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Working Paper No. 85

**Early Retirement in Germany:
Loss of income and lifetime?**

by

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Early Retirement in Germany: Loss of income and lifetime?

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Abstract

The public pension system in Germany allows early retirement albeit at the cost of pension deductions. Deductions are calculated under the assumption that life expectancy is independent of the age of retirement and apply equally for men and women. The “fair” amount of deductions is currently debated, the general feeling being that they are too low.

In this paper we show that remaining lifetime and thus the perpetuity period vary with the age of retirement. In a survival analysis using micro data from the German Pension Insurance,³ we find that remaining life expectancy of men at age 65 receiving old-age pensions with age 60 to 66 is up to 1.9 years higher if retirement occurred later. For women, instead, life expectancy is almost independent of retirement age. Extending the analysis to invalidity pensioners (they receive pensions before the age of 60), we find that men and women reaching the age of 65 have a more than 3 years lower remaining life expectancy than old-age pensioners on average. Many other variables, like residence (West and East Germany), lifetime wage income and number of children are considered, too. In a simple model we finally calculate and compare actuarial deductions under the alternative assumptions of constant and age-of-retirement dependent life expectancy. The main conclusion is that deductions currently in law are too high for very early retirees (below age 63) and too low for all others.

JEL Classification: H55, J14, J26

Keywords: Life expectancy, retirement age, early retirement, pension deductions.

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1 Introduction

Demographic change in Germany puts a double strain on its pay-as-you-go public pension system (Gesetzliche Rentenversicherung, GRV): while the number of beneficiaries increases, that of contributors decreases. Financial consequences of demographic change were repeatedly estimated in model calculations (e.g. BMGS, 2003; Börsch-Supan et al., 2004; Prognos, 2003) leading to policy recommendations like the recently implemented increase in legal retirement age. However, early retirement is still possible, albeit at the cost of pension deductions. On an individual level, the perpetuity period and deductions of payments for early retirement are important factors determining pension costs. The recent reform aims at decreasing the former (and increasing the contribution period, correspondingly) but did not settle the question of “fair” deductions for early retirement. In this paper we shed new light on both aspects. We find that remaining life expectancy at age 65 varies considerably with retirement age and thus modifies the perpetuity period. Given this result, we draw conclusions about a “fair” treatment of early retirement that partly contradict the currently held view.

The paper is structured as follows. Section two briefly overviews the debate on fair deductions for early retirement in Germany. Section three gives a summary of previous studies on the relation between retirement age and life expectancy. In Section four we describe our data and results. Based on the latter and using a simple model, we calculate actuarial deductions in Section five. Section six contains conclusions.

2 Deductions for early Retirement

2.1 Pension Formula and Retirement Age

Income from German Statutory Pension Insurance mainly depends on lifetime relative wage income and retirement age. Monthly gross pension P is calculated as

$$P = EP \cdot AF \cdot PTF \cdot CPV , \quad (1)$$

with EP as sum of earnings points, AF as access factor, PTF as pension type factor and CPV as current pension value. The product of earnings points and access factor ($EP \cdot AF$) is also called personal earnings points, PEP . The pension type factor is 1.0 for old-age pensions and, for example, 0.5 for pensions due to partial earning incapacity. The current pension value is the amount corresponding to a monthly pension from one year’s contributions of an average earner. Each year the federal government sets its value taking economic and, since 2004, also demographic development into account.⁴ The current pension value, set in July 2007, is 26.27 Euro in West Germany and 23.09 Euro in East Germany, due to lower living costs (DRB, 2007a).

The earnings points are calculated as ratio of the income of an insured person to the average income of all insurants in a calendar year. Thus, an average earner gets ex-

⁴ The demographic sustainability factor introduced 2004 accounts for the ratio of pensioners to contributors. It partly explains why pension increases fell behind wage growth or were even zero, since.

actly one earnings point a year. Beside points gained from compulsory social security contributions, earnings points are obtained for e.g. child-raising, vocational training or unemployment periods. However, there is a ceiling to the income from which contributions are due and thus on earnings points achievable in a year. In 2007 the ceiling was 63,000 Euro in West Germany and 54,600 Euro in East Germany. With average earnings being 29,488 Euro and 25,373 Euro, respectively, contributors could achieve about 2.14 or 2.15 earnings points at maximum (DRB, 2007a).

The access factor accounts for early or late retirement. Deductions were enacted by the 1992 pension reform and gradually introduced for persons who retired between 1997 and 2005 (Ohsmann et al., 2003). The access factor is 1.0 for regular legal pension age, which is still 65 for current cohorts but will gradually be raised to 67 in the future.⁵ For every month of earlier retirement, the access factor decreases by 0.003, that is 3.6% per year, because of the longer perpetuity period. Thus, a person retiring at age 62 incurs a permanent 10.8% pension loss. For every month of later than legal age retirement, the access factor increases by 0.005, that is by 6% per year. Adjustments for early and late retirement apply to the whole retirement period and after death also to survivors' pensions.

In Germany, the possibility of flexible retirement was introduced in 1972. A tiny turn-around came with the pension reform in 1992 when the government decided, among other things, to increase standard retirement age for all persons to 65 years. However, this development was thwarted in 1996 with the "early retirement law" encouraging a floating transition to retirement (Börsch-Supan/Schnabel, 1998; Arnds/Bonin, 2002; Wübbecke, 2005). Though the average effective retirement age for old-age pensions rises since 1997 (men) and 1999 (women), reaching 63.2 years in 2006 (DRB, 2007a), numerous factors still work against: high unemployment of the elderly (Bogai/Hirschenauer, 2006; Hirschenauer, 2007), low reemployment rates of the elderly (Frosch, 2007) and particularly the miscellaneous incentives for early retirement set by the partial retirement law (Kaldybajewa/Kruse, 2007). All in all, roughly 41% of West German and 65% of East German men who retired in 2006 incurred deductions on their old-age pensions. For women, the corresponding figures are 31% and 69%, respectively (DRB, 2007b). The German Ageing Survey 2002 shows that between 1996 and 2002 about 60% of employees retired up to 6 years earlier than planned (Tivig/Hetze, 2007, p. 93).

