cohort life tables of the federal statistics office.[16] [17]

[Table 2 about here]

Before adding subjective cohort life expectancy and relative life expectancy to obtain SLE we would like to take a closer look at RLE. For this measure each respondent has to make a comparison between his subjective cohort and his personal life expectancy. In a representative sample like SAVE the positive and negative deviations should cancel each other out, so we would expect a mean relative life expectancy equal to zero for the

[14] Strictly speaking respondents are not asked for subjective life expectancy but for age at death. If it is equally likely that respondents die aged x + 1 month compared to age x + 11 months age at death should be about half a year shorter than SLE. However, as respondents might also round their responses to the nearest full age the answers are still likely to reflect SLE and not age at death.

[15] For a similar analysis based on earlier waves of SAVE see Börsch-Supan and Essig (2005).

[16] The values of the period and cohort life tables of the Statistische Bundesamt are weighted with the age distribution of each sample to make values comparable.

[17] Including the non-eligible individuals does not change the mean subjective life expectancy of our respondents. The small difference of 0.16 years we observe for women can be directly explained by the different age composition of the two samples because the respective weighted statistical cohort life expectancy also differs by 0.15 years. As there is no difference in SLE of the two samples in the remainder of this paper we only use the sample of Riester eligible respondents.

population as a whole. Surprisingly, the SAVE data shows a prevailing pessimism among men and women, meaning that the respondents on average believe they will live a shorter life than their cohorts.[18] The results are in line with previous findings of Börsch-Supan and Essig (2005) that respondents are pessimistic about their own life expectancy. We elaborate on the potential consequences of this result for pension choice in the following subsection.

Figure 1 and 2 show the distribution of SLE (i.e., subjective cohort life expectancy plus RLE) separately for the male and female respondents. The distribution has a mean of 80.5 years for women and 75.8 years for men, respectively. For both distributions we observe different focal points—some specific answers are frequently given by the respondents, for example 75 and 80 years for men and 80 and 85 years for women.

[Figure 1 and 2 about here]

When comparing SLE to the official statistical life tables from the federal statistics office the overall pessimism about individuals' survival age is even sharper. Women (men) estimate their life expectancy to be about 7 (6.5) years lower compared with the statistical cohort life tables.[19] This is in line with an earlier finding by Hamermesh (1985) that individuals underestimate life expectancy until age 60 (however, they are optimistic for older ages). Other studies, like, e.g. Teppa (2011), find similar results. One explanation for this huge gap might be that people have strong reference points that suggest an overall lower life expectancy. One potential anchor might be the more popular and better known period life expectancy that is frequently mentioned in the press when talking about the life expectancy of a new born. Period life tables consist of cross section mortality rates of a given year. Life expectancies are calculated based on those fixed rates and no further decline in mortality rates is taken into account. The corresponding life expectancies are lower compared to the values from the period life tables. However, even compared to the weighted period life expectancy women and men still estimate their life expectancies to be about 3 years lower than the official records. Another reference point might be the age at death of one's parents, grandparents or other close relatives or friends. If people form their expectation based on the mortality rates of much older cohorts they fail to incorporate the positive trend in life expectancies and therefore underestimate their own life expectancy. Both arguments are in line with the so called "availability heuristic" by **?**, describing the use of readily available data to form an expectation. On the other hand respondents might have a better grasp of their own longevity than the forecasts in

[18] We apply a t-test to see whether RLE significantly differs from zero and find significant differences.

[19] Even if we miss-interpret our variable and respondents really stated age at death in stead of SLE a difference of 6.5 (6) years for women (men) with respect to the statistical life tables occurs.

the official records. Perozek (2008) shows for a sample of older US respondents in 1992 that based on their predictions of longevity the unusual revision of the gender specific life tables by the US Social Security Actuary (SSA) between 1992 and 2004 could have been foreseen.[20]

Another noteworthy point is that the standard deviations of the SLE measure appear rather high with values around 8 years. However, if we compare those values with the standard deviation of observed life expectancy, which can take values of around 7 years (see, e.g., Fries (1980)), our estimates seem to match the statistical distribution fairly well. Intuitively the high standard deviation simply reflects that individuals die at very different ages due to personal circumstances like, e.g., differences in health status, health behavior and genetic makeup.

Previous research has shown that measures of SLE seem to convey meaningful information on true mortality (see, e.g., results by Hamermesh (1985), Hurd and McGarry (1995, 2002), Smith et al. (2001)). Subjective life expectancy is related to subjective and objective health status and risk factors such as smoking or early death of relatives (see, e.g., Hamermesh (1985), Hurd and McGarry (1995)). Furthermore, Hurd and McGarry (2002) and Smith et al. (2001) show, that subjective survival probabilities of Health and Retirement Study respondents predict actual survival. Those respondents surviving between waves predicted significantly higher survival in wave 1 compared to those who died between waves. Additionally they find that survival probabilities are adjusted when a parent dies and are updated with changes in health status. As previous studies on subjective life expectancy are mainly based on older US households in the following we present some evidence on the associations between subjective life expectancy, socio-demographic characteristics, and risk factors for our sample.

In table 3 we present results of linear regressions with subjective life expectancy as dependent variable. Individuals realize the gender gap in life expectancy, women believe to live about 5 years longer than men. Subjective life expectancy declines with age and is lower for respondents with lower levels of education as long as we do not control for differences in subjective and objective health status. When we take account of differences in health status the age and education effects disappear: Having good or very good subjective health status is positively associated with long life expectancy and having a serious health condition such as a heart attack, cancer or other problems is negatively related to subjective life expectancy. Smokers expect to live about 2.5 years shorter. The effects vary slightly by gender, however the overall picture is as expected and confirms

[20] In 2004 the SSA lowered life expectancy for US women and increased life expectancy for men, thereby reducing the gender gap in life expectancy by about 25%.

results from previous studies that respondents seem to have a meaningful picture of their own mortality risk relative to each other.

[Table 3 about here]

4.2 Private Pensions

The SAVE questionnaire also includes information about individual old age provision. We know the number of Riester contracts per household. The underlying assumption of our analysis is that a respondent possesses a Riester contract if the number of contracts is larger than zero.[21] The SAVE data contains the information whether or not people possess a contract in each year. We can see a positive dynamic in the distribution of Riester contracts starting with a coverage rate of 32% in 2007 reaching almost 40% in 2009.[22]

5 Subjective Life Expectancy and Pension Choice

In order to quantify a selection effect depending on SLE we divide our sample first by gender and additionally into two subgroups according to pension ownership. The first group is our reference group and consists of those individuals who neither possess a Riester contract nor any other private old age provision. The second group contains all individuals holding a Riester contract. Note that because we want to evaluate the Riester market as a whole, it does not matter whether people in group two hold a Riester contract exclusively or if they also own other forms of old age provision. Comparing the second group with the reference group should reveal the selection effect present on the Riester market. It is important to understand, that individuals who hold a private annuity contract but not a Riester contract are not part of our reference group because these people still take part in the annuity market as a whole and therefore make up the population for which special life tables are applied.[23]

We start our overview by concentrating on the hypotheses presented in section 3. We expect to observe a higher subjective life expectancy for both women and men with a Riester contract compared to the respective reference group without any annuity contract. Table 4 shows the descriptive results for our four subgroups in terms of their mean

[21] In the case that we observe less contracts than eligible household members the respondent does not necessarily possess a Riester contract. We address this problem in the robustness checks.

