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Personal assets and pension reform:

How well prepared are the Germans?

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This preliminary version uses a data set version without fully imputed savings and wealth data. All results are thus preliminary and must NOT BE QUOTED without the explicit authors' permission.

ABSTRACT

Demographic change presents major financing problems for the pay-as-you-go pension system. In response to these problems, the 2001 and 2004 German pension reforms reduced the statutory level of benefits from the pay-as-you system. The resulting pension gap is supposed to be filled by funded second and third pillar private pensions. This paper examines the extent to which households are in a position today to close this gap with their personal assets, assuming that they stick to their current saving and asset accumulation behaviour. Four critical factors are relevant to this issue: 1. the anticipated life expectancy, 2. the level of personal assets on retirement 3. the expected age of retirement, and 4. the anticipated interest rate. Our results indicate that about a third of German households will not be able to fill the pension gap unless they were to change their current savings behaviour.

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1. Introduction

The process of demographic change, and the fact that the benefits of a growing proportion of pensioners must be financed by fewer and fewer contributors, poses major problems for the German pay-as-you-go pension scheme. For this reason, the 2001 pension reform entailed a reduction in the level of statutory pensions and strengthened the funded second and third pillars of old-age pension provision. Financial incentives aimed at encouraging the accumulation of additional pension provision were introduced to enable contributors and pensioners to maintain current levels of old-age pension provision. Private, funded pension provision is less sensitive to demographic developments than pay-as-you-go state systems and, what is more, the accumulation process allows burdens to be spread more evenly across the generations than in the PAYG system. This means that the baby-boom generation will be in a position to prefinance part of their old-age pension provision. The calculations performed by the Rürup Commission on the basis of revised assumptions revealed that demographic developments will have a far more serious impact on the financial standing of the pension system than originally supposed at the time the Riester reform was introduced.[1] As a result, an increasingly important role is set to be played by supplementary private provision in the future.

The aim of partially replacing part of the first pillar of pension provision with voluntary private supplementary provision is an entirely new approach to the pension issue in Germany. At this juncture, so soon after the introduction of the Riester pension, there is little evidence available about how well accepted or how effective this measure has been. In the first year after the Riester pension scheme was introduced, around 5 million policies subject to state bonus were concluded, of which three million were private and two million occupational pension policies. Only one in five of manual and white-collar workers in the core 20 to 45 age group have so far taken out a policy and only a further 18 percent plan to do so (Schnabel 2003). These figures

[1] Commission on the long-term financial viability of the German social security system, referred to in brief in the following as the Rürup Commission..

have so far failed to come up to expectations. However, experience with similar pension products (such as Individual Retirement Accounts in the USA) in other countries suggests that similar supplementary pension products are not successful from one day to the next but require after a lengthy introductory period extending over several years. Nevertheless, there are a number of deficits in the current framework of private pension provision which probably impede the rapid acceptance of such policies on a large scale; discussion of reform proposals to address these problems is already underway.[2]

Two risks are inherent in the introduction of supplementary private pensions. On the one hand, the voluntary nature of supplementary pension provision represents a risk. It is by no means certain that households – and particularly low-income households – are willing and/or able to set aside additional savings for old age on a consistent basis. Empirical findings confirm that lower-income groups are less willing and able to make additional savings for their old-age pensions, and that this is exacerbated by these groups being less well informed about financial matters (Bulmahn 2003). However, it is precisely the households in this group – a group which as a rule can expect to receive a relatively low state pension, in many cases a very modest additional occupational pension, and which also has very few significant assets at its disposal – which would be most in need of additional sources of income in old age. The high rates of cancellation of building society contracts and whole life insurance policies – despite the high losses which such cancellations imply owing to low surrender values and up-front sales commission – suggest that there is also a very real risk that private old-age pension schemes may also be terminated.[3] While they are less damaging than cancellations, periods in which people find themselves in straitened financial circumstances – owing to unemployment, loss of earnings, or if they stay at home to bring up children – and consequently suspend payments to such schemes for a period of time are also of great significance as well as being highly probable.

A further risk – the reverse side of the opportunities involved – is the rate of return on policy contributions. While the rate of return on contributions to the pay-as-you-go system corresponds to the growth rate for total wages and the population, the rate of return on payments to private pension schemes is determined by interest rates on the capital market, whereby individual capital returns depend on the success or otherwise of specific investment vehicles. The critics of funded

[2] Refer, for example, to the discussion by Fehr, Kiesewetter and Myßen – "The Riester pension – a flop" in ifo-Schnelldienst 5/2003, the Bertelsmannstiftung Pension Report (2003), the proposals submitted by the Independent Expert Commission on Tax Reform and the proposals of the Rürup Commission.

[3] A survey in 2002 revealed, in Germany, that only 50 percent of policies are maintained through to the agreed term. Policies are most frequently cancelled shortly before people – in the 55-64 age group - enter retirement. The most frequently cited reasons are debts (26%), divorce (16%) and unemployment (13%) (Bertelsmann Stiftung 2003).

private pension provision emphasise the risk to which financial investments are subject, particularly in view of the recent performance of the capital market. One cause of concern is the so-called "asset meltdown" hypothesis according to which demographic developments will result in a significant decrease in demand for financial assets and consequently in the capital returns on such assets. The pertinent calculations do, however, demonstrate that the portents for a demographically-induced fall in rates of return are by no means as gloomy as predicted in the popular press (Börsch-Supan, Ludwig, Sommer 2003).[4] Nonetheless, the situation on capital markets since 2001 provides an unmistakable warning that lengthy periods of below-average, or even negative, capital returns are certainly a danger to be reckoned with.

Both of the risks referred to above have been investigated by Essig and Reil-Held (2003), who came to the conclusion that consistent savings towards private pension provision will be essential in the future in order to maintain living standards in retirement.

This paper examines whether households are in a position to close the gap in provision created by the reduction in statutory retirement pensions without changing their current patterns of behaviour, i.e. by continuing to save as they are doing at present. In this context, expectations regarding life span and retirement age play a decisive role; both these factors determine the requisite payout volume that needs to be covered by accumulated savings. The age of retirement coincides with the end of the savings phase available to households.

This paper is structured as follows: section 2 examines anticipated life spans. This section compares subjective life expectancy with the latest mortality tables published by the Federal Statistical Office and checks the validity and consistency of the results. Section 3 examines household assets according to their composition and volume as well as the level of assets available to such households at the onset of retirement. Section 4 calculates the statutory pension entitlements of households before and after the two reforms of 2001 and 2003. Section 5 presents the key results of our analysis: the potential payout from private assets is compared with the benefits provided by the public retirement insurance system. The degree to which the new pension gap can be closed over a pensioner's entire period of retirement is then assessed. Section 6 highlights the results of this study in summarised form and presents recommendations for economic policy.

This paper exploits data collected in the framework of the SAVE panel. The first wave of the panel was conducted in 2001 (cf. Börsch-Supan and Essig 2002) and new surveys are due to be

[4] Owing to demographic factors, overall capital market returns will fall by around one percentage point, assuming diversification within the EU region (Börsch-Supan, Ludwig and Sommer 2003).

performed every two years. An additional important variable – precise subjective life expectancy - was required for this paper and a further interview round was conducted in June 2004 for this purpose. Appendix 1 explains the structure of SAVE in more detail and presents the various subsamples which go together to make up the SAVE panel. This paper draws on two of these subsamples: one referred to in the following as TPI 2004[5], which contains the date on subjective life expectancy, and Random Route (RR) 2003[6], which represents the largest and very latest SAVE subsample.

SAVE is a household survey. Values such as savings, assets and income are therefore assigned to households as a whole rather than to individuals. This requires yet another assumption if individual variables such as age, age of retirement or life expectancy are to be related to household size. The assumption made is that, except in the case of households headed by a single woman, the head of household is always a man. This means that calculations at the household level are based on the life expectancy and anticipated age of retirement of the male head of household.

2. Life expectancy and anticipated age of retirement

A key component in the analysis of individual savings behaviour is subjective life expectancy. Individual subjective life expectancy is approximated statistically in a large number of microeconometric studies. This imposes the restriction on the approximations that individuals adapt their behaviour in line with observable statistical variables, such as survival probability in a life cycle model of consumption. There are two objections to this approximation. On the one hand, we might expect changes in life expectancy which cannot be found in the mortality tables as the latter, owing to their design, respond only slowly to environmental changes. On the other hand, the assumption of constant life expectancies for each cohort and sex ignores differences between individuals which certainly can be reflected in subjective life expectancy and which can lead to a corresponding change in behaviour. This means that it is easier to explain individual behaviour if these subjective differences can be integrated in the estimates; cf. Hurd and McGarry (1997). In order to take this into account, SAVE ascertains the individual life expectancy of the respondent and their partner by deploying a three-step question (cf. Appendix). The following analysis looks

[5] The abbreviation is derived from a subsidiary of TNS Infratest, the Wetzlar-based test panel institute which maintains a permanent panel ("access") from which this subsample was taken.

[6] Random Route refers to a method in which households are selected at random from a sampling frame with a specific starting point and continuing along a specified route. A frequently used method for the selection of sampling households.

at the extent to which these subjective results are comparable with the mortality tables of the Federal Statistical Office and how the results of various questions asked in 2001 and 2003 compare with those for the year 2004. The factors influencing individual life expectancy are also determined.

Owing to its complexity this topic needs to be dealt with in considerably more detail. As referred to at the beginning of this paper, life expectancies play an important role in old-age pension provision. We will return to this issue again in Section 5.