2.2 Fair Deductions for Early Retirement

The principle of deductions for early retirement is generally accepted, the question is only which amount is "fair". The answer depends on the structural and legal framing

⁵ In 2007 the Federal government enacted the gradual increase of regular pension age between 2012 and 2029 to 67 years for people born after 1947. The minimum retirement age for old-age pensions already rises gradually since 1992 because for persons born after 1952, old-age pension because of unemployment or after partial retirement as well as old-age pensions for women were abolished. Thus, in future only severely disabled persons can receive an old-age pension at the minimum age of 60. In exchange, the minimum retirement age for longtime insurants, that means persons with at least 35 years of contributions, decreases from 63 years for people born before 1948 to 62 years for those born after November 1949, with transitional regulations for the time between.

conditions of a pension scheme, the view of the beholder as well as the goals and functions of deductions. The general distinction is between actuarial and incentive-based approaches. Thus, deductions could be set to fulfil several functions, e.g. to ensure that employees have the same financial outcome for every retirement age or that insurances' costs for a pensioner are independent from retirement age; to achieve a politically intended retirement behavior or to consider diverse facts positively or negatively (Ohsmann et al., 2004).⁶

Ohsmann et al. (2003; 2004) point out that for the German Pension Insurance, global deductions of 3.6% per year were actuarial fair under the framing conditions then given. Thus, the cumulated pension payments were the same for different retirement ages and different perpetuity periods. However, changes in framing conditions like variations of the pension formula, a higher regular legal pension age, a further increasing life expectancy or a higher share of female pensioners could lead to different results. According to Börsch-Supan (2004), the crucial difference between an insured employee's and the pension insurance's perspectives on fair deductions is the choice of the discount rate. For the insurance it equals the internal yield, for employees the higher long-term interest rate. Börsch-Supan therefore recommends much higher deductions, of 5.5% per year of early retirement. An increase of deductions to a similar level is proposed in Kroker/Pimpertz (2003) and Pimpertz (2004). Model calculations by Werding (2007) also result in deductions of more than 6% per year. Our own model calculations in section five partly contradict this view.

3 Retirement Age and Life Expectancy

In Germany, life expectancy rises steadily – in contrast to retirement age. When the Statutory Pension Scheme was introduced by Bismarck in 1889, regular pension age was 70 years, today it is 65 and it will be 67 in 2029. During the same period, life expectancy at birth doubled from 37.2 years for men and 40.3 years for women by the end of 19th century to 76.21 and 81.78 years, in 2003/2005, respectively. Today, the Federal Statistical Office expects it to lie between 83.5 and 85.4 years for men and 88.0 to 89.8 years for women in 2050 (Statistisches Bundesamt, 2006). This ascending trend is probably due to improvements in health care and better living conditions.

However, individual life expectancy varies with socio-economic status and private lifestyle. Many socio-demographic and medical studies show that mortality is related to education, to the level and relative position of income and wealth, and to occupational status (e.g. Sorlie et al., 1995; Davey Smith et al., 1998; Mokdad et al., 2004; Hoffmann, 2006). We conjecture that in a still highly market-labor oriented society, labor participation has a negative influence on mortality. Besides implying, in most cases, higher income, labor participation also means social participation,⁷ possibly

⁶ There is, for instance, a political debate whether longtime insurants should be allowed to retire with 65 years without deductions even after the increase of regular pension age to 67 (cp. Kaldybajewa/Kruse, 2006; BMGS, 2003, pp. 119).

⁷ In an evaluation of the German Ageing Survey 1996, Kohli/Künemund (1996, pp. 5) find that only 0.8% of age group 60 and above do volunteer work and only 3.5% are integrated in so-called "Seniorengruppen" (arrange-

leading to higher self esteem. We also expect to find pronounced differences between men and women in the early retirement - remaining lifetime relationship. The reason is that in post-war Germany, market-labor participation and orientation of men and women were radical different for many decades.

There are only a few studies of the relationship between age at retirement and remaining life expectancy. One reason may be the lack of capable data. Existing studies mostly indicate a higher mortality for early retirees, but they are based on a low number of cases and often consider the first years after retirement, only. Waldron (2001) analyzes population survey data matched to social security administrative data of roughly 12,000 U.S. retired male pensioners born between 1906 and 1932. She finds a positive correlation between retirement age and remaining lifetime, i.e. mortality risk decreases with increasing retirement age. Tsai et al. (2005) analyze the same relation for more than 3,600 past employees of Shell Oil in the United States which retired before 1973 with 55, 60 or 65 years, respectively. They found that persons, who retired with 55 and were still alive at 65, had a 37 percent higher mortality than those who worked until 65. Furthermore for early retirees mortality until 65 was twice as high as for those who still worked after age 55. However, differences in mortality for retirees at age 60 and 65 were small. Haynes et al. (1978) analyze mortality for about 4,000 men which worked in 1964 at age 56 to 64 for two U.S. rubber tire companies and retired with 62 to 64 years and 65 years, respectively. However, they did not compare the two groups directly. One result was that early retirement was often caused by bad health. The cohort study of Morris et al. (1994) comprises 6,200 British men aged 40 to 59 and is dealing with mortality after five years, differentiated by employment status at that time. They found out that even after exclusion of early retirement cases because of illness, mortality is almost 90 percent higher for early retirees than for continuously working persons. For Germany we are not aware of any other study besides our own, first performed in 2006 (Kühntopf/Tivig, 2006, 2007a, 2007b) with a data sample of the demography dataset of the Research Data Centre of the German Public Pension Insurance (FDZ-RV). In the present paper we perform and deepen our analysis with data on all pensioners.

4 Survival Analysis

4.1 Data

The basis of our survival analysis is micro data of the German Statutory Pension Insurance on the pension cessation due to death in 2003 or 2004 and the pension stock in 2002 to 2004. While the scientific use files of the Research Data Centre (FDZ-RV) contain only a random sample (for the demography dataset: 1% of stock and 10% of cessations) we had access to data of all pensioners. Our focus is on old-age pensions, in order to rule out evident cases of early retirement due to bad-health

ments for the older). Even if this figures did not correctly reflect real behavior, because e.g. definitions of volunteer work vary heavily, they do suggest that labor market exit means a radical change in social integration.

or disability.⁸ Furthermore, to smooth out exceptional variations in mortality that randomly occurred in one year, we pool data for two years, 2003 and 2004. The analysis that follows is based on cessation data, if not otherwise mentioned, hence persons who died in 2003 or 2004. After our data selection described below, we are left with 986,310 death cases and 24.2 million stock cases for old-age pensions.⁹ 47.1% of death cases are male, 52.9% female. Because of their higher life expectancy, women's share in stock is 57.9%. The German Pension Insurance covers about 84% of all private and public sector employees. Excluded are in particular public employees (approx. 7% of the workforce), most self-employed (about 9%) and persons with less than five years general waiting period and full contributions¹⁰ (Börsch-Supan/Wilke, 2004; Hubrich/Tivig, 2006).

In Germany, entitlement to an old-age pension starts soonest at age 60. The regular pension age is 65, few people retire later. Because retirement age is not included in our dataset, we had to calculate it as difference between the year when an insurant drew the first pension and his or her year of birth.¹¹ In the information about the first pension drawing, however, invalidity pensions are included, too, such that for 16.4 percent of our cases the calculated retirement age is below 60 years. We exclude these cases in our main analysis as well as cases of retirement at age 67 and above (3.1 percent). Thus, our main analysis is limited to cases of retirement between age 60 and 66.¹² Table 1 shows the distribution of retirement age for pensioners who died in 2003 or 2004. The pattern reflects the legal framework: many men retired with 60, 63 or 65 years. Those who retired before 63 were mostly long-term unemployed, partial retirees or severely disabled persons (the latter should not be confounded with invalidity pensions received at age under 60). A retirement age of 63 is suggestive of longtime insurants, whereas 65 is the regular legal pension age. Most women, however, retired with 60 or 65 years, few with 63. The high fraction of women retiring at age 60 is a reflection of the legal possibility women born before 1940 had, to receive an old-age pension with 60 years, already.