[22] For more information on the dynamics and determinants of Riester contract uptake see, e.g., Coppola and Reil-Held (2009).

[23] See also section 6.

absolute and relative subjective life expectancy. Comparing the mean absolute subjective life expectancy of individuals with a Riester contract to those with no private pension we find a significant difference for men and women. Women with a Riester pension expect to live about 1.6 years longer (significant at 1%) compared to those without any private provisions. And men with a Riester contract expect to live about 0.9 years longer (significant at 5%) compared to those without a contract.

Taking a closer look at the RLE measure again shows an overall pessimism, meaning that regardless of peoples' annuity choices on average the respondents believe they will live a shorter life than their respective cohorts. One important consequence of pessimism about ones life expectancy is that those individuals might save too little for retirement. Thus, if individuals are badly informed about their own longevity risk this can be a market barrier with regard to demand. Comparing groups with Riester pensions to those without a private pension we find a slightly more pessimistic view of individuals without an annuity contract compared to those with an annuity contract.

[Table 4 about here]

However, the comparison thus far does not correct for a different age composition of the households. In the case of the female respondents those without any annuity happen to be on average 3.45 years older than those with a subsidized Riester contract. In the male population those with no annuity contract are 1.55 years older compared to the Riester savers. Thus the difference in absolute life expectancy could be solely explained by this age gap. Therefore, the main question remains whether we can detect a selection effect in life expectancy on the market for Riester annuities conditioning on all characteristics that the providers can use to set their prize, i.e. age. In other words, if we can find adverse selection in the sense of an information asymmetry. In order to shed some light on this question we apply a simple probit model. In the model we use a binary dependent variable that takes the value one if there is a least one Riester contract in the household and zero otherwise. We first start with a model that uses subjective life expectancy, birth year and age as the only explanatory variables. This represents the perspective of the insurance industry in the sense that it is not a question of causality but simply a test whether or not the population of uninsured people differs from the one with an annuity contract in terms of their subjective life expectancy after controlling for birth year and age as the only relevant variables in terms of pricing. Next, based on the idea of Finkelstein and Poterba (2002), we want to disentangle whether people actively select themselves into annuity contracts based on private information about their life expectancy or if other covariates which correlate with life expectancy drive the decision. For example

people with a higher income might be more likely to purchase an annuity contract and high income individuals happen to have a higher life expectancy. Therefore, more covariates are added to the model to get a better understanding of whether subjective life expectancy remains significant after controlling for all relevant aspects. All analyses are conducted separately by gender because our previous considerations in section 3 regarding unisex tariffs and mark ups suggest a different influence of the covariates depending on the respondents' gender. Table 5 and 6 show the results respectively for women and men.

[Tables 5 and 6 about here]

The first specification for the female respondents in table 5 uses subjective life expectancy, birth year, and age as control variables. We can control for both, birth year and age because we are pooling data for the years 2007–2009. The regression shows a significant effect of subjective life expectancy on the likelihood to buy a Riester contract for women. An increase in SLE by one year increases the chance of possessing a contract by 0.2 per cent. For male respondents table 6 shows that conditional on birth year and age (1) we do not find a significant effect of subjective life expectancy on the likelihood to possess a Riester contract. Birth year and age are significant for both genders and show the expected signs. On the one hand, individuals born in the same year are more likely to buy a Riester contract as they get older. On the other hand people born more recently have a higher chance to have purchased a Riester contract when reaching a certain age. In other words, a 40-year-old born in 1960 is more likely to hold a contract compared to a 40-year-old born in 1950. As a first result the standard test for adverse selection in model (1) reveals an effect of subjective life expectancy for women but not for men. This comes with some surprise considering our initial considerations where we expected an effect for women as well as men, with an even larger effect for men.

Next we look at specification (2) to (4) where we add more covariates to our model. The objective is to differentiate between active and passive selection as the two would have very different policy implications. In the models (2) and (3) we add the number of kids as well as log income. Due to the design of the subsidies the number of children as well as household income has an effect on the subsidy ratio.[24] Intuitively people with more children have a higher subsidy ratio because their lump sum subsidy increases with every child. When it comes to income the complex combination of lump sum subsidy and tax return creates a u-shaped relationship between the overall subsidy ratio and income with the highest subsidy ratio for the lowest incomes.[25] To account for the nonlinearity we

[24]The subsidy ratio is defined as the lump sum subsidies plus tax return divided by the sum of lump sum subsidies plus tax return plus own contributions.

[25]See, e.g. Coppola and Reil-Held (2009).

add the logarithm of net income as our covariate. Additionally we add marital status and education. In a third specification we also control for financial risk as well as health risk preferences.[26] The fourth specification includes only the individuals that participated in the 2009 survey. In 2009 all respondents were asked to fill in their personal gross income as well as the gross income of their partner. Based on these information we are able calculate individual subsidy ratios for each respondent according to their gross income, marital status and the number of children. We include four dummy variables representing subsidy ratio quartiles and all effects are calculated relative to the fourth quartile.

The most important result is that our initial findings from specification (1) remain almost unchanged. We find a significant influence of subjective absolute life expectancy for our female respondents when we add more covariates. The marginal effects become even stronger. That means our hypothesis is not rejected in any of our models. Women seem to select Riester pensions depending on SLE. For men the story is somewhat different. Subjective life expectancy remains insignificant in all four models suggesting that men neither actively nor passively select themselves into Riester contracts depending on their subjective life expectancy.

The signs of the other covariates that show a significant effect reveal no surprises. For women the age effect remains unchanged. However, some caution is required when looking at specification (4). Here the effect of age is negative which means younger individuals in 2009 are less likely to hold a Riester contract. It is important to note that the negative sign is not in contrast to the results of the other three specifications, because in model (4) age represents a different effect because we do not look at panel data and therefore do not control for birth year simultaneously. Income and the number of children show the same significant sign for women an men. Earning more as well as having more children significantly increases the likelihood of owning a Riester contract. In the third model we do not detect a significant effect for financial or health risk. Furthermore, for women there is a significant effect of marital status in model (2) and (3) as well as an effect of the more explicit subsidy ratios in model (4).

In sum, we find some evidence of a small active selection on the basis of subjective life expectancy for women, but no effect for men. Women expecting to live one year longer are more likely to own a Riester pensions. However, compared to the effect of the subsidies (as proxied by the number of children, and marital status in model 2 and 3 and explicitly calculated in model 4) the effects seems to be relatively small.

[26]The dummies financial risk and health risk take on the value one for individuals not willing to take any risk.

6 Life-Tables and Mark Ups

Finally, we would like to compare the selection detected on the demand side to the mark-ups charged from the supply side. This is a highly policy relevant question, because private pension insurers have been accused of charging mark-ups that are too high and thereby discourage investments in private pension contracts. However, before we can compare our findings to the present market premiums in life expectancy we want to look at the underlying life tables in more detail. Therefore, in the next section we compare the statistical life tables used by the federal statistic office of Germany (Statistisches Bundesamt) and the life-tables calculated by the German actuary society (Deutsche Aktuarvereinigung–DAV) for the insured population.