2.1 A comparison of SAVE IV descriptives and official statistics

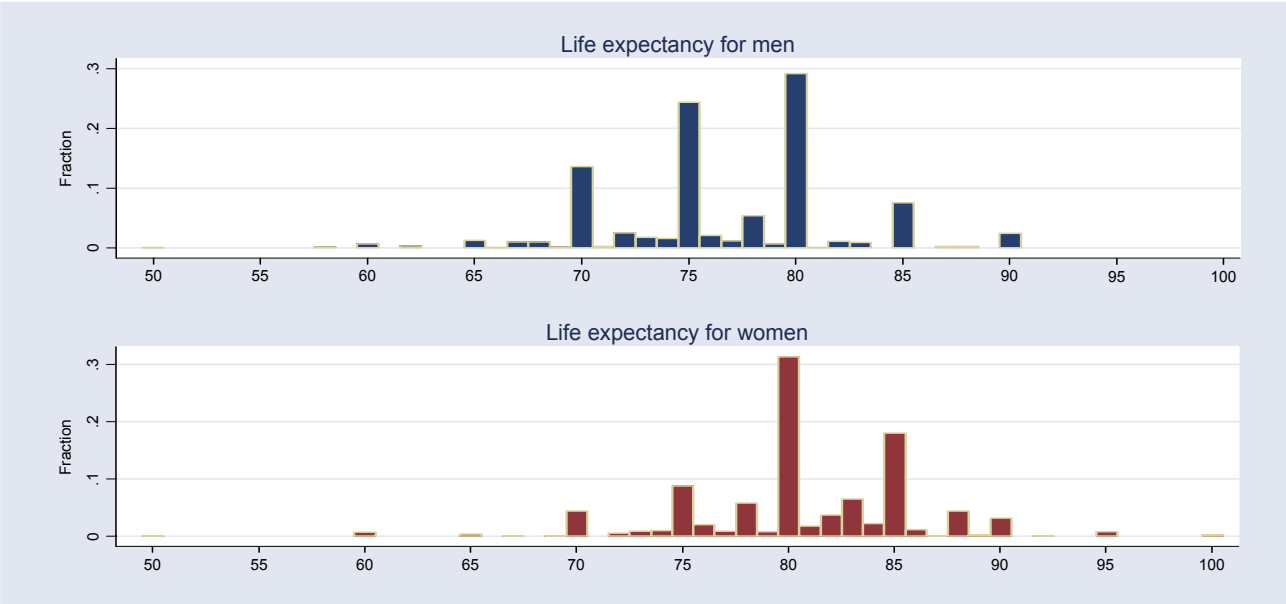
Asking respondents about their subjective life expectancy puts such people in the unpleasant situation of having to think about their own mortality. A striking feature of the post-interview comments offered by respondents is that these questions are felt to be more personal and disquieting than questions about their wealth and assets. While this is not reflected in people's willingness to respond – which at over 96% is in fact extremely high – their comments do suggest that this subject needs to be approached with a degree of caution. For this reason a multi-phase process was used to ascertain to what age respondents and their partners believe they will live. The first question asked was to what age the respondents believed men and women in the same cohort lived on average[7]. The next question was whether the respondents believed they themselves would live longer or shorter than the average for their cohort, followed by the request to express this difference in years. Respondents were then presented with four possible explanations for why they thought they would live longer or shorter lives than the average. [8]

Individual life expectancy is derived from the average age at death stated by respondents and the difference in years between this average age and the age to which they expected to live.

The interview procedure was repeated in the same way with the respondent's partner.

[7] Cf. Figure 1, and Table 1 which shows the average anticipated life expectancy of men and women.
[8] One option was an open field in which other reasons could be entered.

Figure 1: Average life expectancy by sex



Note: Values weighted according to age and income.
Source: SAVE TPI 2004

Figure 1 shows the differences in the anticipated average age at death of men and women. Most of the responses are concentrated around the so-called focal points[9] between age 70 and 85; in the case of women, there is a discernible shift in the age estimates to the right. The modal value is 80 in both distributions, however. Table 1 summarises the results in descriptive form.

Table 1: Average life expectancy by sex

	Men	Women
Mean value	76.71	80.70
Median	76	80
Standard error	0.25	0.25
Mortality table values 2000/2002	75.38	81.22

Note: Weighted according to age and income.
Source: SAVE TPI 2004

The mean values for average life expectancy by sex in SAVE are fairly close to the values in the mortality tables drawn up by the Federal Statistical Office; with a difference of 0.5 years, the life expectancy of women approximates very closely in both sets of data. The difference in life expectancy between men and women is underestimated, however. The difference of 3.99 years is 1.85 years less than that in the mortality tables. It is striking, however, that the differences in the absolute values between the individual and mortality table values are as small as they are given that 75.38 or 81.22 years of age are the life expectancy values for people born in the year 2002,

while the SAVE survey asked for the anticipated life expectancy of people *of the same age*. In combination, Table 1 and Table 2 illustrate what households *understand* by individual life expectancy. The longevity figures which typically find their way into the media reflect the projected life expectancy of the recently born, and because these life expectancy values are based on period mortality tables they are entirely fictitious, with the life expectancy of newborns being thrown into the equation with the same weight as that of a centenarian.[10] Mortality in 100 years is unlikely to be same as it is today.[11] At the same time, lifespan and remaining life expectancy figures which are based on mortaliy tables suggest that life expectancy actually *increases* as people grow older.[12] This is due to the interaction of two opposing effects. On the one hand, the cohort effect - which implies lower life expectancy for older birth cohorts and thus for people who are already in the older age groups – means that life expectancy declines in old age. On the other hand, by the age of 50, for example, people have already survived a number of risks (infant mortality, the risks of various illnesses). People who have already lived longer than the average expected lifespan, for example, will also have significantly higher overall life expectancy.

There are therefore two effects which lead to an underestimation of individual life expectancy. Firstly, life expectancy figures which are based on mortality tables merely describe current population mortality. Secondly, respondents underestimate the effect of having already survived specific risks by the time they reach a certain age. Table 2, which shows individual life expectancy[13] according to age group, clearly demonstrates how the latter effect is neglected. Younger households anticipate living to a significantly older age than do older households.

This underestimation of individual lifespans can lead to serious errors being made in the financing of retirement income. In this context, refer to Section 5.

Table 2: Individual life expectancy (own and that of partner) by sex

	Men					
	<30	30-39	40-49	50-59	60 and older	All
Mean value	81.41	77.86	75.18	73.51	78.86	76.80
Median	80	80	75	75	80	78
Standard error	2.551	0.753	0.680	0.627	0.593	0.343
N	9	110	127	112	106	464

[9] Values which represent a multiple of a specific number, such as 10 or 5.
[10] Life expectancy at birth states the average number of years a specific group (men/women) will live if mortality rates remained unchanged throughout a newborn's life. As a result, the construction of this value means that it encompasses all age groups. Cf. CIA factbook, http://www.cia.gov/cia/publications/factbook/docs/notesanddefs.html#2102
[11] Refer to Oeppen and Vaupel (2002) who demonstrate a roughly linear increase in average life expectancy of around 0.25 years per year over the last 160 years.
[12] Refer to von Gaudecker (2004) for a discussion of various ratios and concepts for measuring life expectancy.
[13] This is average life expectancy ± individual difference.

Mortality table values 2000/2002[a)]	75.97	76.66	77.33	78.64	83.81	78.37
			Women			
Mean value	87.74	80.87	80.10	80.13	81.49	80.84
Median	85	80	80	80	81	80
Standard error	2.422	0.619	0.640	0.540	0.547	0.291
N	5	98	112	110	101	426
Mortality table values 2000/2002[b)]	81.69	82.03	82.42	83.22	87.06	87.06

Note: Weighted according to age and income.
Source: SAVE TPI 2004
a), b) a), b) The mortality table values increase as people grow older because they have already managed to survive to a specific age. The life expectancy of a centenarian, for example, is not 75.4 (as negative probabilities, like time machines, do not exist), but 101.96.

Another interesting question is the extent to which the respondents believe that their income position exercises an influence on their individual life expectancy. Gaudecker (2004), for example, identifies socioeconomic status as the key factor explaining differences in mortality in Baden-Württemberg, and Reil-Held (2000) uses Socio-Economic Panel data to show how income and life expectancy are linked. Table 3 shows that the differences between four income groups are negligible, however. In other words, the respondents do not associate an improved income situation with a lower mortality risk.

Table 3: Individual life expectancy according to income quartiles

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
		Men		
Mean value	76.58	75.72	77.16	77.03
Median	77	75	76	76
Standard error	0.76	0.84	0.87	0.85
Number	102	79	79	81
		Women		
Mean value	81.8	79.84	80.3	81.82
Median	85	80	80	80
Standard error	0.97	1.71	1.25	0.65
Number	28	23	37	36

Note: Weighted according to age and income.
Source: SAVE TPI 2004

Another interesting question is whether there was a divergence in response behaviour between the years 2001 and 2004. While the question about average general life expectancy was changed (and respondents were asked for a specific figure rather than age groups), the question about relative individual life expectancy was identical at the time of both observations.

Table 4 shows the figures produced by households or individual respondents in both years only in response to the question on relative life expectancies for the years 2001 and 2004. There may

be two reasons for changes in the information provided about respondents' relative life situation. Certain things may well have actually changed in a respondent's life, which represent new information for the estimation of a person's individual life expectancy. On the other hand, responses may simply vary owing to the fact that a period of three years lies between both interviews. All in all, Table 4 shows that the assumptions regarding relative life expectancy are essentially stable over time. Zaller (1992), for example, examined how opinions changed over a period of four months. The responses – selected from a choice of 5 categories (one of which, however, was a "don't know" category) were identical in 48% of cases (cf. in this context the diagonals in Table 4.).

Table 4: Comparison of relative and average life expectancy[a)]

	Relative life expectancy 2001			
Relative LE[b)] 2004	Shorter	Exactly as long	Longer	Total
Shorter	32	31	1	64
	55.2%	8.9%	1.4%	13.4%
Exactly as long	25	278	41	344
	43.1%	79.7%	58.6%	72.1%
Longer	1	40	28	69
	1.7%	11.5%	40.0%	14.5%
Total	58	349	70	477
	100.0%	100.0%	100.0%	100.0%

a), b) The precise wording of the question was: "If you think of your own situation and the state of your health, do you think that, in comparison to the men (if subject male) / women (if subject female) of your age group, you will live shorter, approximately as long as, or longer than the average?"
Source: SAVE TPI 2001 and 2004; panel structure.

The descriptive results and the discussion of the implications of results generated by mortality tables show that households tend to underestimate their own life expectancy. This is likely to prove a pleasant surprise in old age for some households – the surprise may however be accompanied in some cases by a recognition that one's plans have been too short sighted. We will return to this issue later.

2.2 Regression results

The questions on precise subject life expectancy were asked for the first time in the SAVE survey in the TPI 2004 subsample. This subsample is about a quarter of the size of the RR 2003 subsample, although the latter only surveyed general anticipated lifespans in relation to general life expectancy categories. This subsample can still be used if certain prerequisites are met, however, by imputing individual life expectancy data. This section therefore presents the regression

results from the TPI 2004 subsample; the dependent variable is the subjective life expectancy, explanatory variables are a set of observable individual and household characteristics. The estimated coefficients of these regression results are therefore used in the same set of independent variables for subsample RR 2003 in order to impute individual life expectancies in the latter. Forecasting life expectancy would only be justified by the high explanatory power of the regression. The following analysis will show whether this can be reliably assumed.

The multivariate regression analysis broadens the previous bivariate tables to enable the influence of a number of different factors to be measured at the same time. Our analysis includes potential influencing factors such as permanent income[14], age, educational and occupational variables, as well as further explanatory variables such as optimism, health expectations, and current or previous smoking behaviour. The results are detailed in Appendix 2 Table 23 (for respondents) and Table 24 (for partners). Respondent variables were also used for the regression of the life expectancy of the partner, as the data was given by the respondent on behalf of the partner and the characteristics of the respondent could consequently influence the data provided for the partner.

The results can be summarised as follows. The age effect is significant in both regressions, with age difference[15] also being significant for the partner regression. Interestingly enough, income and education variables are not significant. This contradicts the findings of Gaudecker (2003), for example, according to which the influence of socio-economic status on mortality appeared to be strengthened or even caused by the level of educational attainment. Women have a considerably longer life expectancy in both regressions, even more so in the regression for the partner (4.8 vs. 3.4 years). While smokers are obviously not yet fully aware of the potential curtailing of their lifespan by their habit, the message seems to have got home to former smokers who anticipate living 1.2 years less than average.