Table 1: Distribution of retirement age by gender

	Retirement age						
	60	61	62	63	64	65	66
Men	94,780	45,500	32,395	91,893	31,443	156,015	12,486
Women	231,978	43,766	23,249	24,340	14,562	163,386	20,517

Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

⁸ However, in a separate study we also briefly analyzed life expectancy of invalidity pensioners (see the general results in section 4.3). Pensions for orphans, widows or children were not considered.

⁹ In addition, we analyze 200,437 more death cases and 3.5 million additional stock cases for invalidity pensioners.

¹⁰ The 5 years could also consist of e.g. 4 years of contributions from employment and 1 year of substitute periods like military service.

¹¹ An accurate calculation of the retirement age is not possible because there is no information about the day or even month of the first pension drawing. Therefore, some small inaccuracies are probable.

¹² As already mentioned, we also briefly analyze life expectancy at age 65 for persons who draw their first pension before age 60, i.e. invalidity pensioners.

When analyzing the link between retirement age and remaining lifetime it must be kept in mind that persons who retire late are older than persons who retire earlier such that the former have *ceteris paribus* a shorter remaining life expectancy. Therefore, as well as in order to reduce the number of evidently bad-health induced early retirement cases, we only consider retirees who reached at least age 65.¹³ Hence, our topic is not remaining life expectancy after retirement but remaining life expectancy at age 65, differentiated by retirement age. All persons who drew a pension before age 65 without reaching age 65 are excluded from the analysis. We therefore know that all persons considered are born in 1939 or earlier.

Type of old-age pension

In Germany, there are five major old-age pension types: regular old-age pensions, old-age pensions for longtime insurants, old-age pensions for women, old-age pensions because of unemployment or after part-time work for employees over 55, and old-age pensions for severely disabled persons.¹⁴ The demography dataset (as scientific use file) does not contain information on it. However, in the course of the 1992 pension reform, most pensions were reevaluated - being recoded as regular old-age pension, regardless of what they were before. As a result, 82.2% cases in our dataset are coded as regular old-age pensions (for persons who retired before 1992, there are almost no other pension types). We therefore refrain from differentiating retirement age by type of old-age pensions.

Place of residence

For sake of clarity, in this paper we differentiate the place of residence by West and East Germany, only, and not by "Länder". Another reason for such a rough distinction is that socialization patterns between East and West Germany differ heavily whereas they are much less distinctive within the two groups. This is of particular importance when considering our hypothesis that early retirement under conditions of normal age-specific health is conducive to lower remaining life expectancy because of social exclusion and self-esteem effects.

At the time of retirement, 95.2% of our cases had their residence in Germany, out of which 77.7% in West and 22.3% in East Germany. This regional distribution is approximately equal to the effective distribution of population in 2005. The remaining 4.8% lived in a foreign country. The distribution of place of residence by retirement age and gender is presented in Table 2.

¹³ It is conceivable that perceived bad health is a major determinant of the (endogenous) decision on early retirement age as well as of mortality. However, a direct inference on the state of health on the basis of creditable periods for illness is hardly possible from our data because of many missing values.

¹⁴ A discussant therefore suggested to analyze life expectancy by the type of old-age pensions. This seemed particularly desirable as it would have allowed controlling for disability as a cause of both early retirement and higher mortality.

Table 2: Distribution of pensioners by retirement age, place of residence and gender

		Retirement age						
		60	61	62	63	64	65	66
Men	West Germany	77,133	37,112	25,987	81,254	25,240	83,544	8,742
	East Germany	15,178	6,879	5,196	6,593	4,497	51,097	1,084
	Abroad	2,392	1,454	1,173	3,935	1,644	21,104	2,637
Women	West Germany	116,575	40,190	21,384	22,637	13,583	154,437	19,134
	East Germany	112,081	2,368	1,000	767	432	2,204	353
	Abroad	2,780	1,065	766	854	491	6,366	986

Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

Obviously far more than half of men who lived in East Germany and abroad retired with 65 years while the share for West German men is much lower. In contrast, most East German women retired with 60. This is a reflection of German Democratic Republic legislation that provided 65 years as regular pension age for men and 60 years for women.¹⁵ Combining information from Tables 1 and 2 we find that many more West German women retired at age 65 than age 60.

Lifetime relative wage income

An interesting question concerns mortality differentiated by socio-economic status. Gaudecker/Scholz (2006) and Hupfeld (2006) extensively deal with this question, using similar data from the FDZ-RV. Both studies see the socio-economic status reflected in accumulated personal earnings points, *PEP* (see section 2.1 above).

In our own analysis we prefer to speak of lifetime relative wage income because the sum of earnings points is, for several reasons, a weak indicator of socio-economic status.¹⁶ This is evident for West German women in the data set who were frequently never, only over a certain period, or part-time employed. It might also apply to retirees located abroad. Both studies therefore limit their analyses to men living in Germany. We also consider the 920,729 residents, only, but we additionally look at gender specific differences in personal earnings points (see Table 3). It stands out that over three-quarter of female retirees but only 16.9% of males have less than 30 *PEP*, while 2.6 percent of women but 46.1 percent of men have over 50 *PEP*.¹⁷

¹⁵ The data show that retirement pattern of East Germans shifts. While most men retired late before the middle of the 90s, thereafter a majority retired young, probably due to unemployment.

¹⁶ The individual income position at old-age is only insufficiently described by lifetime relative wage income since income from company pensions, wealth, heritages and (for lower income groups) transfers are not considered. Kortmann (2003, p. 22) finds that in 2003 almost half of male and over 40% of female employees in West Germany had entitlements to a company pension, with an upward trend. In East Germany rates are lower. (See also Hubrich/Tivig, 2006, ch. 3.4). Concerning wealth, West Germans aged under 65 possessed up to 50,000 Euro monetary wealth and about 170,000 Euro of real estate in 2003. For East Germans, the values are much lower (see Tivig/Hetze, 2007, p. 89). Finally, the German Ageing Survey 1996 revealed that about half of those aged 40-85 had made inheritances (Tivig et al., 2005, p. 80).