6.1 Life Tables

When comparing so called "real" mark ups on the Riester market we need a life table that represents the insured and one that represents the uninsured population. First we have to choose whether we want to apply period or cohort life tables. Period life tables represent a cross section of mortality rates while the latter incorporates a declining mortality trend in the future. Because we know that mortality rates have been declining since the start of empirical statistics for Germany in 1871 and are likely to decline in the future, it seems more appropriate to compare the cohort life tables for our two populations. Unfortunately the German statistics association (Statistisches Bundesamt) only provides us with a cohort life table that represents the population as a whole rather than the population without an annuity contract alone. Bearing that in mind, we know that the underlying mark up only represents the difference between the insured population and the population as a whole and therefore will be smaller than the full selection effect between those with and without an annuity contract. More precisely, we will look at the last cohort life table issued in 2004 by the Statistische Bundesamt. The calculation comprises two underlying trend scenarios named V1 and V2. V1 looks at the mortality trends since 1871 while the latter places extra weight on the short term trend since 1970.[27] Because mortality rates experienced a stronger decline in the short run, life expectancies are always higher in V2 compared to V1. For our analysis we will focus on the short term scenario V2 because first, it seems more appropriate to forecast the mortality rates in the future based on values since 1970 compared to 1871 and second, we want to avoid overestimating the selection effect by underestimating the life expectancy of our reference group.

[27] Statistisches Bundesamt (2006), p.10.

With regard to the individuals holding an annuity contract we make use of the second order DAV life table 2004 R (DAV (2005)). The DAV is the professional representative of insurance and financial actuaries in Germany. The DAV estimates cohort life tables of a so called "first" and "second" order based on their own data and certain assumptions. These life tables aim to be representative for the individuals engaged in the annuity market. The second order represents the life table that incorporates only the selection effect in life expectancy on the annuity market whereas the first order is the life table actually applied by the industry. The latter also takes additional risk parameters, like volatility or simply misapprehension, into account. The first order table with all its additional mark ups is justified by the fact that a private firm needs to make a financially sustainable calculation that assures the solvency of the company in the future.[28] For the purpose of our comparison we will use the second order cohort life table as our benchmark, because it represents the mark up that is solely justified by the underlying selection effect. In order not to overestimate the statistical selection effect we will use the most pessimistic version of the second order table with respect to the underlying trend moderation, meaning the trend that predicts the lowest life expectancies. The graphs below compare the resulting life expectancies in the year 2009 from the Statistische Bundesamt and the DAV for our age window from 26 to 60 for men and women.

[Figure 3 and 4 about here]

Overall we see substantial differences between the statistical values for the two populations that varies to a small extent with age due to a slightly different shape of the two graphs. The next chapter answers the question how those differences compare to the mark ups that can be detected in the micro-data.

6.2 Mark-Ups

When comparing the mark ups in subjective life expectancy and statistical life expectancy we focus on 6 age groups as shown in table 7. The table shows the mark ups we observe in the SAVE data (subjective mark ups) as well as the statistical mark ups separately for women and men.

[Table 7 about here]

[28] Because there is empirical evidence that the short term trend in mortality will mitigate in the future, see DAV (2005)(p. 112ff), the second order includes different moderation scenarios that differ in moderation timing and speed. However, the first order does not include such moderation because it views the possibility that the underlying moderation will turn out to be wrong as specific risk factor.

We want to focus on the subsidised Riester market. Before we can compare the subjective and statistical mark ups we have to discuss the effects of unisex tariffs. Due to a statistically higher life expectancy of women compared to men as well as the construction of a standard Riester annuity contract that matures at the policyholder's death, the average contract of a woman induces a longer pay-out phase or in other words higher costs for the provider. Consequently, if by law the differentiation by gender is taken away an insurance company has to make an assumption about the composition of its clients regarding their sex. The higher the share of women that are expected to buy a Riester contract the higher the implicit life expectancy upon which a provider bases the calculation. Looking at a broad range of companies that provide information about their underlying gender decomposition we can detect a lower and upper limit regarding the weight that is put on male and female life expectancy. Each decomposition leads to a corresponding unisex life expectancy. In this case the lower limit implies decomposition into 60% women and 40% men, whereas the upper limit translates into 80% women and only 20% men.[29] In a next step these artificial unisex life expectancies can be compared to the corresponding life expectancies for men and women that are found in the cohort life table from the Statistische Bundesamt. In table 7 the resulting mark ups for the lower and upper limit scenario are shown in the rows "Riester I" and "Riester II" and the subjective SAVE differences between those with a Riester contract and those without any annuity contract are shown in the row "Difference: Riester - no Annuity". In order to be able to assess the effect of unisex tariffs the row "Statistic Cohort Life Tables" shows the mark ups that would result in a world were gender discrimination is still permitted.

In table 7 we can see that in a world of gender specific contracts the mark ups for men and women are fairly similar and lie between 3 and 4 years. Second, the difference in the sex decomposition of the lower and upper limit translates into an increase in the statistical mark up by about one year. Third, the fact that the companies need to offer unisex tariffs decreases the mark ups for women but at the same time increases the mark ups for men relative to scenario with separate male and female DAV life tables. It is important to note, that in absolute terms the increase for men doesn't correspond to the decrease for women because this would only be the case for an underlying decomposition of 50% male and 50% female contract holders. However, the fact that even the lower limit scenario implies a greater share of women always results in the stronger increase for men relative to the decrease for women.

Comparing the subjective mark ups and the statistical mark ups reveals a very different picture for men and women. While for women on average the subjective mark up

[29] See Risiko und Vorsorge (4/2010): Alleinstellungsmerkmale bei Riestertarifen, Teil 2

is positive (as already reported in the multivatriate regressions in the previous section) for men the picture is very mixed. More interestingly when we compare the mark ups in the SAVE data to the mark ups charged by the industry there seems to be a fairly good match for women. The observed selection effect based on SLE of around 1 to 2 years, corresponds to the loading charge by the industry. However, if we look at the male population we get very different results. Not only can we see overall lower subjective differences between the individuals with and without a Riester contract (the results in the previous section were not significant), but more importantly the statistical mark ups are very high due to the unisex regulation. Loading charges for men range between 6 and 8 years.

Overall, unisex tariffs create a huge disparity between the mark ups for women and men and this can be expected to have an effect on the selection process on the Riester market. For women the mark ups are relatively modest and are reflected fairly well in the difference in subjective life expectancy. In other words for women we observe a match between actuarial assumptions and individual expectation. However, for men the mark ups are disproportionately high and do not reflected peoples' expectations. This might explain that for men subjective life expectancy does not seem to play a role in the selection process Men are generally prevented from buying Riester contracts based on subjective life expectancies due to the high loading charges. Based on a crude calculation regarding the relationship between the MWR and the subsidy rate it would take an additional annual subsidy of around 17% for an average man to be on par with the average woman in terms of the expected MWR. Men's Riester ownership is driven by socio-demographic characteristics but not by subjective life expectancy.

7 Robustness Checks

One important aspect of the SAVE study is that it is a household based questionnaire where only one person of the household is interviewed. The questions regarding old age provisions relate to the situation of the household as a whole, meaning that in some cases it is not possible to directly link a Riester contract to a specific person. As an example we can pick a married couple who live together and hold one Riester contract. In this case we do not know which spouse owns the contract and therefore we might assign the subjective life expectancy of the respondent to that one contract when in reality his or her spouse is the actual owner of the Riester contract.