Also significant in the partner regression are the expectations regarding the development of respondents' own and their partners' health situation. The effect of self-assessed optimism is also significant: the higher this value is (on a scale from 0 to 10), the higher life expectancy is. Four dummy variables offering possible explanations of relative life expectancy are also included, each with a high explanatory value of, on average, plus or minus four years.

[14] The construct 'permanent income' is intended to eliminate potential transitory fluctuations in gross or net monthly income and to obtain a better planning variable for households. The method of estimating permanent income is based on the proposals of King and Dicks-Mireaux (1982) and is described in more precise terms for the SAVE data in Essig (2004).

[15] This may reflect the hope that an older partner does not die before oneself.

In summary, the variables very effectively map individual life expectancy (50% for a small cross-section). Cohort effects of life expectancy are recognized, as shown in the overall negative significant age effect (with a minimum of 45 years), but not the opposite effect of risks which have already been survived by people who have reached a ripe old age (cf. Section 2.1).

As referred to at the beginning of this section, imputed life expectancy in another subsample or data record is only legitimate if the regression has sufficient explanatory power. For a small cross-sectional analysis, the explanatory variable R^2 is – at over 50% - very high. As explained in Appendix 1, we will broaden the basis of the data used to calculate the asset position, pension claims (and gaps in provision) at retirement age by drawing on the SAVE Random Route Sample 2003 subsample.

2.3 Anticipated age of retirement and replacement rates

This section looks at the second variable determining the length of a person's retirement - the anticipated age of retirement. The age of retirement has been a protracted topic of discussion in Germany over the last twelve months as more and more observers have pointed out that the average age of retirement is too low. Table 5 shows the relevant figures from the Socio-Economic Panel and VDR, both of which demonstrate an age of retirement of 60 – significantly earlier than the state pension age of 65. The anticipated ages of retirement in SAVE are also shown, these being significantly higher than the current figures.

Table 5: Actual and anticipated age of retirement

	SOEP 1999[a)]		VDR 2001[b)]	SAVE[c)]					
				TPI 2001[d)]		TPI 2004[d)]		RR 2003	
	Men	Women	Men and women	Men	Women	Men	Women	Men	Women
Mean value	59.7	60.7	60.2	63.1	61.7	64.4	62.9	63.3	63.0
Median	N/A	N/A	N/A	65	60	65	64	65	65
Std. dev.	N/A	N/A	N/A	3.19	3.01	2.55	3.14	4.09	3.79
Std. error	N/A	N/A	N/A	0.21	0.31	0.18	0.34	0.18	0.14
Number				223	92	203	84	547	702

Note: Weighted according to age and income in SAVE; figures exclude freelance professionals and the self-employed.
a) Observed values *Source:* Berkel and Börsch-Supan (2003)
b) Observed values. *Source:* Own calculations / with grateful acknowledgement to Christina Benita Wilke for the data provided.
c) Estimated values
d) Panel comparison: Only households / respondents interviewed in both waves

The first SAVE survey was carried out before the introduction of the "Riester" pension scheme. Discussion of the pension system came to the attention of large sections of the population in 2003 in the wake of the work of the "Rürup" Commission. The quintessence of the discussion is also reflected in the data: the average age of retirement for men in 2004 is estimated to be 1.5 years later, while the average expected pension replacement rate fell by 5 percentage points. Table 6 shows the expected age of retirement and replacement rates according to age group. While the age of retirement differed only insignificantly between the group of under 30-year-olds and the group of 50-59-year-olds in the year 2001 among re-interviewed male respondents, the difference of 3.6 years in the year 2004 reached the significant 5% mark. However, the anticipated pension replacement rate for this group, which also increased, is unrealistic.

Table 22 shows the results of the multivariate regression analysis for the age of retirement and relative pension levels. Education variables are positively significant, which could mean one of two things. People with higher educational qualifications may really retire later, or they may simply be more aware of the normal age of retirement of the future. The dummy variables for the Random Route 2003 subsamples and TPI 2004 are also significant. On average, respondents for this subsample anticipated retiring between 0.6 and 1.2 years later. Particularly for the TPI 2004 variable, this is clearly a result specific to this particular year, during which pension reform was a focal point of public discussion. The significant age effect [16] is positive with a maximum of 71 years. This means that younger households expect to receive relatively lower value pensions than older households – again probably due to the current pension reform discussion.

Table 6: Anticipated age of retirement and pension replacement age according to age

	TPI 2001[a)]				TPI 2004[a)]				2003 RR			
	Men		Women		Men		Women		Men		Women	
Age	Retirement	Rate[b)]	Retirement	Rate	Retirement	Rate	Retirement	Rate	Retirement	Rate	Retirement	Rate
Under 30	63.8	58.2%	63.4	54.0%	66.0	65.0%	62.0		63.6	50.9%	63.7	48.0%
30-39	63.7	59.9%	61.2	58.7%	65.2	53.3%	63.2	53.1%	64.0	57.6%	62.8	52.2%
40-49	62.6	64.9%	61.4	62.3%	64.0	56.5%	62.8	43.9%	62.9	59.2%	62.8	59.5%
50-59	62.1	63.6%	60.9	57.1%	63.4	64.0%	62.3	53.9%	62.8	62.2%	62.8	61.2%
60 and older	63.0	67.0%	62.5	59.0%	64.0	52.6%	63.9		63.8	60.6%	63.2	60.7%

Note: Weighted according to age and income in SAVE; figures exclude freelance professionals and the self-employed.
a) Panel comparison: Only households / respondents interviewed in both waves
b) Pension replacement rate in relation to last income received prior to retirement

[16] Age and quadratic age are jointly significant.

3. Household assets

This section describes the asset situation of households based on the data provided by both SAVE subsamples TPI 2004 and Random Route 2003. We begin by presenting the current asset situation and go on to describe how the asset situation can be calculated at the age of retirement.

3.1 Descriptives for SAVE IV and SAVE RR 2003

Table 7 shows the value of households' financial, real estate (owner-occupied and other real estate) and total assets. While the mean values are very close to each other, the underlying distribution of assets differs in both subsamples. The median for total assets in TPI 2004, for example, is thirteen times the value of RR 2003. This is partly to do with the fact that 15% of households in TPI 2004 and 32% of households in RR 2003 have 0 or negative assets.

A median of 0, for example, for real estate means that at least half of all households do not own any residential property at all.

Table 7: Financial, real estate, and total assets

	Financial assets		Real estate assets		Total assets	
	TPI 2004	RR 2003	TPI 2004	RR 2003	TPI 2004	RR 2003
Mean value	23805.1	21062.73	151863.3	130270	166507.2	140014.5
Median	4000	2300	100000	0	119000	9000
Std. error	2791.49	2791.49	8955.31	5930.80	12768.12	14105.88
Number	306	1266	469	1901	234	1109

Note: Weighted according to age and income.

Table 8 and Table 9 show which asset categories go to make up total assets and demonstrate that owner-occupied property makes up by far the largest element of people's assets. This is certainly noteworthy in the light of people's asset position upon entering retirement. Residential property is seldom divisible. In other words, it is not possible to sell off a house or flat bit by bit[17]. Nor is post-retirement communal living or flat-sharing likely to be to everyone's taste. It is of course possible to sell one's property and to reshuffle one's assets by converting real estate into financial wealth. However, this also entails a substantial increase in the household's consumption expenditure in the form of rental payments for alternative rented property. Bearing in mind the

[17] Excluding the renting out of accessory apartments, for example.

value attached to home ownership in Germany, this latter option obviously cannot be in the interests of owner-occupiers.

Table 8: Relative value of assets: [a] SAVE TPI 2004

	Owner-occupied property	Other real estate	Business assets	Financial assets	Loans	Other assets
Absolute values						
Mean value	60.4%	4.9%	0.2%	33.3%	40.7%	1.3%
Median	79.0%	0.0%	0.0%	11.4%	0.0%	0.0%
Std. error	2.8%	1.0%	0.1%	2.8%	17.8%	17.8%
Number	211	211	211	211	211	211
Conditional values for possession of asset category						
Mean value	81.7%	35.0%	8.5%	39.1%	99.9%	10.9%
Median	93.5%	30.5%	4.6%	17.6%	20.0%	4.7%
Std. error	1.9%	3.6%	3.1%	3.0%	38.2%	3.8%
Number	150	39	6	187	109	32

Note: Weighted according to age and income.
a) Value of specified assets divided by the value of gross total assets (total assets – loans).

Table 9: Relative value of assets: [a] SAVE RR 2003

	Owner-occupied property	Other real estate	Business assets	Financial assets	Loans	Other assets
Absolute values						
Mean value	43.2%	3.6%	1.6%	50.1%	38.7%	1.5%
Median	28.6%	0.0%	0.0%	29.4%	0.0%	0.0%
Std. error	1.6%	0.5%	0.3%	1.6%	12.5%	0.3%
Number	787	787	787	787	787	787
Conditional values for possession of asset category						
Mean value	83.7%	35.5%	32.4%	56.9%	165.7%	16.8%
Median	91.3%	30.0%	25.7%	77.1%	25.6%	7.5%
Std. error	1.0%	2.6%	4.6%	1.7%	51.4%	2.9%
Number	404	79	40	694	192	73

Note: Weighted according to age and income.
a) Value of specified assets divided by the value of gross total assets (total assets – loans).

3.2 Assets on retirement

Assets on retirement will differ from current assets owing to the influence of two factors. On the one hand, assets will bear interest at a nominal rate *i*. On the other, account must be taken of general inflation. The purchasing power of 1 euro will not be the same in ten years' time as it is

today. In this respect, the required rate of return *r* equals the difference between the nominal rate of interest *i* and the rate of price increase *p*. We assume that all assets are subject to a constant effective interest rate and base our calculations on the required rate of return of 2.8% per annum used by the Rürup Commission.

The interest period is the difference between the expected age of retirement and the present age of the head of household. We assume that no asset consumption takes place prior to retirement. Compound interest effects therefore generate a substantial increase in assets during the period prior to retirement. At an effective rate of interest of 2.8%, for example, the value of assets doubles over a period of 25 years.

Current flows of savings in each period up to retirement are added to existing assets as described in the following. SAVE surveys total household savings for the previous year. These annual savings are then recalculated and spread evenly across the year as monthly savings figures. We also assume that these monthly savings remain at a constant level right up to retirement and that they also yield 2.8% p.a. interest.

The entire asset position of the household on entering retirement is therefore determined by the assets with accrued interest added plus the monthly savings and interest on such savings.

Appendix 3 summarises the relevant financial equations.

4. Old-age income provision and claims on the public retirement insurance system

This section describes households' claims on pension benefits from the public retirement insurance system before and after the reform proposals of the Rürup Commission adopted for 2005 and which involve an incremental reduction, as a response to demographic trends, in relative pension levels. Section 4.2 calculates a household's hypothetical annuities[18] based on assets saved prior to entering retirement. In this framework we distinguish between total assets and financial assets: real estate assets typically form the largest share of a household's assets portfolio. It is quite a different matter liquidating real estate assets than typical financial assets.