¹⁷ Gaudecker/Scholz (2006) point to the fact that significance of *PEP* for socio-economic status is further shortened by heterogeneity of the group with few *PEP*. Besides men who earned low income during a long working life, it might also comprise persons who were only short-time socially insured. Among them there are well-earning graduates that got self-employed or became public servants later on. The authors partly filter these persons out by excluding men with less than 20 *PEP*. Moreover, they create subgroups of pensioners who were mandatorily

Table 3: Allocation of accumulated personal earnings points by gender

	Sum of personal earnings points						
	under 19	20-29	30-39	40-49	50-59	60-69	over 70
Men	40,874	29,631	51,907	102,840	109,960	59,419	23,613
Women	280,494	110,308	74,751	23,720	9,435	3,136	641

Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

When interpreting results in terms of lifetime relative wage income (from own work, unemployment and child-rearing), it must be kept in mind that accumulated *PEP* rise not only by relative income level increases but also by longer contribution periods. An employee who earned 90 percent of the average gross income for 40 years would draw the same pension as an employee who earned the average income for 36 years or 120 percent of the average income for 30 years. Furthermore, *PEP* include early retirement deductions for persons retired after 1997; these persons are in our dataset if they died before 2003/2004.

The focus of our work is on the link between age of retirement and remaining life expectancy. Table 4 therefore displays the distribution of earnings points by gender and retirement age.¹⁸

Table 4: Accumulated personal earning points by retirement age and gender

	Retirement age	Sum of personal earnings points						
		under 19	20-29	30-39	40-49	50-59	60-69	over 70
Men	60	2,546	3,729	12,417	30,809	28,097	10,776	1,027
	61	1,976	2,424	5,867	13,419	12,504	5,788	862
	62	1,836	2,091	4,128	8,202	8,435	4,437	1,193
	63	2,024	3,427	9,387	22,056	27,218	16,338	5,864
	64	1,288	1,732	3,446	6,426	7,788	5,363	2,977
	65	27,958	14,750	15,367	20,789	24,885	16,046	11,140
	66	3,246	1,478	1,295	1,139	1,033	671	550
Women	60	71,809	73,753	56,175	17,014	6,246	1,864	251
	61	20,001	10,590	6,960	2,684	1,331	444	86
	62	13,701	4,282	2,415	957	450	214	47
	63	14,213	4,748	2,519	899	446	180	48
	64	9,085	2,572	1,287	480	237	114	39
	65	134,701	12,931	4,829	1,522	662	290	156
	66	16,984	1,432	566	164	63	30	14

Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

It can be seen that most men with few earnings points retired at age 65. This is suggestive of the hypothesis that these persons are often self-employed or civil servants. Men with a medium lifetime income (30-69 *PEP*) obviously took advantage of the main legal retirement possibilities at age 60, 63 and 65. Men with a very high lifetime

insured within the public health insurance scheme and/or had at least 25 years of pension-relevant insurance periods. We do not use the latter criterion because the corresponding variable has missing value in 73% of cases.

¹⁸ Given great differences between West and East Germany, a further differentiation by location seems interesting and will be subject of our future work.

wage income retired late. Of course, a later retirement implies a higher lifetime income. However, even with 45 years of working, those persons would be considered high earners.

Like men with low lifetime wage income, almost half of women with less than 20 *PEP* draw their first pension with 65 years. In contrast, women with more than 20 *PEP* retired much often earlier. Between 59% and 75% of women with 20 to 69 *PEP* retired with 60, with the peak at a lifetime income of 30-39 *PEP*. Looked the other way round, most women who retired after 62 years had few *PEP*. For retirement ages 60 and 61, lifetime income is much more evenly distributed. This suggests that women retired more often early, if they could afford it financially.

Kind of Health Insurance

We also looked for differences in life expectancy by health insurance type. Roughly 87% of German population are member of the statutory health insurance; civil servants and most self-employed persons are not subject to compulsory health insurance. High earners¹⁹ can choose their preferred health scheme, too. They may be voluntarily insured at the statutory health insurance, be member of a private health insurance or even be non-insured. We again limit our analysis to Germans living in Germany. 88.7% of men in this category were statutory, the remaining 11.3% voluntarily or private insured²⁰. Among women the share of statutory insurants is 93.1%.

The distribution of health insurance arrangements by gender and retirement age is presented in Table 5. Men, as well as women who are voluntarily or privately insured, obviously choose to work longer in many cases. One reason might be that they perform work offering more income but also more satisfaction. Another reason could be that some self-employed find it difficult to retire because they do not find a successor.

Table 5: Kind of health insurance by retirement age and gender

		Retirement age						
		60	61	62	63	64	65	66
Men	Compulsory insured	85,761	40,213	27,957	81,526	26,809	102,292	6,400
	Voluntarily or private insured	3,640	2,627	2,365	4,788	2,211	28,643	3,012
Women	Compulsory insured	221,842	40,261	20,662	21,285	12,794	134,158	16,628
	Voluntarily or private insured	5,270	1,835	1,404	1,768	1,020	20,933	2,625

Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

¹⁹ Annual wage ceiling was 41,850 Euro in 2004.

²⁰ According to FDZ-RV, persons who have been coded to be non-insured under German law, are mostly voluntarily or private insured.

Nationality

In some 94.1% of our death cases persons had German nationality. The share of foreigners in our dataset is thus smaller than the fraction of foreigners in total population (8.1% in 2004). It is somewhat higher in our pension stock (7.0%) but still lacks behind. There are several reasons that could account for this under representation of foreigners, for example the higher share of self-employed among foreigners and lower labor force participation of foreign women as compared to Germans. But, civil servants are almost all of German nationality and do also not, in most cases, participate in German Pension Insurance.²¹ All in all, we conjecture that in the past, when present pensioners were employed, there were simply less foreigners living in Germany, as or instance 4.9% in 1970. Table 6 shows that the share of late retirees is higher for foreigners than for Germans.

Table 6: Nationality by retirement age and gender

		Retirement age						
		60	61	62	63	64	65	66
Men	German	89,667	42,995	30,472	86,854	29,249	132,815	9,619
	Non-German	5,113	2,505	1,923	5,039	2,194	23,200	2,867
Women	German	228,069	42,408	22,307	23,302	13,953	156,515	19,455
	Non-German	3,909	1,358	942	1,038	609	6,871	1,062

Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

Additional to the selection effects mentioned above, there is the problem that many foreigners do not unregister when leaving Germany for their home country such that the official number of foreigners is inflated.²² As a consequence, many deaths are not registered or are registered with a time lag, such that life expectancy of foreigners appears higher as it is. Our analysis shows that it would be the case for our pension data, too. Thus, we don't publish the results.

Number of children

Finally, we consider female life expectancy by number of children. Our dataset takes those children into account for which child-raising benefits or at least one month child-raising periods were registered. Child-benefits accrue to the child-raising parent; unless otherwise declared, it would be the mother. Because of differences in legal conditions between East and West Germany regarding child-raising periods, we limit our analysis to the 383,547 West German women with German nationality in our dataset. For this group, data on the number of children fits well with census data (Kreyenfeld/Mika, 2006). The distribution of the number of children we find is: 23.9% have no children, 23.0% one child, 25.0% two children, 14.3% three children, 7.0% four children and 6.7% five and more children.