However, in a larger number of cases we do know if it is the respondent that owns the contract. The obvious cases are single households where the respondent is the only

adult in the house and therefore we can directly link any annuity contract. In a second case when we look at couples that own more than one Riester contract we can assume that the person answering the questionnaire directly owns one of the contracts.[30] Apart from these two circumstances there is a third combination of answers from which we can directly link a Riester contract to the respondent. If there is only one Riester contract and no private old age provision contract in a non-single household we can exploit a question that asks for the expected old age income sources separately for both partners. One sub-item contains private old age provisions including Riester contracts. The reason we do not use this question directly is that it covers both, subsidized and unsubsidized, old age provisions. In our case we know that out of the broader category there is only one Riester contract in the household, therefore if the respondent answers that he or she will expect income out of that category but his or her partner will not we can link the Riester contract to the respondent.

Based on this approach, we compare our newly derived smaller group of directly linked contract holders with our initial group of Riester annuity savers. Table 8 shows the resulting subjective life expectancies of our two initial groups from table 4 plus the newly derived expectancies of Riester savers where a direct link was possible. Our initial results remain unchanged when using the reduced sample. For women, conditional on age, we find a significant positive effect of subjective life expectancy on the likelihood of owning a Riester pension, for men we still do not find a significant effect of subjective life expectancy on Riester ownership.

8 Conclusions

We have three central findings. First, men as well as women are pessimistic about their life expectancy. Women (men) underestimate their life span by about 7 (6.5) years compared to the official records by the German statistical office. Second in line with our hypothesis we find a small selection effect in the German market for Riester annuities based on women' subjective life expectancy. This selection effect is present not only when controlling solely for age, as the only variable that the provider can use to set the price for a Riester contract, but also when controlling for additional covariates that potentially influence annuity choice and subjective life expectancy at the same time. Women holding a Riester contract expect to live longer compared to women without an annuity contract. However, in contrast to our hypothesis we do not find a selection effect

[30] In very rare cases there might be children eligible for Riester annuities that also live in the household. In these cases if the number of contracts is smaller than the amount of eligible household members we again have an assignment problem. For our analysis we will disregard these cases.

for men on the Riester market based on their subjective life expectancy. At first glance our findings appear counterintuitive considering the design of the Riester contracts. Women benefit from subsidies as well as unisex life tables which generally make the contracts attractive, even for women with lower life expectancies. Men only benefit from the subsidies but suffer from the unisex regulation. As a result the difference in subjective life expectancy between Riester savers and individuals without an annuity contract should be more pronounced for men.

The third important finding concerns the loading charge of the insurance industry compared to the selection effect based on subjective life expectancy. For women the subjective mark up ranges between 1 and 2 years and is approximately in line with the loading charge by the industry. However, due to the special unisex regulation on the Riester market mark ups are very high for men (up to 8 years) and do not correspond to the subjective mark ups for men. Men do not select themselves into Riester contracts based on SLE but rather due to other socio-demographic characteristics. The gender gap in mark ups gives us a possible explanation for the results regarding our hypotheses. The mark ups for men might simply be high enough to prevent a selection process according to subjective life expectancy. For men other factors seem to determine whether to invest into the Riester scheme.

The overall judgment of whether the mark up of the insurance industry is justified based on adverse selection remains complex because we can only compare the statistic adjustments by the DAV with subjective estimations of our sample. If the SAVE participants systematically make errors regarding their subjective life expectancy their real mortality risk could still match the assumptions by the insurance companies. However, because people base their decision making process on subjective assumptions the fact that they think the mark up is too high can already cause negative consequences, namely that a large share of the population will be underinvested in private annuity contracts. Informing individuals about their longevity risk might improve individual's risk assessment and ultimately lead to better coverage.

References

Akerlof, G. A.: 1970, The market for "Lemons": Quality uncertainty and the market mechanism, *Quarterly Journal of Economics* **84**(3), 488–500.

Attanasio, O. and Hoynes, H. W.: 2000, Differential Mortality and Wealth Accumulation, *Journal of Human Resources* **35**(1), 1–29.

Benartzi, S., Previtero, A. and Thaler, R. H.: 2011, Annuitization Puzzle, *Journal of Economic Perspectives* **25**(4), 143–164.

Börsch-Supan, A., Coppola, M., Essig, L., Eymann, A. and Schunk, D.: 2009, *The German SAVE Study - Design and Results*, 2nd edn, Mannheim Institute for the Economics of Aging (MEA).

Börsch-Supan, A. and Essig, L.: 2005, Personal assets and pension reform: How well prepared are the Germans?, *MEA Discussion Paper* **85-2005**.

Börsch-Supan, A. and Gasche, M.: 2010a, Kann die Riester-Rente die Rentenlücke in der gesetzlichen Rente schliessen?, *MEA Discussion Paper* **201**.

Börsch-Supan, A. and Gasche, M.: 2010b, Zur Sinnhaftigkeit der Riester-Rente, *MEA Discussion Paper* **197**.

Börsch-Supan, A., Gasche, M. and Ziegelmeyer, M.: 2010, Auswirkungen der Finanzkrise auf die private Altersvorsorge, *Perpektiven der Wirtschaftspolitik* **11**(4), 383–406.

Börsch-Supan, A., Reil-Held, A. and Schunk, D.: 2008, Saving Incentives, Old-age Provision and Displacement Effects: Evidence from the Recent German Pension Reform, *Journal of Pension Economics and Finance* **7**(3), 295–319.

Brown, J. R.: 2001, Private pensions mortality risk, and the decision to annuitize, *Journal of Public Economics* **82**, 29–62.

Brown, J. R.: 2007, Rational and Behavioral Perspectives on the Role of Annuities in Retirement Planning, *NBER Working Paper* **13537**.

Chiappori, P.-A. and Salanie, b.: 2000, testing for Asymmetric Information in Insurance Markets, *Journal of Political Economy* **108**(1), 56–78.

Coppola, M. and Gasche, M.: 2011, Die Riester-Förderung—das unbekannte Wesen, *MEA Discussion Paper* **244-11**.

Coppola, M. and Reil-Held, A.: 2009, Dynamik der Riester-Rente: Ergebnisse aus SAVE 2003 bis 2008, *MEA Discussion Paper* **195**.

Corneo, G., Keese, M. and Schröder, C.: 2009, The Riester Scheme and Private Savings: An Empirical Analysis based on the German SOEP, *Schmollers Jahrbuch* **129**(2), 312–332.

DAV: 2005, Herleitung der DAV-Sterbetafel 2004 R für Rentenversicherungen, *Blätter der DGVFM* **XXVII**(2), 199–313.

Fassauer, S. and Toutaoui, N.: 2009, Die Anzahl des förderberechtigten Personenkreises der Riester-Rente—eine Annäherung, *Deutsche Rentenversicherung* **6**, 478–486.

Finkelstein, A. and McGarry, K.: 2006, Multiple Dimensions of Private Information: Evidence from the Long-Term Care Insurance Market, *American Economic Review* **94**(4), 938–958.

Finkelstein, A. and Poterba, J.: 2004, Adverse selection in insurance markets: Policyholder evidence from the U.K. annuity market, *Journal of Political Economy* **112**(1), 183–208.

Finkelstein, A. and Poterba, J. M.: 2002, Selection effects in the United Kingdom individual annuities market, *The Economic Journal* **112**(January), 28–50.