This section is structured as follows. 4.1 outlines the method used to calculate individual household pension entitlements. Section 4.2 explains how the critical variables used to calculate pen-

[18] The term annuity as used here differs from its usual actuarial definition in that there is no longevity risk if the household reaches precisely its anticipated life expectancy. Life annuities are typically based on mortality tables.

sion entitlements are determined and section 4.3 briefly elucidates the presentation format and presents the results of the SAVE data for household pension entitlements.

4.1 Calculation method

We calculate claims on the public retirement insurance system on the basis of individual data relative to the entitlement position of a benchmark pensioner ("Eckrentner").[19]

Two values are needed in order to calculate individual entitlements from the public retirement insurance system: the number of insurance years (calculated on the basis of the anticipated age of retirement and estimated age at which people's working lives begin[20]), and average earned income over an entire working life.

The pension entitlement RA per household *HH* for the year 2004 is therefore as follows:

$$RA_{HH} = \frac{\left(\mathrm{E}\left[\mathrm{REA}_{\mathrm{HH}}\right] - \mathrm{EEA}_{\mathrm{HH}}\right)}{45 years} \bullet \frac{\varnothing \mathrm{EK}_{HH}}{\varnothing \mathrm{EK}_{BEV}} \bullet RA_{ER} \bullet AF \qquad (1)$$

where

$\mathrm{E}\left[REA_{HH}\right]$ = anticipated age of retirement of the household *HH*

EEA_{HH} = Age at which household begins its working life *HH*

$\varnothing EK_{HH,BEV}$ = Average earned income of household *HH* or of the population

RA_{ER} = Benchmark pensioner's net pension entitlement (€1,068.40 in 2002)

AF = Adjustment factor used to calculate deductions or additional credits in the case of earlier or later retirement

We draw on the standard age of retirement of 65, disregarding total and partial disability rules. The earliest possible age of retirement is currently age 63 and will be reduced by the 1999 Pension Reform Act in two-monthly steps to the age of 62 [21] by 2010 to 2011. Monthly deduc-

[19] A benchmark pensioner has worked and paid pension contributions for 45 years – precisely in accordance with the average for all contributors – and has consequently had one earnings point per year credited to his or her pension account. Average income in 2002 was €28,949, or net monthly average earnings of €1,531.92. 45 earnings points currently entitle a benchmark pensioner to a gross monthly pension of €1,175.85 euros in the western Germany and €1033.65 in the new eastern states or, after deducting health and long term care insurance contributions of €89.77, a net monthly pension of €1,086.08. Refer to the publications of the German Federal Social Insurance Office for Salaried Employees (BfA).

[20] People are assumed to begin their working lives at the following ages: age 16 for those with a lower or intermediate secondary school leaving certificate, aged 20 for those with the 'Abitur' upper secondary school leaving certificate, and age 25 for those with university or polytechnic degrees. If the head of household has been unemployed for a period longer than one month, an additional year of work is deducted.

[21] Which implies a pension benefit deduction of 10.8%

tions/credits amount to 0.3/0.5% per month or 3.6/6% per year. While there is no statutorily defined upper age limit for retirement, the actuarially unfair credits do not, however, offer any incentive for people to postpone their retirement decisions.[22]

Equation (1) describes the deductions or credits received by a household compared with a benchmark pensioner depending on relative income, relative number of insurance years and anticipated age of retirement.

We calculate the pension gap as follows.

Gross pension levels prior to the Riester reform and the introduction of the sustainability factor, as well as the values after both reforms had taken full effect, were calculated using the MEA-PENSIM model (for a description of the simulation model, refer to Wilke (2004)). Post-reform pension value is estimated at 86.6% of the pre-reform gross pension value where the 2004 Pension Reform Act provisions have taken full effect, which will be the case from the year 2030 onwards. Calculating net pension levels is somewhat more complicated. The new pension taxation rules make it very difficult to make any general assumptions in this respect. For the sake of simplicity we therefore assume that the percentage decrease in gross pension levels is reflected analogously in net pension levels. Based on these assumptions the reduction factor, RF, will therefore be specified in the following way:

$$RF = f(\text{cohort, pension entry age, life expectancy}) \qquad (2)$$

See Table 10 clarifying examples of (2).

Table 10: Pension levels after the year 2003 relative to pension levels before the pension reforms 2001 and 2004

	Age				
Life expectancy	40	45	50	55	60
70	85.7%	87.7%	89.7%	91.6%	93.2%
75	85.0%	86.9%	88.7%	90.6%	92.4%
80	84.5%	86.3%	87.8%	89.7%	91.5%
85	84.3%	85.7%	87.1%	88.8%	90.6%

Note: Assumed retirement age of 65 years. Early retirement leads to slightly *higher* values since the relative pension level declines with time, and with earlier retirement one would get the higher values. Ex.: At retirement with 61 years of a today 40-year-old with life expectancy of 70 years, shown values would be higher by 0.5%, for a 60-year-old by about 1%. These values are only relative numbers and are contrasted by the pension reduction factor for early retirement. *Source:* MEA-PENSIM.

The gap in provision, DL, is thus calculated as follows:

[22] Börsch-Supan et al. (2004) calculated the incentive-neutral deductions and credits at around 7% p.a. Refer also to Börsch-Supan (2004) for a definition of incentive-neutral deductions.

$$PG_{HH} = RA_{HH} \, x \, RF = RA_{HH} \bullet (1 - RF) \quad (3)$$

where PG_{HH} indicates the pension gap of household HH due to the pension reforms. (3) suggests that the pension gap is equally great in percentage terms for all households, as was intended by the Commission on the long-term financial viability of the German social security system ("Rürup Commission").

4.2 Specification of individual variables

The anticipated age of retirement of a household HH, $\mathrm{E}[REA_{HH}]$, is derived from the data record "What are your expectations? – At what age do you expect to retire or receive an old-age pension?" In this context we draw on the earliest possible retirement age under future legislation – age 62, with a pension deduction of 10.8%. As there is no statutorily stipulated upper age limit, higher figures are not corrected. The deductions and credits referred to in section 4.1 are taken into account to determine the deduction factor AF.

The age at which people started their working life EEA_{HH} is not surveyed in the SAVE study. We therefore assume the following three labour market entry ages, in relation to educational attainment: age 16 for those with a lower or intermediate secondary school leaving certificate, age 20 for those with the 'Abitur' upper secondary school leaving certificate and 25 for those with a university or polytechnic degree.

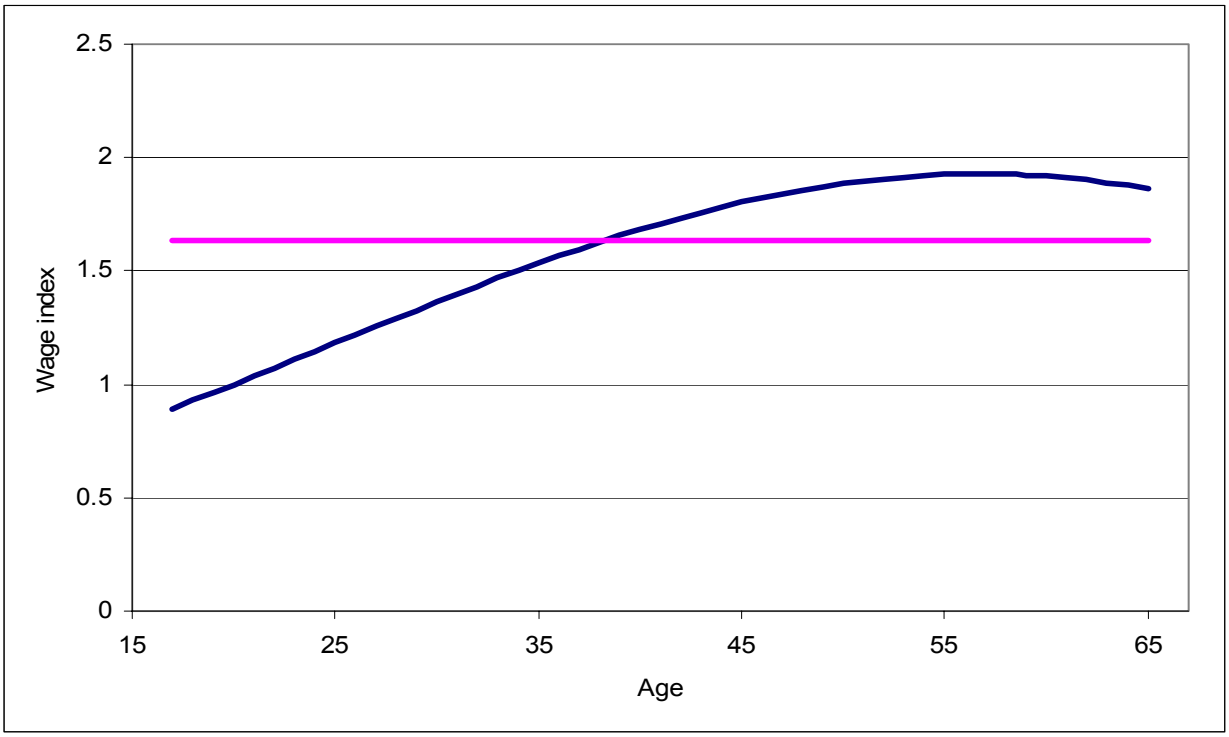
The length of a person's working life, and thus the number of years during which contributions are paid, the difference between $\mathrm{E}[REA_{HH}]$ and EEA_{HH}, is reduced by one year if the employment history of the head of household includes a period of unemployment of longer than six months.[23]

The household's average earned income, $\varnothing EK_{HH}$, is determined by estimating the age profile of the income received according to the estimate of permanent household income. The household's earned income on retirement is thus determined and compared with the average value over the

[23] This ultimately simplifies the actual statutory rules. In fact, unemployed people in receipt of benefits from the labour office are also covered by the pension insurance scheme. Contributions to the scheme are paid by the labour office. The relevant contributions for those in receipt of unemployment benefit are levied on the basis of 80% of their last earned income. The contributions for unemployment assistance claimants are only levied on the basis of the assistance amount. People drawing old-age pensions or receiving total disability benefits are no longer entitled to benefits from the labour office, even if their entitlement period has not yet expired. The situation is quite different for those in receipt of partial disability benefits. In this case the labour office continues to pay unemployment benefit in addition to disability benefits, but only up to the additional earnings limit.