²¹ Unless they were subject to compulsory social security employment before.

²² In 2004, the Central Aliens Register was revised and the official number of foreigners decreased between 2003 and 2004 from 7.3 to 6.7 million (Opfermann et al., 2006).

4.2 Method

After the data processing described above, we get a new dataset, which is the basis of our survival analysis. Using the formulas of Chiang (1984) we calculate period life tables for the particular retirement ages. As a result we obtain probabilities of surviving to each age and survival curves. Furthermore, we can calculate the remaining life expectancy at every age, that is, the expected number of years remaining to live at a particular age. It is assumed that for all ages the age-specific death rates of the underlying period remain constant. This contradicts reality since age-specific death rates are still decreasing at many ages. Hence, life expectancy is underestimated using period life tables (Luy, 2006). However, a cohort life table, showing factual lifetime of a birth cohort, could only be calculated for the past, when all persons of a cohort died. In our case this is not possible.

We calculate the remaining life expectancy at age 65, differentiated by retirement age and gender. Additionally, we analyze the link between retirement age and life expectancy by place of residence, lifetime relative wage income and kind of health insurance. Finally, we calculate life expectancy of West German women by their number of children.

4.3 Results

The survival analyses with our micro data show great gender-specific differences; this is not surprising because it is well-known that women have a significantly higher life expectancy than men. According to official German statistics remaining life expectancy at age 65 was 16.47 years for males and 19.94 years for females in 2003/2005. Our results for old-age pensioners of the German Pension Insurance in 2003/2004 show slightly higher values: 16.78 years for men and 20.44 years for women. The explanation is that invalidity pensioners, that have a much lower life expectancy, do not belong to the old-age pensioners' group. Additionally, the German Pension Insurance does not cover all people in Germany. Before proceeding with detailed results, it must be stressed that our results do not include any statement on causality. From the data we have we cannot infer that the link we find between age at retirement and life expectancy means that retirement at a certain age causally determines a higher life expectancy.

General Results

Our results show large deviations in mortality at different retirement ages for men (figure 1).²³ Men live longest after age 65 if they retire with 64 and 66 – namely 17.71 and 17.74 more years, respectively. Hence, they grow on average 82.7 years old.

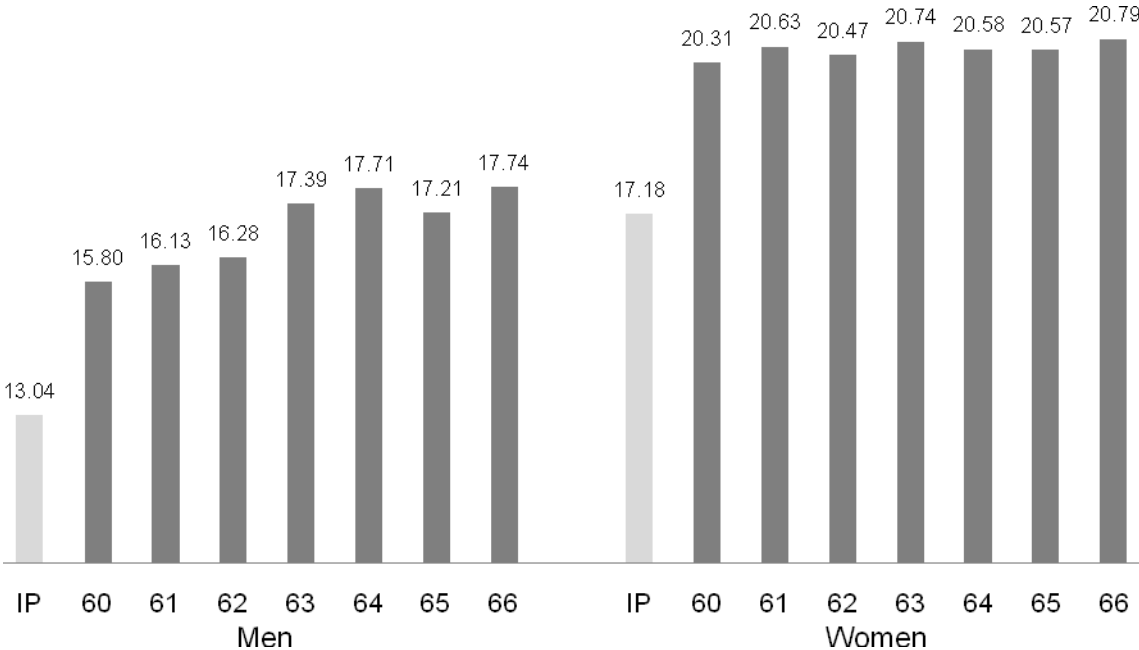
²³ The differences are not explained by cohort effects. To control for these effects, you could, for instance, analyze mortality for retirement age 60 with data from 1997/1998, for retirement age 61 with data from 1998/1999 and so on. We have not done it yet because of technical restrictions at FDZ-RV. However, due to the generally increasing life expectancy, the results for retirement at age 60 would have been even lower in 1997/1998 than in 2003/2004. Thus, the lifetime gap by retirement age would be probably even greater.

The somewhat lower life expectancy for men with a retirement age of 65 may be explained by the heterogeneous composition of retirees at regular pension age.

Up to retirement at age 64, life expectancy rises with increasing retirement age. At earliest retirement with 60, remaining lifetime was only 15.80 years; almost two years lower than for retirement at age 66. However, for invalidity pensioners (IP) life expectancy at age 65 is with 3.04 years even far shorter. There is a large gap in life expectancy for retirement before 63 and thereafter. Remembering legal conditions, those old-age pensioners who retired before 63 were long-term unemployed, partial retirees or severely disabled persons while a retirement age of 63 and 64 suggests many long-time insurants.

In contrast, for women remaining life expectancy at age 65 seems to be quite independent from retirement age. It is shortest for retirement with 60 and longest for 66, namely 20.31 and 20.79 years, respectively. Thus, the maximum deviation of six months is much lower than the 1.9 month for men. Again, remembering legal conditions mentioned in section 4.1, it was much easier for women to retire with 60; this group is therefore more heterogeneous for women than for men. Life expectancy at age 65 for female invalidity pensioners is similar to that of males: about three years shorter than the lowest life expectancy of old-age pensioners.