Friedman, B. M. and Warshawsky, M. J.: 1990, The Cost of Annutities: Implications for Saving behavior and Bequests, *Quarterly Journal of Economics* **105**(1), 135–154.

Fries, J.: 1980, Aging, Natural Death and the Compression of Morbidity, *The New England Journal of Medicine* **303**(3), 130–135.

Gasche, M. and Ziegelmeyer, M.: 2010, Verbreitung der Riester-Rente—Hat die Finanz- und Wirtschaftskrise Spuren hinterlassen?, *MEA Discussion Paper* **198**.

Geyer, J. and Steiner, V.: 2009, Die Zahl der Riester-Renten steigt sprunghaft—aber Geringverdiener halten sich noch zurück, *DIW Wochenbericht* **32**.

Hamermesh, D. S.: 1985, Expectations, Life Expectancy and Economic Behavior, *Quarterly Journal of Economics* **100**(2), 389–408.

Hurd, M. D. and McGarry, K.: 1995, Evaluation of the Subjective Probabilities of Survival in the Health and Retirement Study, *Journal of Human Resources* **XXX**, S268–S291.

Hurd, M. D. and McGarry, K.: 2002, The Predictive Validity of Subjective Probabilities of Survival, *The Economic Journal* **112**, 966–985.

Mitchell, O. S., Poterba, J. M., Warshawsky, M. and Brown, J.: 1999, New evidence on the Moneys Worth of Individual Annuities, *American Economic Review* **89**(5), 1299–1318.

Perozek, M.: 2008, Using subjective expectations to forecast Longevity: Do respondents know something we don't know?, *Demography* **45**(1), 95–113.

Pfarr, C. and Schneider, U.: 2011, Anreizeffekte und Angebotsinduzierung im Rahmen der Riester-Rente: Eine empirische Analyse geschlechts- und sozialisationsbedingter Unterschiede, *Perspektiven der Wirtschaftspolitik* **12**(1), 27–46.

Rothschild, C.: 2009, Adverse selection in annuity markets: Evidence from the British Life Annuity Act of 1808, *Journal of Public Economics* **93**, 776–784.

Smith, V. K., Taylor, D. H. and Sloan, F. A.: 2001, Longevity Expectations and Death: Can People Predict Their Own Demise?, *American Economic Review* **91**(4), 1126–1134.

Sommer, M.: 2007, Fiskalische Auswirkungen einer Erweiterung des Förderungsrahmens von Riesterrenten, *MEA Discussion Paper* **122**.

Statistisches Bundesamt: 2006, *Generationen-Sterbetafeln für Deutschland, Modellrechnungen für die Geburtsjahrgänge 1871-2004*, Statistisches Bundesamt, Wiesbaden.

Teppa, F.: 2011, Can the Longevity Risk Alleviate the Annuitization Puzzle? Empirical Evidence from Dutch Data, *DNB Working Paper* **302**.

v. Gaudecker, H.-M. and Weber, C.: 2004, Surprises in a growing market niche: an evaluation of the German private life annuities market, *The Geneva Papers on Risk and Insurance* **29**(3), 394–416.

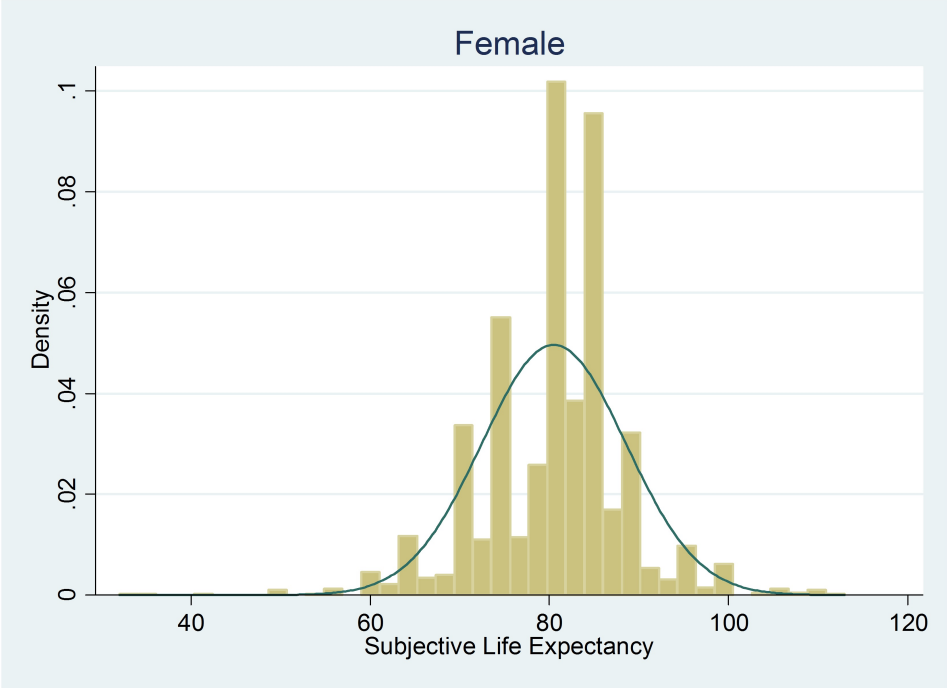
v. Gaudecker, H.-M. and Weber, C.: 2006, Mandatroy unisex policies and annuity pricing: quasi-experimental evidence from Germany, *Discussion Paper University of Mannheim, Sonderforschungsbereich 504* **07-07**.

Yaari, M. E.: 1965, Uncertain Lifetime, Life Insurance, and the Theory of the Consumer, *The Review of Economic Studies* **32**(2), 137–150.

FIGURES AND TABLES

Figure 1: Distribution of Subjective Life Expectancy - Women

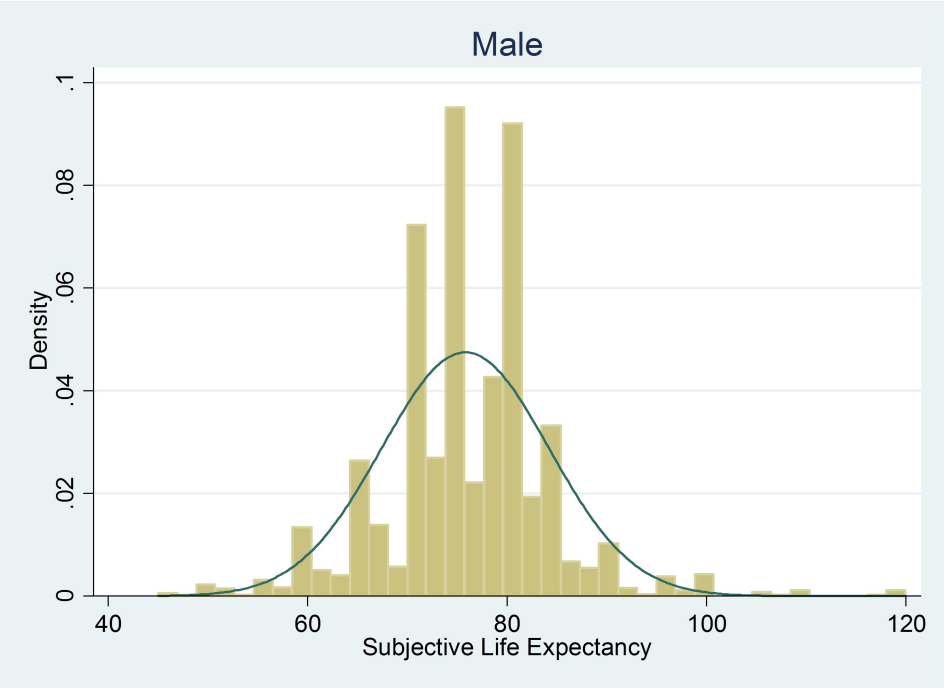
This figure shows the distribution of subjective life expectancy among female Riester eligible SAVE respondents (N=1872).