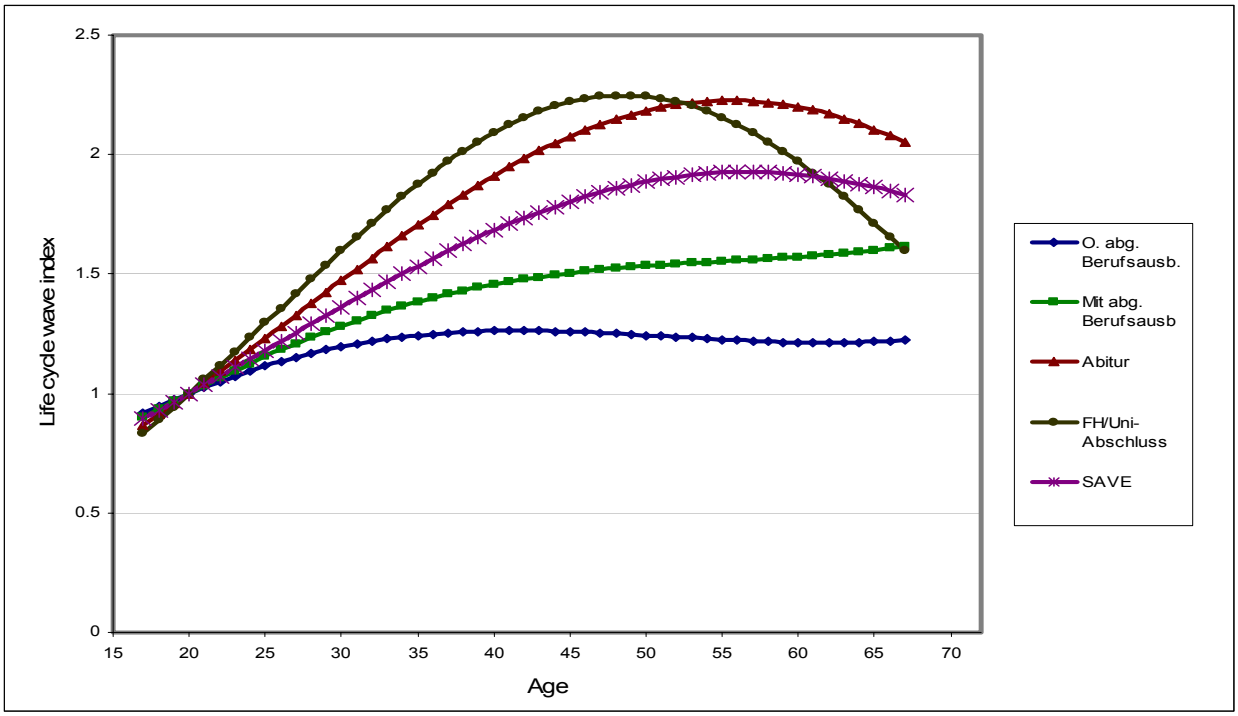
working life. The estimates reveal that earned income is 5% higher than average income at the age of retirement (cf. Figure 2).

Figure 2: Estimated earnings curve over the entire working life



Notes: Normalized values: Indx is 1 at age 20. The average figure is 12.3% below that at age 65 (normal age of retirement).
Source: All *SAVE* data without retired, self-employed freelancers.

Figure 3: Comparison with results from Fitzenberger et al. (2001)



Notes: Normalized values: Index is 1 at age 20. Wage projections except SAVE refer to results from Fitzenberger et al. (2001).

The retirement ages elicited in the survey were in many cases considerably lower than the future earliest state pension age of 62. These values were therefore replaced by the minimum pension age.

Deductions are frozen at 10.8% for these cases. If no pension entry age was given by respondents, an entry age of 61 was assumed.[24]

Households are typically subject to larger uncertainties and exogenous fluctuations at the beginning of their working lives than they are later on.[26] All the results in Sections 4 and 5 therefore relate to households in the age 40 or older age group and are not yet retired.

4.3 Results

The actual meaning of the figures and how they should be interpreted are now briefly discussed before the results themselves are presented.

[24] If the respondent is already older than 61 and not yet retired: pensions entry age = age + 1

Projected future pension benefits can basically be regarded as nominal, real or economic status-preserving euro amounts. These three different presentation options differ by the way in which future inflation or, additionally, wage trends are accounted for.[25] It is also possible to present possible (future) pension benefits in relation to (future) income. While this enables explicit adjustments for inflation to be avoided, the disadvantage is that it is necessary to know what percentage rates mean, which is unfortunately not necessarily the case for many households.

The status-preserving variables for pension data are consequently values which specify how much the household would receive if it were to enter retirement today, taking account of all other outstanding future contributions. This does away with the need for any further mental acrobatics for general or wage inflation adjustments and the variables can therefore be compared directly with today's income.

Table 11: Pension levels prior to and after the impact of the 2004 pension reform

	Current values		Post Rürup		Pension gap
	Pension level	Relative to pred. last net income	Pension level	Relative to pred. last net incom	In today's Euros
Mean value	1393.9	58.6%	1247.6	52.2%	156
Median	1352.8	57.7%	1211.5	51.1%	144.4
Std. error	17.1	0.3%	15.2	0.3%	2.5
Number	897	897	875	875	875

Note: Weighted values.
Source: SAVE RR 2003 and TPI 2004. Self-employed and freelancers are excluded.

Table 11 shows that the reform measures entail a 13% reduction in net pension levels in current euro amounts – i.e. around 260 € or one fifth of current pension levels.

[25] Cf. Börsch-Supan, Ludwig and Reil-Held (2004), who discuss the presentation options in considerable detail and emphasise the importance of how each of them are used. The way these are presented can have a huge influence on the way a person's individual pension future is perceived as is the case, for example, with pension notifications sent by the BfA. The latter present a picture of future nominal pension entitlements and include a statement that no adjustments have been made for inflation. The values as stated are therefore higher than many people expect, which can in turn result in misguided economic behaviour.

5. Private pension provision: how the pension gap can be closed

This section compares the post-retirement income sourced from annuitized assets (cf. section 3) with claims on the public retirement insurance system, and considers in particular whether private asset positions can compensate for the pension gap.

Section 5.1 calculates a household's hypothetical annuities [26] based on assets saved prior to entering retirement. In this framework we distinguish between total and financial assets: real estate assets typically form the largest share of a household's assets portfolio. It is quite a different matter liquidating real estate assets than typical financial assets, however. Section 5.2 compares private savings accumulated by the age of retirement with the pension gap and examines to what extent households are in a position to close this gap.

Section 4.3 argues that status-preserving variables offer an appropriate means of presenting future income and assets positions. Similarly we make adjustments to the development of assets in order to ensure that personal assets are not overestimated in comparison with pension developments. Future assets are therefore adjusted for wage growth g by dividing them by $(1+g)^{Rentenieintrittsalter_{HH\#}}$ or using the approximative required rate of return $cr = r - g$.

Section 5.2 compares private savings accumulated by the age of retirement with the pension gap and examines to what extent households are in a position to close this gap. The starting point in the analysis is the subjective life expectancy. But since it can be presumed thathouseholds systematically underestimate their life expectancy, results from alternative values are also shown, including the official life tables.

After the sensitivity analysis for life expectancy values, Section 5.3 shows the results from Section 5.2 in dependence of the parameters r, the real interest rate, and *g,* the real wage growth rate.

Section 5.4 shows the ability to fill the pension gap in dependence of three household characteristics: age, income, and schooling.

[26] The term annuity as used here refers to individual life expectancy and is not based on the life expectancy calculated by insurance companies using individualised mortality tables. In this respect the term differs from its usual actuarial definition in that there is no longevity risk if the household reaches precisely its anticipated life expectancy.

5.1 Provision for old age and personal assets

In addition to pension benefits provided by the public retirement insurance system, all households could hypothetically receive annuities from their saved personal assets. In this case we make the following assumptions. The household does not include any inheritances in its financial planning; these only arise if members of the household die earlier than expected and therefore do not consume their entire savings. The relevant points in time for calculating annuities are the anticipated date of retirement (in order to project savings and assets based on the effective rate of interest r = 2.8% p.a.) and life expectancy (the point in time up until which annuity payments will be made). The payout period is thus the difference between these two points in time.

In *SAVE,* Gross financial wealth[27] is constructed by eight different wealth categories. For consistency reasons, only full information observations are used. This means that for a household indicating the ownership of a wealth category but refuses the answer for the corresponding wealth value for any of these categories, financial cannot be constructed. This procedure entails a large data loss. To mitigate this data loss, financial wealth is imputed in the following way. In a semi-logarithmic specification, relative financial wealth (financial wealth / net income) was regressed on a polynomial on net income and age; socio-demographics; and dummy variables indicating the ownership for any of the six[28] wealth categories. Solving the predicted values for financial wealth (exponent of ln(financial wealth/ net income) times net income) raises the number of observations by 50%. The relevant sample was the later used (age 40 to 65, no retired HH, no self-employed and freelancers). The regression results are shown in the Appendix. Imputed values are only used for households for which computing wealth was not possible. Households indicating no possession for every financial wealth group have a total financial wealth, accordingly.

Table 12: Monthly life annuities from predicted savings, future financial and housing wealth, based on subjective life expectancy

	Savings	Financial wealth[a]	Housing wealth	Conditional housing wealth
Mean	348.0 €	299.6 €	1,548.7 €	2,960.4 €
Median	108.4 €	99.6 €	384.9 €	1,834.5 €
Std. error	26.7 €	39.8 €	176.6 €	316.0 €
Obs.	662	673	768	417

[a] Net financial wealth (total financial wealth reduced by consumption, family and other short-run credits) *Note:* Weighted values.

Source: SAVE RR 2003 and TPI 2004. Only households with head being between 40-65. Self-employed and freelancers excluded.

[27] financial wealth without credit

[28] The three forms of private old-age provisions of any form were aggregated.

The means of monthly life annuities are relatively high. The future values of today's financial net wealth reaches a monthly life annuity of 300 €. Assuming that today's savings will be continued in the future and annuitized at the pension entry age, an additional second monthly life annuity of 348 € will be received. Finally, if it would be liquidated, housing wealth would provide a third annuity of 1548 €.

Means of wealth values are misleading, since the wealth distributions typically are skewed to the right. This can be read by the median values which are significantly lower than the means; the median values are about 1/3 for savings and financial wealth. Additionally, some households do not hold financial assets or do not even save, which leads to an annuity of 0. E.g., the conditional[29] annuity for housing wealth provides an annuity of 2960 € which is about twice as high as the unconditional value.

Additionally, the annuities presented in Table 12 are calculated using subjective life expectancies. These are, as shown in Section 2, significantly lower projections from current life tables. Table 13 shows the same values as in Table 12, but assumes a more realistic life expectancy. Hence, monthly private pensions from accrued savings, financial and housing wealth drop by about 20%.

Table 13: Monthly life annuities from predicted savings, future financial and housing wealth, based on subjective life expectancy plus 3 years

	Savings	Financial wealth[a]	Housing wealth	Conditional housing wealth
Mean	311.0 €	248.8 €	1,222.6 €	2,324.2 €
Median	94.8 €	84.6 €	378.8 €	1,580.4 €
Std. error	31.3 €	33.6 €	85.4 €	139.1 €
Obs.	672	683	781	427

[a] Net financial wealth (total financial wealth reduced by consumption, family and other short-run credits) *Note:* Weighted values.
Source: SAVE RR 2003 and TPI 2004. Only households with head being between 40-65. Self-employed and freelancers excluded.

5.2 Values from monthly private pensions in relation to the pension gap

As the next step, it will be shown how the private pension wealth from Table 12 and Table 13 compare to the pension gap shown in Table 11.

[29] Conditional on home ownership

Table 14 summarizes the results as percentaged filling of the pension gap. It also compares three different measures of financial wealth plus savings.