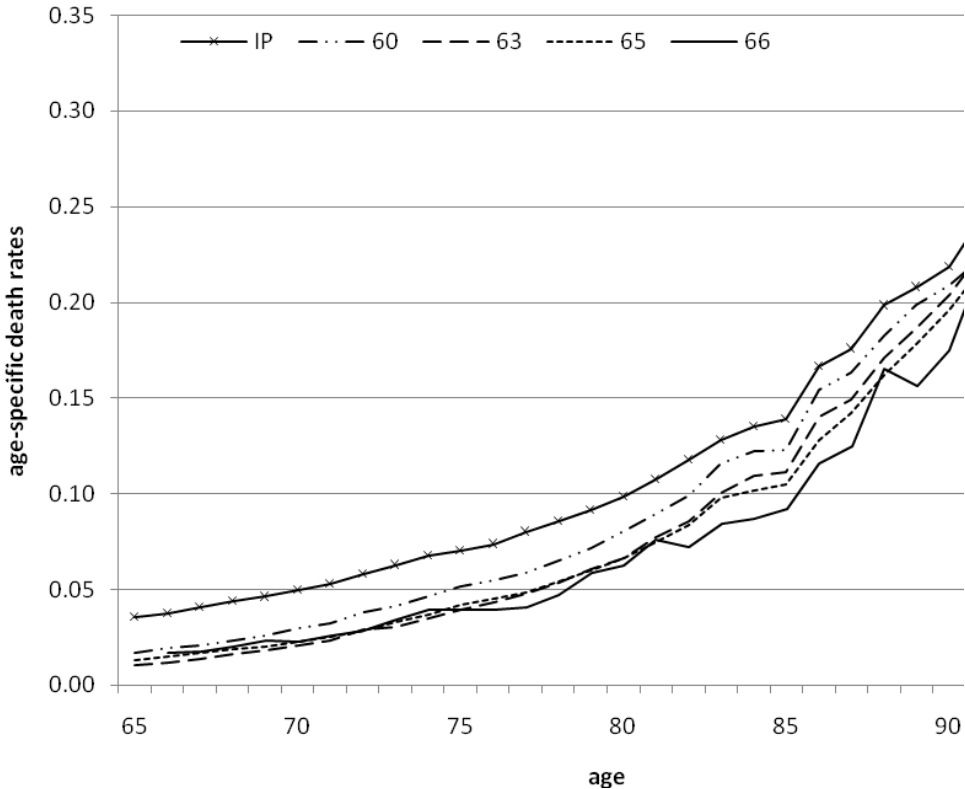
Figure 1: Remaining life expectancy at age 65 by retirement age and gender



Data source: FDZ-RV – RTBNRTWF93-04TDemo; own calculations.

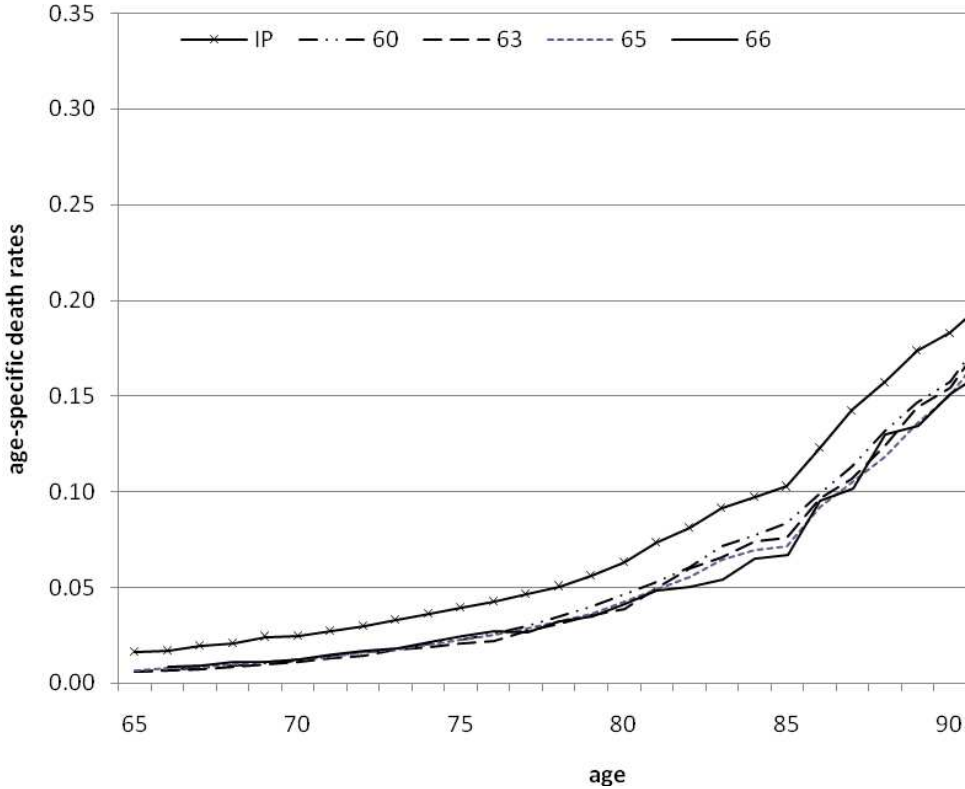
On closer inspection mortality rises exponentially with age, being throughout roughly twice as high for men as for women (Figures 2 and 3). The low life expectancy at age 65 for invalidity pensioners comes from the much higher mortality risk at all ages.

Figure 2: Age-specific death rates of men by retirement age



Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

Figure 3: Age-specific death rates of women by retirement age



Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

Figure 2 shows that until age 70 differences in age-specific mortality rates of male old-age pensioners are quite small. Still, they account for the lower life expectancy of very early retirees. Comparing retirement with 63 and 65, mortality is lower for the first years and higher after age 80, resulting in a slightly higher life expectancy for a retirement age of 63. Men lived longest when retired with 66, as a consequence of a quite high mortality during the first five years after retirement but significant lower mortality risk thereafter. For women, the small differences in mortality risks after around age 75 (Figure 3) are the main explanation for differences in life expectancy by retirement age.

Place of Residence

If we differentiate pensioners by place of residence at time of retirement, life expectancy in West Germany differs little from general results. That is because almost 78% of the population lived here. In contrast, results for East Germany are all the more interesting (Table 7). Life expectancy of East German men is lower than in West Germany for each retirement age – it is 0.7 to 1.6 years shorter. Furthermore, it is highest for men who retired with 65. Even more surprising is the fact that life expectancy of East German women is lowest at age 65. However, as seen in Table 2, most East German men retired at age 65 whereas only a few women retired late in the East. Hence, results may be partly due to selection effects.

Table 7: Remaining life expectancy at age 65 by retirement age, place of residence and gender

		Retirement age						
		60	61	62	63	64	65	66
Men	West Germany	15.83	16.20	16.40	17.46	17.89	17.25	17.55
	East Germany	15.10	15.07	15.37	15.87	16.38	16.98	16.40
Women	West Germany	20.42	20.59	20.31	20.66	20.44	20.52	20.72
	East Germany	20.16	19.44	19.52	19.22	19.74	18.58	19.39

Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

Lifetime Wage Income

Our results for life expectancy of men by lifetime income, shown in column 3 of Table 8, fit well with those of Gaudecker/Scholz (2006) and Hupfeld (2006). Because of similar data this is no surprise, although we analyze different years. They found for men with less than 35 earnings points a negative relation of *PEP* and longevity, for higher lifetime incomes it is positive. Our results show a drop in life expectancy at 65 from 16.66 years for men with less than 20 *PEP* to 15.59 years for 30-39 *PEP*. Thereafter, life expectancy rises with increasing lifetime income up to 19.05 years for men with more than 70 *PEP*. For women we find life expectancy to rise with lifetime relative wage income.