Source: Own Calculation based on SAVE 2007 - 2009.

Figure 2: Distribution of Subjective Life Expectancy - Men

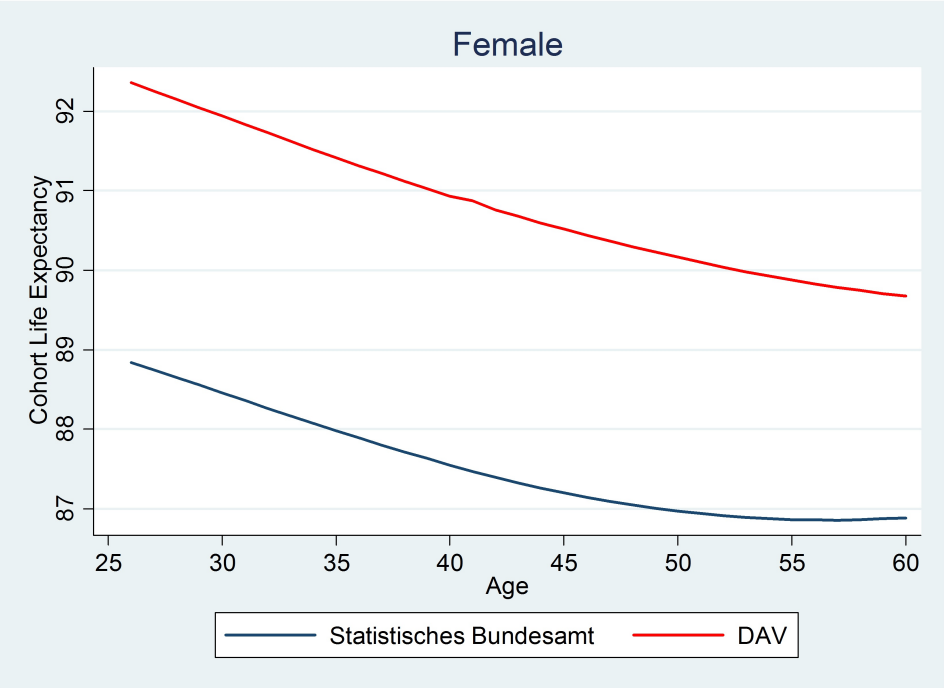
This figure shows the distribution of subjective life expectancy among male Riester eligible SAVE respondents (N=1802).



Source: Own Calculation based on SAVE 2007 - 2009.

Figure 3: Statistical Cohort Life Expectancy - Women

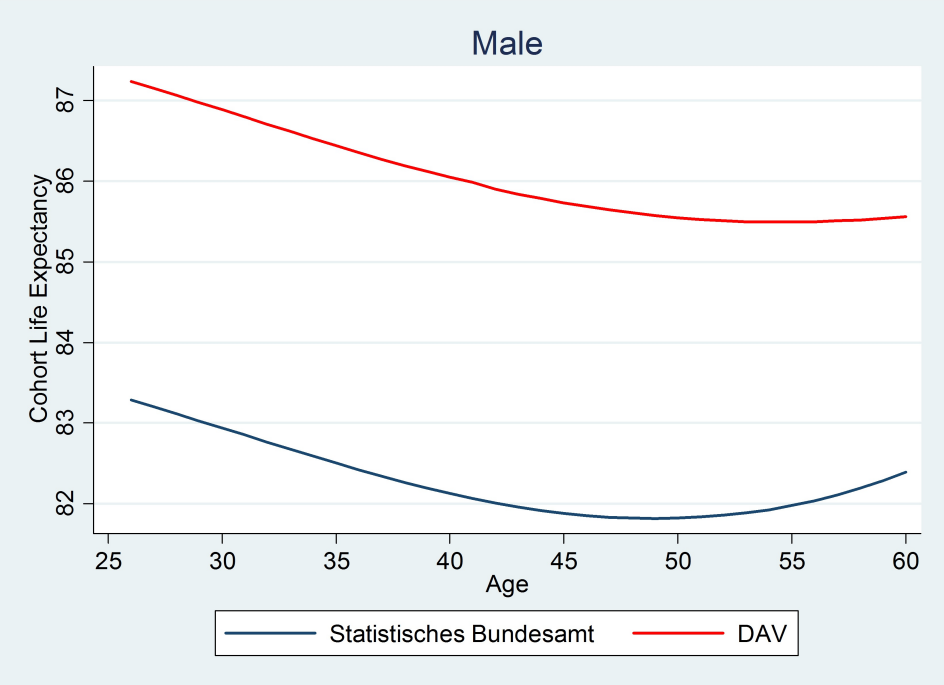
This figure shows the statistical cohort life expectancy for women between the age 26 to 60. The life tables of the Statistische Bundesamt make predictions for the whole population while the German Actuary Association (DAV) bases their calculations solely on individuals owning an annuity contract. Both forecasts assume a further decline in mortality rates.



Source: Own Calculation.

Figure 4: Statistical Cohort Life Expectancy - Men

This figure shows the statistical cohort life expectancy for men between the age 26 to 60. The life tables of the Statistische Bundesamt make predictions for the whole population while the German Actuary Association (DAV) bases their calculations solely on individuals owning an annuity contract. Both forecasts assume a further decline in mortality rates.



Source: Own Calculation.

Table 1: Variables and Summary Statistics

This table describes all variables used in the paper. Dummy variables are marked as (d). The number of observations for all variables apart from the subsidy ratio dummies is 3673. The subsidy rates are only calculated in 2009 for 962 observations.