The first one is net financial wealth (computed as the sum of eight different financial wealth categories minus short-run consumption, family and other credits) and net savings (computed as gross savings[30] plus credit repayments plus contributions to life insurances), 'Riester' plans and occupational pension plans, assuming that households do not think of these categories when trying to recall total last year's savings. Evidence for this hypothesis is provided in Essig (2005). The second one is gross financial wealth (all financial wealth categories ignoring short-run credits) and net savings. The third is net financial wealth and gross savings (without credit repayments and imputed contributions). The numbers are quite similar and do not change the qualitative statements. This becomes clear when looking at the short-run credit volume which is rather low with a mean of 1850 € and a median of 0 (weighted values). The difference between the gross and net medians of monthly savings measure is about 15 €. In the following, the first set will be used for the rest of the analysis (net savings, net financial wealth).

Numbers higher than 100% means that the private pensions which a household can retrieve from private wealth, suffice to fill the pension gap, numbers below 100% indicate that the pension gap cannot be covered. It shall be emphasized again at this point that the *current* savings behavior is projected, and therefore it is not accounted for possible behavioral changes possibly induced by the pension reforms 2001 and 2004. The research interest is: do household save enough today to fill the future gap?

Table 14: Households' ability to fill the pension gap in dependence of the life expectancy

	own LE	own LE + 3	own LE + 5	own LE + 10	LE from life tables
Net financial wealth including consumption credits and accrued savings, including contributions to Riester plans, life insurances and credit repayments					
Mean	362.3%	290.1%	262.0%	216.9%	305.0%
Median	198.8%	157.2%	141.6%	117.6%	161.0%
Std. error	25.6%	19.5%	17.4%	14.1%	19.1%
Obs.	575	579	579	579	599
Gap in provision	32.4%	35.8%	37.3%	43.7%	35.1%
Financial wealth without credits and accrued savings, including contributions to Riester plans, life insurances and credit repayments					
Mean	379.1%	303.4%	273.6%	226.1%	316.8%
Median	204.2%	168.9%	147.0%	121.0%	168.3%
Std. error	25.6%	19.5%	17.3%	14.0%	18.9%

[30] as the values given to the one-shot savings question

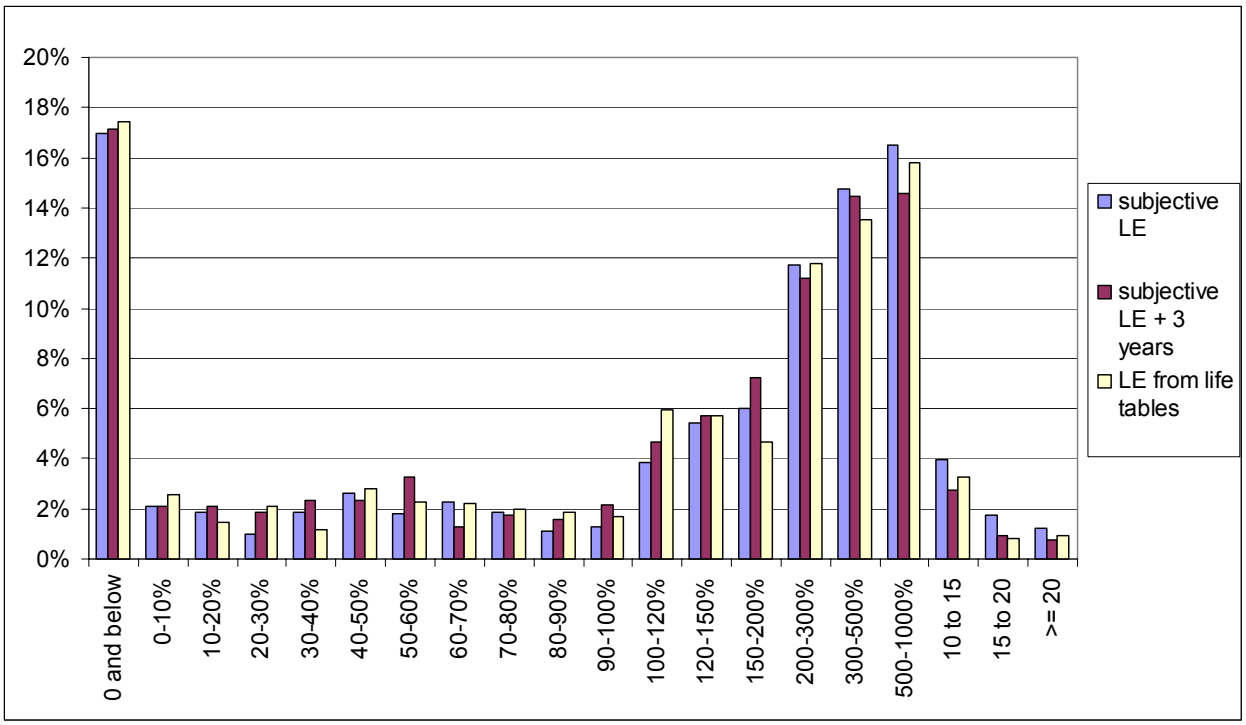
Obs.	593	597	597	597	619
Gap in provision	30.5%	34.0%	35.9%	42.0%	33.4%
Net financial wealth and accrued gross savings, including consumption credits and accrued gross savings					
Mean	328.2%	262.0%	237.1%	196.7%	275.7%
Median	174.5%	146.4%	131.9%	107.5%	144.1%
Std. error	23.3%	17.8%	15.9%	12.9%	17.0%
Obs.	609	614	614	614	638
Gap in provision	35.5%	38.8%	40.6%	45.6%	37.8%

Note: Weighted values. Share of households with zero or negative savings and financial wealth: 1 6%.

The same arguments pointed out for Table 12 and Table 13 also apply for Table 14: mean values are quite high and definitely high enough to fill the gap. Median values, in contrast, come close to one when assuming a 10 year longer life expectancy, and about one third of the households in the sample will not be able to fill the gap. This percentage grows to 44% assuming a 10 year higher life expectancy. The values' dependence on life expectancy is has a simple reason. Individual longevity risk is not covered by personal assets where this risk is not borne by other insured persons as is the case, for example, in the public retirement insurance system. The last column of the table shows the filling of the gap assuming values of current life tables; results compare about to underestimating the subjective life expectancy by three years. But the current life tables ignore all medical progress in the future and of the past[31] . The Rürup-commission, for example, anticipates an increase in life expectancy of 2.5 years over the next 30 years. This forecast is about 2/3 lower than the estimates of Oeppen and Vaupel (2002). If the more optimistic of these scenarios - a long-term increase in life expectancy of 0.25 years per year - proves to be correct, the public pension insurance system will be confronted by further financing problems which will articulate themselves once again in the form of rising contribution rates and lower pension benefits. The non-coverage of the gap thus affects about 36 to 40% of all households, while the median value is able to fill the gap by more than 100%.

Figure 4: Distribution of the ability to fill the pension gap

[31] affecting the survivors of each cohort in the life tables



Note: Weighted values.

The skewness of the distribution of savings and wealth is thus also reflected in Figure 4 which shows the distribution of the ratios of monthly life annuities to the pension gap. The distribution also shows that obviously, there are two major groups of households: the ones not being able at all to fill the gap at 0% and below, and the other ones who can easily absorb the financial task with 200-1000% of the gap.

5.3 Robustness of the results

This section checks the effects of different interest and growth rate scenarios on the results found so far. The shown numbers base on a scenario with real interest rate of 2.8% p.a., which corresponds to a nominal interest rate of 4.3% p.a. assuming an inflation rate of 1.5% which is aspired by the European Central Bank. The current interest rate is below the assumed real interest rate, but the average rate since the 1970s is higher than this value. The same is true for the current growth rate; its average value since the 1970s is also higher than the assumed wage growth rate of 1.5%. Current reforms aim to strengthen productivity and regain higher growth rates; on the other hand, the demographic change might weaken economic growth and reduce the probability to reach a long-run growth rate of 1.5% or more.

The procedure here is thus as follows. First, the growth rate is assumed being constant, while the interest rate will be varied (r = 2,0% / 2,8% / 3,5%, cf. Table 15), while in the second comparison, interest rates will be held constant and growth rates are varied (g = 1,0% / 1,5% / 2,0%, cf. Table 16). In a third step, a pessimistic scenario is contrasted by an optimistic one (r=2,0% and g=1,0% versus r=3,5% and g=2,0%, cf. Table 17).

Table 15: Filling the pension gap in dependence of the capital market return

Low returns, r = 2.0%

	Net financial wealth and accrued savings				
	own LE	own LE + 3	own LE + 5	own LE + 10	LE from life tables
Mean	323.6%	256.1%	229.7%	186.9%	270.0%
Median	174.1%	142.1%	126.5%	100.4%	139.2%
Std. error	23.4%	17.5%	15.4%	12.2%	16.8%
Obs.	575	579	579	579	599
Gap in provision	35.1%	38.7%	41.6%	47.5%	38.7%

Medium returns, r = 2.8%

	Net financial wealth and accrued savings				
	own LE	own LE + 3	own LE + 5	own LE + 10	LE from life tables
Mean	362.3%	290.1%	262.0%	216.9%	305.0%
Median	198.8%	157.2%	141.6%	117.6%	161.0%
Std. error	25.6%	19.5%	17.4%	14.1%	19.1%
Obs.	575	579	579	579	599
Gap in provision	32.4%	35.8%	37.3%	43.7%	35.1%

High returns, r = 3.5%

	Net financial wealth and accrued savings				
	own LE	own LE + 3	own LE + 5	own LE + 10	LE from life tables
Mean	400.2%	323.5%	294.0%	246.9%	339.4%
Median	216.8%	175.6%	158.1%	132.4%	179.4%
Std. error	28.0%	21.7%	19.4%	16.0%	21.4%
Obs.	575	579	579	579	599
Gap in provision	31.1%	32.8%	34.2%	39.2%	33.2%

Note: Weighted values. Wage growth rate g = 1.5%.

A higher interest rate clearly raises the level of coverage of the pension gap, while lower interest rates makes this task more difficult. The effects are also not strong enough to change the number of households not being able to fill the gap in a large scope; the ratio remains by about 1/3.

Table 16: Filling the pension gap in dependence of the wage growth rate

Weak wage growth rate g = 1.0%					
			Net financial wealth and accrued savings		
	own LE	own LE + 3	own LE + 5	own LE + 10	LE from life tables
Mean	379.8%	303.8%	274.4%	227.2%	319.9%
Median	207.0%	165.3%	147.9%	122.2%	169.0%
Std. error	26.8%	20.5%	18.2%	14.8%	20.2%
Obs.	575	579	579	579	599
Gap in provision	31.3%	34.0%	36.4%	42.1%	33.7%

Medium wage growth rate g = 1.5%					
			Net financial wealth and accrued savings		
	own LE	own LE + 3	own LE + 5	own LE + 10	LE from life tables
Mean	362.3%	290.1%	262.0%	216.9%	305.0%
Median	198.8%	157.2%	141.6%	117.6%	161.0%
Std. error	25.6%	19.5%	17.4%	14.1%	19.1%
Obs.	575	579	579	579	599
Gap in provision	32.4%	35.8%	37.3%	43.7%	35.1%

Strong wage growth rate g = 2.0%					
			Net financial wealth and accrued savings		
	own LE	own LE + 3	own LE + 5	own LE + 10	LE from life tables
Mean	345.8%	277.1%	250.4%	207.3%	291.0%
Median	186.2%	152.1%	137.8%	111.4%	150.1%
Std. error	24.6%	18.7%	16.6%	13.4%	18.1%
Obs.	575	579	579	579	599
Gap in provision	33.7%	36.8%	39.6%	45.1%	36.4%

Note: Weighted values. Capital market return r = 2.8%.