Table 8: Remaining life expectancy at age 65 by retirement age, lifetime relative wage income and gender ²⁴

	Sum of PEP	Retirement age							
		All ages	60	61	62	63	64	65	66
Men	up to 19	16.66	14.18	14.26	14.95	16.02	15.45	16.91	17.52
	20-29	16.25	14.25	14.59	15.01	16.55	16.15	16.97	17.25
	30-39	15.59	14.30	14.81	15.01	16.35	16.65	16.78	16.96
	40-49	15.95	15.23	15.60	15.75	16.73	16.99	16.56	16.98
	50-59	16.83	16.21	16.55	16.57	17.41	17.74	17.11	18.16
	60-69	17.96	17.25	17.55	17.63	18.33	18.78	18.21	18.69
	over 70	19.05	17.88	18.11	18.03	19.03	19.50	19.27	19.30
Women	up to 19	20.28	20.09	20.06	19.76	20.39	20.24	20.47	20.67
	20-29	20.45	20.32	20.79	20.48	20.91	20.51	20.73	20.88
	30-39	20.40	20.24	20.92	20.95	21.14	20.81	20.36	21.28
	40-49	20.86	20.69	21.26	21.42	21.59	21.33	21.23	-
	50-59	21.31	21.16	21.59	22.08	21.65	-	21.36	-
	60-69	21.69	21.49	22.10	-	-	-	-	-
	over 70	21.92	-	-	-	-	-	-	-

Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

We globally find a positive link between pension income and life expectancy at age 65, when differentiating groups by retirement age. Life expectancy is shortest for those with few *PEP* and early retirement, and highest for late retirees with a high lifetime wage income. An explanation for the observed pattern may lie in interdependencies between health and income, a high income leading to better health and vice versa. The relation seems surprising for men because it contradicts our results without considering the retirement age. However, the reason is the different number of cases and thus weight of each income group and retirement age.

Type of Health Insurance

Linking life expectancy to age at retirement for groups differentiated by type of health insurance reveals higher longevity for persons who are voluntarily or private health insured as compared to those who are compulsory insured in the statutory health insurance. For men the difference is on average 1.1 years, the extreme values being 16.59 and 17.68 years, respectively. For women the gap is twice as high: Those compulsory insured have a live expectancy at age 65 of 20.24 as compared to 22.42 for the other group. These differences are preserved for all retirement ages (Table 9). Surely, there is a strong connection to our results for lifetime income, because as mentioned in section 4.1, only high earners have the possibility to choose their kind of health insurance and are, thus, voluntarily or private insured.

²⁴ Period life tables require a great number of cases for reliable results on life expectancy. Here, we set the limit to 400 cases. Thus, if the distribution of lifetime earnings by retirement age (Table 4) shows less than 400 cases, we do not report results.

Table 9: Remaining life expectancy at age 65 by retirement age, gender and type of health insurance

		Retirement age						
		60	61	62	63	64	65	66
Men	Compulsory insured	15.69	16.08	16.28	17.35	17.71	16.97	17.17
	Voluntarily or private insured	17.31	16.61	16.64	18.31	18.20	17.80	18.16
Women	Compulsory insured	20.24	20.50	20.27	20.54	20.30	20.19	20.38
	Voluntarily or private insured	22.83	23.08	22.18	22.38	22.11	22.11	22.37

Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

Number of Children

Survival analysis for women differentiated by their number of children reveals that life expectancy of West German women at age 65 is 19.90 years for childless women. It then increases with the number of children, being highest (20.95) for women with two children and falls thereafter to 19.14 years for women with five and more children. These results are almost independent from retirement age. Thus, women with two children lived longest. Our results fit well with previous studies on this topic (cp. Doblhammer, 2000).

Table 10: Remaining life expectancy of West German women at age 65 by number of children

Childless	1 child	2 children	3 children	4 children	5+ children
19.90	20.63	20.95	20.75	20.28	19.14

Data source: FDZ-RV – RTBNRTWF03-04TDemo; own calculations.

5 Model Calculation

In the German Statutory Pension Insurance, deductions are uniformly set to 0.3% per month of early retirement. There is no distinction by retirement age, gender and hence life expectancy. For gender it may be justified with de facto longer perpetuity periods for men because of widows' pension after the death of men; besides, there may be other, political reasons for not charging women for their longer life expectancy. However, the difference in life expectancy by retirement age we found out in section four is not considered.

In this Section we perform a simple, standard capital value calculation and compare actuarial deductions under the assumption of a given life expectancy with those calculated on the basis of our results concerning the age-at-retirement dependency of life expectancy. The present value of pensions at time S over the whole perpetuity period, PV_S , should be the same for each retirement age R .

$$PV_S(R) = \sum_{t=R}^{\infty} EP \cdot AF(R) \cdot CPV(t) \cdot PTF \cdot a(t, R) \cdot (1 + \delta)^{t-S} . \quad (2)$$

Usually, the sum of earnings points, EP , changes with retirement age R because of a different length of working life. For simplicity, we only consider entitlements that are in stock at age 60 ($S = 60$), as Ohsmann et al. (2003) do.²⁵ Contributions for working between age 60 and 65 are also not included. The access factor, AF , depends on retirement age R and accounts for deductions. CPV represents exogenous pension growth. PTF as pension type factor is 1.0 for old-age pensions. Life expectancy as a function of age at retirement is expressed by the share of survivors at age t , $a(t,R)$. It is assumed that all pensioners reach at least age 65. The discount rate is δ .

The amount of actuarial deductions calculated by the present value method, depends basically on assumptions regarding mortality, the discount factor and pension growth. In case of a *fixed* life expectancy, deductions are lower if, ceteris paribus, life expectancy is higher, exogenous pension growth is higher, the retirement age is lower, the pension eligibility age is lower, the discount factor is lower and the (positive) difference between the discount factor and pension growth is lower (Ohsmann et al., 2003). In our model we take pension growth to be 1% or 2% and the discount rate 2% or 3.5%. We calculate the present value of pensions at age 60 for each retirement age. Then we set monthly deductions iteratively to a value such that the present value of pensions retiring at ages 60, 61, 62, 63 and 64 years equals the present value of pensions at retirement age 65 years. We perform calculations for a fixed life expectancy as well as the life expectancy we calculated as function of the age at retirement. The corresponding values of monthly actuarial deductions are shown in table 11. Please remember that deductions per month of early retirement are currently set to 0.3%.