Variable	**Definition**	**Mean**	**Standard Deviation**
Subjective Cohort Life Expectancy	Individual expectation about the average life expectancy of their cohort	78.85	6.29
Subjective Relative Life Expectancy	respondent's expectation whether to live longer or shorter compared to his/her cohort	-0.65	5.38
Subjective Individual Life Expectancy	Sum of individual cohort plus relative life expectancy	78.20	8.54
Female (d)	Equals one if respondent is female	0.51	0.50
Age	Individual age in years	43.85	8.98
Riester (d)	Equals one if the respondent's household holds at least one Riester contract	0.37	0.48
Married (d)	Equals one if respondent is married	0.62	0.49
Log adjusted net income	log of net income adjusted for household size according to the OECD's modified equivalence scale	7.19	0.55
Number of children	Respondent's number of children	1.63	1.38
Schooling:	three dummy variables for different schooling levels		
More than 12 years of schooling (d)	Equals one if respondent has more than 12 years of schooling	0.31	0.46
10 to 12 years of schooling (d)	Equals one if respondent has between 10 and 12 years of schooling	0.44	0.50
Up to 10 years of schooling (d)	Equals one if respondent has less than 10 years of schooling	0.25	0.44
Subjective health at least good (d)	Equals one if respondents assess their personal health as "good" or "very good"	0.63	0.48
Chronic condition (d)	Equals one if a respondent states to have long-term health problems	0.42	0.49
Serious illness (d)	Equals one if the respondent was diagnosed with at least one serious health conditions. The survey checks for 9 common conditions plus a box for "other conditions".	0.62	0.49
Currently smoking (d)	Equals one if the respondent states to be a smoker	0.33	0.47
Birth year	Respondent's birth year	1964	8.96
Financial risk (d)	Respondents are asked whether they are willing to take financial risks on a scale of 0 to 10. The risk averse (answer 0 to 2) are assigned the value one.	0.64	0.48
Health risk (d)	Respondents are asked whether they are willing to take risks regarding their health on a scale of 0 to 10. The risk averse (2 answer 0 to 2) are assigned the value one.	0.57	0.50
Subsidy Ratio 0-25 percent (d)	Equals one if respondent's subsidy ratio for a Riester contract lies below 25 percent	0.04	0.20
Subsidy Ratio 25-50 percent (d)	Equals one if respondent's subsidy ratio for a Riester contract is between 25 and 50 percent	0.58	0.49
Subsidy Ratio 50-75 percent (d)	Equals one if respondent's subsidy ratio for a Riester contract is between 50 and 75 percent	0.19	0.39
Subsidy Ratio 75-100 percent (d)	Equals one if respondent's subsidy ratio for a Riester contract is between 75 and 100 percent	0.19	0.39

Source: Own Calculation.

Table 2: Subjective Life Expectancy

This table reports the different life expectancy measures asked in SAVE (separately for the whole sample and for the Riester eligible population only). Subjective life expectancy equals the sum of individuals' cohort plus relative life expectancy. The second part of the tables reports the corresponding statistical life expectancies issued by the Statistische Bundesamt. All statistical values are weighted using the age distribution of the respective SAVE sample.

	Women		**Men**	
	All	Riester eligible	All	Riester eligible
Subjective Cohort Life Expectancy	81.01	81.12	76.55	76.48
	(5.95)	(5.97)	(5.76)	(5.71)
Subjective Relative Life Expectancy	-0.67	-0.63	-0.73	-0.67
	(5.02)	(5.10)	(5.86)	(5.65)
Subjective Life Expectancy	80.34	80.50	75.83	75.82
	(8.01)	(8.04)	(8.57)	(8.40)
Mean Age	44.06	43.31	45.12	44.42
Observations	2318	1871	1989	1802
Statistisches Bundesamt (2009):				
Period Life Expectancy	83.62	83.58	79.18	79.10
Cohort Life Expectancy	87.42	87.57	82.17	82.17

Source: Own Calculation. Standard deviation in parentheses.

Table 3: OLS: Subjective Life Expectancy

This table reports relationship between subjective and relative life expectancy and various socioeconomic characteristics. Specification (1), (3) and (5) include basic covariates while additional health proxies are added in specification (2), (4) and (6). (d) indicates the change of a dummy variable from 0 to 1.

	All		**Men**		**Women**	
	1	2	3	4	5	6
Female (d)	4.86***	4.86***				
	(0.533)	(0.509)				
Age	-0.08***	-0.02	-0.13**	-0.05	-0.03	0.03
	(0.031)	(0.031)	(0.052)	(0.053)	(0.037)	(0.036)
Married (d)	0.97*	0.25	0.26	-0.63	1.78**	1.21*
	(0.573)	(0.555)	(0.935)	(0.923)	(0.752)	(0.713)
Log adjusted net income	1.04**	0.39	1.48**	0.54	0.69	0.21
	(0.513)	(0.464)	(0.702)	(0.654)	(0.761)	(0.685)
Number of children	-0.11	-0.08	-0.17	-0.12	0.03	0.03
	(0.205)	(0.186)	(0.351)	(0.314)	(0.236)	(0.223)
Education: Reference schooling > 12 years						
Up to 10 years of schooling (d)	-0.97	-0.07	0.25	0.99	-2.15**	-1.18
	(0.671)	(0.643)	(0.941)	(0.900)	(0.968)	(0.924)
10 to 12 years of schooling (d)	-1.35**	-0.75	-1.78*	-1.00	-1.16	-0.54
	(0.609)	(0.574)	(0.927)	(0.881)	(0.816)	(0.771)
Subjective health at least good (d)		4.22***		4.92***		3.63***
		(0.614)		(1.027)		(0.748)
Chronic condition (d)		-0.03		0.81		-0.92
		(0.641)		(1.071)		(0.739)
Serious illness (d)		-1.45**		-1.47		-1.35
		(0.694)		(1.134)		(0.826)
Currently smoking (d)		-2.46***		-2.93***		-1.76**
		(0.549)		(0.849)		(0.720)
Constant	72.37***	72.76***	72.00***	73.13***	77.08***	77.13***
	(3.943)	(3.608)	(5.264)	(4.906)	(5.785)	(5.221)
Observations	3676	3676	1804	1804	1872	1872

Source: SAVE 2007 to 2009, own calculation.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Subjective Life Expectancy and Private Pensions

This table reports the subjective life expectancy separately for respondents with a Riester pension and those without any annuity contract.

	Women					
	Subjective LE		Relative LE		N	Age
	Mean	Std. Dev.	Mean	Std. Dev.		
No Annuity Contract	79.74	8.22	-0.85	4.96	981	44.74
Riester Pension	81.31	7.65	-0.48	5.39	733	41.29

	Men					
	Subjective LE		Relative LE		N	Age
	Mean	Std. Dev.	Mean	Std. Dev.		
No Annuity Contract	75.48	8.26	-0.81	5.53	1110	45.02
Riester Pension	76.38	8.79	-0.32	6.00	628	43.47

Table 5: Probit: Riesterownership Women

This table reports results of a probit regression of owning a Riester contract on subjective life expectancy and various covariates. The dependent variable is a dummy that equals one if a household owns a Riester contract and zero if the household owns no annuity contract. Observations where a household owns an annuity contract but not a Riester contract were excluded from the analysis. Coefficients and marginal effects are reported (robust z statistics in parentheses). Marginal effects (MFX) are evaluated at the mean of all variables. Coefficients, marginal effects and standard errors are calculated using 5 imputed data sets combined according to Rubin's Rule (Rubin 1987, 1996)). Specifications (1) to (3) include all three SAVE waves from 2007 to 2009 while specification (4) includes only observations from 2009. (d) indicates the change of a dummy variable from 0 to 1.