A stronger wage growth rate affects the relative position of retirees. Since economic status-preserving values are compared here, the relative value of savings is negatively affected by a higher wage growth rate. This is why a higher growth rate would lower the share of coverage of the pension gap.

Table 17: Filling the pension gap in dependence of the wage growth rate

Optimistic scenario (g = 2.0%, r = 3.5%)					
	Net financial wealth and accrued savings				
	own LE	own LE + 3	own LE + 5	own LE + 10	LE from life tables
Mean	381.6%	308.8%	280.7%	235.7%	323.4%
Median	210.7%	166.8%	151.4%	126.4%	169.5%
Std. error	26.7%	20.7%	18.5%	15.2%	20.3%
Obs.	575	579	579	579	599
Gap in provision	31.5%	33.7%	35.6%	41.6%	34.1%

Pessimistic scenario (g = 1.0%, r = 2.0%)					
	Net financial wealth and accrued savings				
	own LE	own LE + 3	own LE + 5	own LE + 10	LE from life tables
Mean	338.8%	267.9%	240.2%	195.5%	282.9%
Median	184.7%	146.0%	130.4%	106.4%	148.0%
Std. error	24.3%	18.2%	16.1%	12.7%	17.7%
Obs.	575	579	579	579	599
Gap in provision	34.1%	37.8%	40.8%	45.9%	37.7%

Note: Weighted values.

The difference between the optimistic and the pessimistic scenario are, given the results from Table 15 andTable 16, relatively small. Scenarios for interest and wage growth rate thus do not change the results qualitatively.

5.4 Household types and the ability to fill the pension gap

This part examines household types by three characteristics, schooling, age and income, and checks whether differences in any of these three variables influences the household's ability to fill the pension gap. The procedure is to divide households for each of these three variables into three groups. For age and income, terciles are built to uniformly distribute households.

Table 18: Filling the pension gap in dependence of age

	Age		
	40 to 45	46 to 52	53 bis 65
Mean	349.65%	360.63%	375.25%
Median	197.86%	220.68%	181.54%
Std. error	37.83%	37.93%	54.58%
Obs.	192	192	191
Gap in provision	32.29%	31.77%	32.98%
Relation of monthly pensions	86.51%	89.12%	91.50%
Pension values before `Riester' (Median)	1,480.47 €	1,342.89 €	1,191.72 €
Pension gap (Median)	196.19 €	145.91 €	102.32 €
Monthly life annuities (Median)	376.79 €	335.71 €	168.13 €

Note: Weighted values.

The share of households being able to fill the gap is rather constant over age classes. On a first glance, this is surprising since older households are not as hard affected by the pension reform as younger households (cf. Table 11). But younger households have a larger amount of financial wealth which will accrue to the pension entry age from which they will receive higher monthly life annuities.

Table 19: Filling the pension gap in dependence of income

	Income		
	up to 1800€	1800 up to 2750 €	more than 2750 €
Mean	193.08%	356.07%	621.43%
Median	71.65%	233.66%	395.34%
Std. error	22.92%	38.85%	64.51%
Obs.	217	163	194
Gap in provision	53.00%	28.83%	12.37%
Relation of monthly pensions	90.06%	88.53%	88.55%
Pension values before `Riester' (Median)	977.56 €	1,479.84 €	1,859.53 €
Pension gap (Median)	94.32 €	169.36 €	201.65 €
Monthly life annuities (Median)	71.37 €	358.85 €	806.33 €

Note: Weighted values.

When looking at pension gaps and income classes, one can find that the calculated pension reduction factors[32] are distributed relatively evenly over income classes. This is due to the age distribution which is relatively even between income classes. Differences arise concerning the ability to fill the pension gap since households in the upper third of the income distribution are better prepared due to a larger financial provision *relative to their income.* This is important to mention since, of course, the pension gap of these households is also higher, according to their income and their pension entitlements.

Table 20: Filling the pension gap in dependence of schooling levels

	Schooling		
	Hauptschule/Mittlere Reife	Abitur/ Fachhochschulabschl.	FH/ Studiumsabschluss
Mean	297.84%	361.30%	624.98%
Median	151.87%	220.68%	375.91%
Std. error	22.87%	57.97%	97.20%
Obs.	413	50	112
Gap in provision	38.74%	30.00%	9.82%
Relation of monthly pensions	89.32%	88.36%	88.76%
Pension values before `Riester' (Median)	1,249.09 €	1,600.82 €	1,632.66 €
Pension gap (Median)	132.04 €	189.17 €	180.53 €
Monthly life annuities (Median)	187.78 €	411.19 €	620.34 €

Note: Weighted values.

Similar to income classes, the separation for schooling classes reveals an even distribution for the pension reduction factor, as age is evenly distributed between the schooling classes. But concerning the ability to fill the pension gap, Table 20 shows large differences. The share of households not being able to fill the gap is much smaller for the group with a college degree. One might presume that this is due to a higher associated income, but that is not the case as can be at the pension entitlements. They are much the same for the second and the third group, but their financial wealth and savings is not. The share of households with zero savings is much smaller in the group with the highest schooling. This can have two explanations. The first one is that households with a college degree are more disciplined and self-controlled concerning their financial planning and foresight. The other one is that that their response behavior might differ from households with a lower schooling, which might more likely to tend to escape the effort to answer to 'annoying' questions for savings and wealth.

[32] which take account of the affect of the pension reforms

6. Conclusion

This chapter analyzes how many households are already prepared to fill the upcoming pension gap, assuming no changes of of financial behavior. Considering accrued[33] financial wealth and monthly savings as the basis for calculating monthly life annuities, it can be shown that about 1/3 of all households in the sample will not be able to fill the pension gap they will have to face, even if they use all their financial wealth and savings. Even the median household would nearly loose all degree of freedoms for other financial allocation choices. If a household is forced to consume all the financial wealth to reach to the pension level known today, it practically eliminates the possibilities reaching a *higher* pension level which is closer to the income flows before retirement.

The values of subjective life expectancy, which is a crucial variable in this analysis, are shown to be assumed independent of age which is counterfactual. Therefore, the subjective life expectancy is compared to the influence of more realistic values. This affects additional 3 to 10% of the households in the sample which, assuming the realistic values, will not be able to fill the pension gap.

The lessons to be learned are that the long-term savings rate will need to increase if we are to master the challenges posed by the demographic trends which, in the final analysis, are the reason for the introduction of the sustainability factor. Policymakers would be well advised to draw attention to these developments.

Despite low uptake and acceptance, the introduction of the Riester pension has at the very least increased peoples' awareness of the problems the future holds. Households now reflect considerably more on the provision they are making for their old age than was the case prior to the reform. The task must be to reinforce this trend.

[33] at the time of the households' pension entry age

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Appendix 1: Description of SAVE data records

In Germany there is currently no set of data available that records detailed savings data in conjunction with sociological and psychological characteristics. The socio-economic panel (SOEP) only records rough indicators such as "Did you spend all of your income last year or was there anything left over?" or "Do you have a savings book?", etc. but does not cover the quantitative composition of or any changes in assets. The position is similar for the "debit and credit" survey which contains very detailed data on the composition of various forms of investment but does not quantify these in greater detail.

The income and consumption survey (EVS) conducted every five years by the Federal Statistical Office, with its detailed information on the amount and composition of income, expenditure and wealth, is the main source of data on the savings behavior of households in Germany. The 1993 EVS also contains the most important socio-demographic characteristics for all persons living in the household; SOEP surveys in contrast only contain information on the reference person. In the light of the squeeze on public funds, the 1998 EVS survey has again been slimmed down drastically and in some areas it bears very little resemblance to earlier surveys. It still covers a very large number of households but several variables that are important for savings behavior are now missing, however, and more extensive sociological or psychological factors are completely absent in the income and consumption surveys, because these very expensive surveys are primarily intended for the work of the Federal Statistical Office.

Weaknesses of existing data material can only be rectified by new surveys. The previous section has shown that to understand savings behavior it is important to record variables which can also describe psychologically determined behavioral phenomena. Taking as a basis the examples of the Dutch CentER Panels, the US Health and Retirement Surveys, and the Bank of Italy's Survey on Household Income and Wealth (SHIW) we have cooperated with the Mannheim Center for Surveys, Methods and Analyses (ZUMA), Infratest-Burke (Munich), Psychonomics (Cologne) to produce a questionnaire consisting of six sections. It is printed in the Appendix. The questionnaire has been designed in such a way that the interview should not exceed 45 minutes. Table 21 provides an overview of the SAVE questionnaire.

Table 21: Structure of the SAVE questionnaire

Part 1:	Introduction, identifying the household respondent
Part 2:	Basic socio-economic household data
Part 3:	Qualitative questions concerning saving behaviour, income and wealth
Part 4:	Budget balance: quantitative questions on income and wealth
Part 5:	Psychological and social determinants of savings behaviour
Part 6:	Conclusion: interview situation

The brief first section explains the purpose of the questionnaire and describes the precautions that have been taken in respect of data protection. We feel this introduction is appropriate because the survey particularly deals with the personal affairs of those surveyed. The interviewer then asks to speak to a member of the household who knows about their income and assets. If this person is not at home, the interviewer must make a return visit.

Part 2 lasts about 15 minutes and is the standard initial interview in which questions are asked about the composition and socio-economic structure of the household, including age, education and participation in the labor force of the person surveyed and his or her partner.

The interviewer deals with the key issues in Part 3 of the questionnaire. This part contains qualitative and simple quantitative questions on saving behavior and how households deal with income and assets, such as the type of investment selected for one-off injections of cash, the importance of a series of savings motives, whether there is actually anything left over to save, how regularly savings are made, etc. Questions are also asked about decision processes and possible rules of thumb, past patterns of behavior as well as their parents and attitude to money.

Part 4 is the critical part of the questionnaire because this is where a complete "financial review" is made of the household. A detailed survey is made of income according to the types of income, changes in income, the level of assets according to the various kinds of wealth and changes in the types of wealth over the last year. Apart from financial assets, the questions also cover private and company pensions, ownership of property and business assets. Questions are also asked about debt. Part 4 is kept separate from the other parts and we will come back to this.

Part 5 contains questions about psychological and social factors. It includes the social environment, expectations about income, the economic situation, health, life expectancy and general attitudes to life.

Part 6, the final part, ends the interview with the standard questions about the interview situation and leaves both the person surveyed and the interviewer considerable scope for their own com-

ments. Here we expect comments about confidentiality, the length and accuracy of the questionnaire. Questions are also asked about Internet access and the possibility of conducting a repeat survey.

A survey of this kind is an experiment. Apart from the income and expenditure survey, no German survey to date has attempted to produce such an accurate assessment of wealth. When one combines this with the numerous questions about psychological and social factors, it provides a multi-faceted picture of the household surveyed – indeed it is only such a detailed picture on different levels that will provide information on the complex individual decisions which ultimately make up the savings behavior of a household. However, the price of this complex picture is a questionnaire, which demands considerable patience and willingness to answer the questions on the part of the household.

SAVE has now been in the field in the years 2001, 2003 and 2004. As a result 5 subsamples are currently available – two from the years 2001 and 2003 and one from the year 2004. This survey is primarily based on the most recent subsample. The reasons for this are as follows. On the one hand, this study required a modification of the questionnaire in order to obtain the precise subjective data about individual life expectancy which was required. On the other hand, this is also the latest data available relevant to the reform discussion referred to in section 2.3. In order to increase the available data, values were imputed for the Random Route Sample 2003 from the TPI 2004 values. Re-surveyed households from TPI 2001 were also compared with each other using TPI 2004. This ‘panel comparison’ allows unobservable household or respondent characteristics to be eliminated.

Appendix 2: Regression tables

Table 22: Regression results: Age of retirement and replacement rate

	Age of retirement		Replacement rate	
	Coefficient	P value	Coefficient	P value
Permanent net income / 10,000	-3.090	0.352	0.000	0.121
(Perm. income/10,000) squared	2.870	0.508	-0.343	0.156
Age / 10	-0.638	0.218	**0.056**	0.047
(Age / 10) squared	0.051	0.383	-0.004	0.219
Intermediate secondary school leaving certificate (D)	**0.646**	0.003	-0.017	0.162
Upper secondary school leaving certificate (D)	**0.538**	0.057	-0.027	0.106
University/polytechnic degree (D)	**1.261**	0.000	**-0.031**	0.052
Children (D)	**0.698**	0.032	0.005	0.781
Children living in same household (D)	-0.243	0.347	0.003	0.814
Job: Employee (D)	-0.002	0.993	0.002	0.890
Job: Civil servant (D)	**-1.888**	0.000	**0.076**	0.000
In part-time employment (D)	0.064	0.842	-0.025	0.175
In marginal part-time employment (D)	**0.747**	0.035	**-0.066**	0.003
Not gainfully employed (D)	0.244	0.422	**-0.078**	0.000
Unemployed (D)	-0.310	0.378	**0.041**	0.065
Unemployed for more than one month	-0.031	0.895	0.004	0.732
Unemployed for more than six months	0.020	0.943	-0.011	0.479
Partner (D)	-0.200	0.556	-0.021	0.289
Separated or divorced (D)	-0.106	0.767	-0.021	0.332
Widowed (D)	0.332	0.350	0.012	0.563
Sex: female (D)	**-0.972**	0.000	0.002	0.881
Eastern Germany (D)	0.640	0.014	-0.027	0.054
Subsample: RR 2003	**1.269**	0.000	**-0.051**	0.002
Subsample: TPI 2004	**-0.306**	0.200	-0.011	0.415
Constant	**64.582**	0.000	**0.429**	0.000
Number of observations	1856		941	
Prob > F	4.870		6.630	
F(33, 1100 / F(20, 661)	0.000		0.000	
R2	0.060		0.148	
Adj. R2	0.048		0.126	

Table 23: Regression results: Respondents' life expectancy

	Coefficient	P value
Permanent income / 10,000	9.056	0.530
(Permanent income / 10,000) squared	-5.140	0.813
Age / 10	**-0.714**	0.004
(Age / 10) squared	**0.008**	0.002
Intermediate secondary school leaving certificate (D)	-0.426	0.555
Upper secondary school leaving certificate (D)	0.068	0.942
University/polytechnic degree (D)	-1.092	0.259
Children (D)	0.572	0.603
Children living in same household (D)	**-1.873**	0.015
Job: Employee (D)	-0.576	0.542
Job: Civil servant (D)	1.537	0.238
Job: Freelancer (D)	3.368	0.240
Job: Self-employed (D)	-0.667	0.589
Pensioner (D)	**-4.222**	0.007
In part-time employment (D)	-0.004	0.997
In marginal part-time employment (D)	**4.488**	0.001
Not gainfully employed (D)	**2.511**	0.067
Unemployed (D)	**-2.926**	0.073
Unemployed for more than one month	1.140	0.126
Unemployed for more than six months	**-2.346**	0.014
Partner (D)	**-2.157**	0.128
Separated or divorced (D)	-0.077	0.953
Widowed (D)	1.728	0.568
Sex: female (D)	**3.399**	0.000
Eastern Germany (D)	-0.835	0.335
Smoker (D)	-0.842	0.243
Former smoker (D)	**-1.212**	0.075
Expectations regarding health status	0.229	0.121
Self appraisal: optimist	**0.217**	0.077
Live less long owing to: Illness (D)	**-5.088**	0.000
Live less long owing to: Life circumstances (D)	-1.133	0.426
Live less long owing to: Early death of family member (D)	**-5.811**	0.001
Live less long owing to: Other reasons (D)	**-3.884**	0.097
Live longer owing to: Health status (D)	**3.583**	0.010
Live longer owing to: Life circumstances (D)	**3.842**	0.001
Live longer owing to: Longevity of family members (D)	**3.341**	0.011
Live longer owing to: Other reasons (D)	**4.884**	0.009
Self assessment of risk: Health	0.002	0.982
Constant	**89.902**	0.000
Number of observations	430	
Prob > F	10.60	
F(33, 1100 / F(20, 661)	0.0000	
R^2	0.5074	
Adj. R^2	0.460	

Table 24: Regression results: Partners' life expectancy

	Variables von BP		Variables von P	
	Coefficient	P value	Coefficient	P value
Permanent income / 10,000	-14.040	0.454		
(Permanent income / 10,000) squared	25.554	0.344		
Age / 10	**-0.905**	0.003		
(Age / 10) squared	**0.010**	0.002		
Age difference to partner (Age_P - Age_BP)			**0.208**	0.022
Intermediate secondary school leaving certificate (D)	-0.104	0.902	-0.406	0.616
Upper secondary school leaving certificate (D)	-0.106	0.926	-0.186	0.873
University/polytechnic degree (D)	-1.455	0.216	**3.315**	0.004
Children (D)	-0.571	0.682		
Children living in same household (D)	-1.081	0.265		
Job: Employee (D)	**-2.162**	0.051	-0.859	0.563
Job: Civil servant (D)	-0.516	0.750	-1.549	0.366
Job: Freelancer (D)	2.978	0.388	-3.426	0.286
Job: Self-employed (D)	-1.350	0.332	0.050	0.986
Pensioner (D)	-2.721	0.120	-0.356	0.798
In part-time employment (D)	1.565	0.292	1.060	0.341
In marginal part-time employment (D)	**2.910**	0.066	-1.614	0.209
Not gainfully employed (D)	-0.685	0.662	0.035	0.977
Unemployed (D)	-2.900	0.124	-1.465	0.378
Unemployed for more than one month	0.744	0.388	0.400	0.645
Unemployed for more than six months	-0.960	0.392	0.489	0.627
Separated or divorced (D)	2.285	0.234		
Widowed (D)	2.121	0.722		
Sex: female (D)	**-4.887**	0.000		
Eastern Germany (D)	0.113	0.914		
Expectations regarding health status	**-0.373**	0.099	**0.904**	0.000
Self appraisal: optimist	**0.473**	0.001		
Live less long owing to: Illness (D)	-1.227	0.435		
Live less long owing to: Life circumstances(D)	**2.953**	0.068		
Live less long owing to: Early death of family members (D)	-3.433	0.115		
Live less long owing to: Other reasons (D)	-3.416	0.227		
Live longer owing to: Health status (D)	2.196	0.152		
Live longer owing to: Life circumstances(D)	**2.298**	0.080		
Live longer owing to: Longevity of family members (D)	-1.430	0.328		
Live longer owing to: Other reasons (D)	**4.480**	0.081		
Constant	**96.640**	0.000		
Number of observations	365			
Prob > F	3.9			
F(33, 1100 / F(20, 661)	0.0000			
R^2	0.3831			
Adj. R^2	0.2849			

Appendix 3: Calculation equations

A number of methods used in financial mathematics to present future value and annuities were applied in sections 3 and 4. The equations used to calculate individual values are presented in brief here.

The future value of a current asset is determined by

$$ZW\left(V_{Renteneintrittsalter_{HH}}\right)=\left(1+r\right)^{Renteneintrittsalter_{HH}}, \tag{2}$$

where

$ZW\left(V_{Renteneintrittsalter_{HH}}\right)$ represents the future value of an asset V at the age of retirement of the household

r is the effective rate of interest.

We assume that savings remain constant at today's levels every year until retirement. The future value of savings at the age of retirement is therefore:

$$ZW\left(S_{Renteneintrittsalter_{HH}}\right)=S_t^{HH}\bullet\frac{\left(1+r\right)^{Renteneintrittsalter_{HH\#}-Alter_{HH}}-1}{r} \tag{3}$$

where

S_t^{HH}, $\left(S_{Renteneintrittsalter_{HH}}\right)$ represents the household's savings in year t or on retirement.

The quotient in (3) forms the inverse of the annuity equation as, in this case, constant contributions are invested over a specific period of time.

Assuming that contributions are not paid in annually but on a monthly basis, the following modification must be made to (3):

$$ZW\left(S_{Renteneintrittsalter_{HH}}\right)=\frac{S_t^{HH}}{12}\bullet\frac{r}{\left(1+r\right)^{\frac{1}{12}}-1}\bullet\frac{\left(1+r\right)^{Renteneintrittsalter_{HH\#}-Alter_{HH}}-1}{r} \tag{4}$$

The annuity arising from all the savings accumulated up to the age of retirement, including the accrued assets and accrued interest, is calculated as follows:

$$LR_m^{HH}=ZW\left(GV\right)\bullet\frac{r}{1-\left(1+r\right)^{-Ruhes\tan dsjahre+1}}\bullet\frac{1-\left(1+r\right)^{-\frac{1}{12}}}{r} \tag{5}$$

where: LR_m^{HH} = the annuity of a household in month m following retirement

$ZW\left(GV\right)$ = the future value of the entire assets

Years of retirement = Number of years during which person continues to live following retirement = anticipated life expectancy – age on retirement

Design of the subjective life expectancy questions

Subjective life expectancy is asked in a three step question to keep the level of concern about this subject as low as possible.

The wording of the questions was:

1. *What do you belief: up to what age will men and women of your age live?*

2. *When thinking about your living and health situation. What do you believe: compared to persons of your gender and age, will you live shorter, about as long, longer?*

   followed by the question for the number of how many years longer or shorter that might be.

3. If answer to last question was 'shorter' or 'longer': *Why do you believe to live shorter / longer than the average?*

   followed by a list with four possible reasons respondents might think of and one open field.

The interview procedure was repeated in the same way with the respondent's partner.

When calculating subjective life expectancies, one has to be aware of the gender of the person to which the calculation applies (respondent/partner) since the first question asks not for the average of persons of the *same* gender but for both, men and women.

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