	(1)		**(2)**		**(3)**		**(4)**	
	Coefficient	MFX	Coefficient	MFX	Coefficient	MFX	Coefficient	MFX
Subjective life expectancy	0.01***	0.002***	0.01**	0.005**	0.01**	0.005**	0.02***	0.009***
	(0.005)		(0.005)		(0.005)		(0.009)	
Birthyear	0.10***	0.033***	0.10***	0.038***	0.10***	0.038***		
	(0.029)		(0.030)		(0.031)			
Age	0.08***	0.029***	0.06**	0.025**	0.06**	0.025**	-0.02***	-0.009***
	(0.029)		(0.030)		(0.030)		(0.008)	
Married (d)			0.34***	0.131***	0.34***	-0.133***		
			(0.094)		(0.094)			
Log adjusted net income			0.14*	0.056*	0.14*	0.056*		
			(0.083)		(0.083)			
Schooling: Reference more than 12 years of schooling								
Up to 10 years of schooling (d)			-0.01	-0.003	0.00	0.000	-0.21	-0.080
			(0.136)		(0.136)		(0.195)	
10 to 12 years of schooling (d)			0.03	0.013	0.04	0.016	0.05	0.019
			(0.113)		(0.113)		(0.156)	
Number of children			0.13***	0.052***	0.13***	0.052***		
			(0.034)		(0.034)			
Financial risk (d)					-0.13	-0.052		
					(0.090)			
Health risk (d)					0.08	0.029		
					(0.087)			
Subsidy Ratio 0-25 percent (d)							-0.70*	-0.235*
							(0.383)	
Subsidy Ratio 25-50 percent (d)							-0.60***	-0.228***
							(0.158)	
Subsidy Ratio 50-75 percent (d)							-0.44**	-0.161**
							(0.197)	
Subsidy Ratio 75-100 percent (d)							Omitted	
Constant	-207.68***		-197.11***		-198.22***		-0.71	
	(59.162)		(61.097)		(61.349)		(0.796)	
Observations	1717		1717		1717		494	

Source: SAVE 2007 to 2009, own calculation.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Probit: Riesterownership Men

This table reports results of a probit regression of owning a Riester contract on subjective life expectancy and various covariates. The dependent variable is a dummy that equals one if a household owns a Riester contract and zero if the household owns no annuity contract. Observations where a household owns an annuity contract but not a Riester contract were excluded from the analysis. Coefficients and marginal effects are reported (robust z statistics in parentheses). Marginal effects (MFX) are evaluated at the mean of all variables. Coefficients, marginal effects and standard errors are calculated using 5 imputed data sets combined according to Rubin's Rule (Rubin 1987, 1996)). Specifications (1) to (3) include all three SAVE waves from 2007 to 2009 while specification (4) includes only observations from 2009. (d) indicates the change of a dummy variable from 0 to 1.

	(1)		**(2)**		**(3)**		**(4)**	
	Coefficient	MFX	Coefficient	MFX	Coefficient	MFX	Coefficient	MFX
Subjective life expectancy	0.01	0.002	0.00	0.001	0.00	0.001	0.01	0.002
	(0.005)		(0.005)		(0.005)		(0.007)	
Birthyear	0.08***	0.031***	0.08***	0.031***	0.08***	0.031***		
	(0.028)		(0.030)		(0.030)			
Age	0.07**	0.027**	0.06*	0.021*	0.05*	0.021*	-0.02***	-0.008***
	(0.028)		(0.030)		(0.030)		(0.007)	
Married (d)			0.41***	0.153***	0.41***	-0.152***		
			(0.104)		(0.104)			
Log adjusted net income			0.35***	0.131***	0.34***	0.127***		
			(0.084)		(0.084)			
Schooling: Reference more than 12 years of schooling								
Up to 10 years of schooling (d)			-0.17	-0.037	-0.16	-0.061	-0.32*	-0.120*
			(0.124)		(0.124)		(0.171)	
10 to 12 years of schooling (d)			-0.10	-0.038	-0.09	-0.034	-0.20	-0.077
			(0.110)		(0.110)		(0.146)	
Number of children			0.15***	0.056***	0.15***	0.056***		
			(0.038)		(0.038)			
Financial risk (d)					-0.08	-0.029		
					(0.085)			
Health risk (d)					0.05	0.020		
					(0.081)			
Subsidy Ratio 0-25 percent (d)							-0.60	-0.203
							(0.381)	
Subsidy Ratio 25-50 percent (d)							-0.13	-0.050
							(0.226)	
Subsidy Ratio 50-75 percent (d)							-0.28	-0.102
							(0.272)	
Subsidy Ratio 75-100 percent (d)							Omitted	
Constant	-164.26***		-168.12***		-166.03***		0.49	
	(57.107)		(60.654)		(60.627)		(0.682)	
Observations	1647		1647		1647		460	

Source: SAVE 2007 to 2009, own calculation.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Mark Ups and Age

This table reports the subjective and statistical mark ups in the market for Riester contracts by age classes. The first row report the subjective life expectancy of the population without any annuity contract, the second row of those owning a Riester pension. The subjective mark ups are calculated as the difference between these two groups. The statistical mark ups are calculated as the difference between the life expectancies of the Statistische Bundesamt for the whole population and the life expectancies according to the estimations of the German Actuary Society (DAV). The first row reports the mark ups in the case where gender discrimination can be applied, the second and third row report the mark up for unisex contracts using a different composition and therefore applying a weighting factor for male and female life expectancies.

			Women				
Age class	26-30	31-35	36-40	41-45	46-50	51-60	All
No Annuity Contract	81.38	79.4	79.79	78.97	79.52	79.95	79.74
	(8.44)	(7.77)	(8.11)	(9.53)	(8.30)	(7.29)	(8.22)
Riester Pension	81.04	82.29	80.36	81.23	81.59	81.51	81.31
	(8.10)	(8.30)	(7.39)	(7.26)	(7.77)	(7.29)	(7.65)
Subjective Mark Ups:							
Difference "Riester - no Annuity"	-0.34	2.89	0.57	2.27	2.07	1.56	1.57
Statistical Mark Ups:							
No unisex	3.49	3.45	3.40	3.35	3.25	3.00	3.28
Unisex Riester I: 60% Women 40 % Men	1.46	1.46	1.42	1.42	1.37	1.25	1.36
Unisex Riester II: 80% Women 20 % Men	2.48	2.46	2.41	2.38	2.31	2.13	2.32

			Men				
Age class	26-30	31-35	36-40	41-45	46-50	51-60	All
No Annuity Contract	78.49	77.66	76.07	73.64	74.9	75.05	75.48
	(10.14)	(9.59)	(9.39)	(8.51)	(7.32)	(6.69)	(8.26)
Riester Pension	80.7	78.06	76.71	76.35	75.78	74.12	76.38
	(11.31)	(9.38)	(9.34)	(8.67)	(7.16)	(7.29)	(8.79)
Subjective Mark Ups:							
Difference "Riester - no Annuity"	2.21	0.40	0.64	2.71	0.87	(-)0.93	0.90
Statistical Mark Ups:							
No unisex	3.95	3.94	3.93	3.88	3.78	3.49	3.77
Unisex Riester I: 60% Women 40 % Men	7.00	6.94	6.89	6.78	6.6	6.11	6.66
Unisex Riester II: 80% Women 20 % Men	8.02	7.94	7.88	7.75	7.54	6.99	7.62

Table 8: Robustness Test for Contract Linkage

This table reports the subjective and relative life expectancy separately for respondents with a Riester pension and those without any annuity contract. The second row includes all observation where the household of the respondent owns at least one Riester contract. The third row (Riester Direct) includes only the observation where the contract can be directly allocated to the respondent.

	Women					
	Absolute LE		Relative LE		N	Age
	Mean	Std. Err.	Mean	Std. Err.		
No Annuity Contract	79.74	8.22	-0.85	4.96	981	44.74
Riester Pension	81.31	7.65	-0.48	5.39	733	41.29
Riester Direct	81.11	7.14	-0.69	4.84	423	40.09
	Men					
No Annuity Contract	75.48	8.26	-0.81	5.53	1110	45.02
Riester Pension	76.38	8.79	-0.32	6.00	628	43.47
Riester Direct	76.86	9.05	-0.31	6.22	374	42.77