Results for a *fixed life expectancy* are as expected. Actuarial deductions for women are generally lower than for men due to a higher life expectancy; compensation for pension payments before age 65 can thus be stretched over a longer period. For the same reason, deductions are lower for lower retirement ages. A higher discount factor obviously increases the value of actuarial deductions; the reduction in the amount of pensions compensating for early retirement is simply less valuable, such that reductions must be higher. Finally, actuarial deductions are lower, the higher current pension value adjustments are. If future pension payments grow stronger, compensation for payments before age 65 are easier.

The really new insights come from calculations with a *variable life expectancy*. Actuarial deductions for men should decrease, as compared to the standard case of a given life expectancy, for retirement at ages 60 to 62 years and increase for later retirement. For example, taking a discount rate of 2% and pension growth of 2% per year, actuarial deductions should be 7.8% for a retirement at age 64 and thus 2.3 percentage points lower than under the assumption of a fixed life expectancy and more than twice as high as current deductions of 3.6%. In contrast, for a retirement

²⁵ Calculations in Ohsmann et al., are performed for the birth cohort 1943, assuming age- and gender-specific mortality rates for the years 2003 to 2043. We, in contrast, use the results of our period life tables. Hence, life expectancy we calculate is lower and a direct comparison with results for actuarial deductions in Ohsmann et al. is not possible.

age of 60 years, deductions should be 3.36% p.a. of early retirement, i.e. 16.8% in total, as opposed to the 4.4% p.a. we calculated for a fixed life expectancy. The explanation is evident: the lower than average life expectancy in case of retirement with 60 to 62 years implies a shorter perpetuity period. Hence, overall pension payments are lower. Analogously, pension payments rise in case of retirement at age 63 and later, as compared to a situation with fixed life expectancy, such that deductions should be higher. As deductions were calculated based on payments for retirement at age 65, they can be lower for very early retirement in order to achieve the same cumulated discounted pension value.

Table 11: Monthly actuarial deductions for early retirement (in %)

		Retirement Age						
		64	63	62	61	60		
Men	$\delta = 2.0\%$, CPV 1%	Fixed life exp.	0,50	0,48	0,45	0,43	0,41	
		Variable life exp.	0,69	0,50	0,35	0,35	0,33	
	$\delta = 3.5\%$, CPV 1%	Fixed life exp.	0,58	0,55	0,52	0,49	0,47	
		Variable life exp.	0,74	0,57	0,43	0,42	0,40	
	$\delta = 2.0\%$, CPV 2%	Fixed life exp.	0,46	0,43	0,41	0,39	0,37	
		Variable life exp.	0,65	0,46	0,29	0,30	0,28	
	$\delta = 3.5\%$, CPV 2%	Fixed life exp.	0,53	0,50	0,47	0,45	0,43	
		Variable life exp.	0,70	0,53	0,37	0,37	0,35	
	Women	$\delta = 2.0\%$, CPV 1%	Fixed life exp.	0,43	0,41	0,39	0,37	0,36
			Variable life exp.	0,43	0,44	0,38	0,38	0,35
$\delta = 3.5\%$, CPV 1%		Fixed life exp.	0,50	0,48	0,46	0,44	0,42	
		Variable life exp.	0,51	0,50	0,45	0,44	0,41	
$\delta = 2.0\%$, CPV 2%		Fixed life exp.	0,38	0,36	0,35	0,33	0,32	
		Variable life exp.	0,39	0,39	0,34	0,34	0,31	
$\delta = 3.5\%$, CPV 2%		Fixed life exp.	0,45	0,43	0,41	0,39	0,38	
		Variable life exp.	0,46	0,46	0,40	0,40	0,37	

Source: own calculations.

Adjustments in the current pension value were longtime expected to follow wage growth. However, after introducing the demographic sustainability factor, pension growth lacks behind wage growth, a situation that will probably continue. Thus, under the assumption of a discount rate of 3.5% and pension growth of 2%, actuarial deductions would be 8.4% and 4.2% p.a. for retiring with 64 and 60, respectively. The greater the gap between the discount rate and pension growth, the higher must the actuarial deductions be.

Under the usual assumption of a *fixed life expectancy*, actuarial deductions for women are lower than for men because of their higher life expectancy. But considering *variable life expectancy*, they are higher for retirement with 60 to 62 years. The reason is the short perpetuity period for men which exceed the effect of a higher life expectancy of women. The effects of considering a variable life expectancy are small.

When interpreting the results, it must be kept in mind that the accurate amount of actuarial deductions depends strongly on the assumed pension growth and the discount factor. But, as shown in Table 11, when considering differential mortality by

age of retirement, it is well possible that for reasonable parameter values deductions for very early retirement are currently too high and far too low for retirement with 63 years and later. Finally, our results would have been lower, had we used a cohort life table and thus considered the general increasing trend in life expectancy, like Ohsmann et al. (2003, 2004) did.

6 Conclusion

This paper poses and analyzes the question whether remaining life expectancy at age 65 varies with retirement age and investigates the respective pattern. We also consider changes linked to place of residence, pension income and other variables. The result may be of importance for individual retirement decisions as well as for public, occupational and private old-age provisions, health insurances and the government whose financial burden is affected by differential mortality.

Our survival analyses show great differences in mortality. With respect to old-age pensions, remaining life expectancy of men at age 65 increases with up to 1.9 years if retirement occurs later. It is lowest for retiring at age 60 and highest for retiring at age 66, namely 15.8 and 17.7 years, respectively. Life expectancy of women is, however, with a maximum spread of 0.5 years, between 20.3 and 20.8 years, almost independent of the retirement age. Invalidity pensioners, which we briefly analyzed, too, have a much lower life expectancy, of about 3 years lower than the lowest value for non-invalids. East German men have a 0.7 to 1.6 years lower life expectancy at age 65 as West Germans. Only for East German women we found a negative link between life expectancy and retirement age. Differentiation according to pension income yields that life expectancy is shortest for those who have few *PEP* and retire early and highest for late retirement with a high lifetime wage income – for both, men and women.

The low life expectancy of early retirees implies a shorter perpetuity period, as compared to the conventional assumption that mortality is independent of retirement age. In contrast, a higher life expectancy for late pensioners means a longer perpetuity period of old-age pensions. In a simple model calculation we find that the current global deductions of 3.6% per year are not actuarial fair. Under plausible assumptions, deductions should be lower than currently provided by law for retirement with 60 to 62 and higher for later retirement, especially for men.

Literature

Arnds, P./H. Bonin (2002), Frühverrentung in Deutschland: Ökonomische Anreize und institutionelle Strukturen, IZA Discussion Paper 666.

Bogai, D./F. Hirschenauer (2006), Erwerbsbeteiligung und Arbeitslosigkeit der Älteren, in: H. Faßmann/B. Klagge, P. Meusburger (Hrsg.), Nationalatlas Bundesrepublik Deutschland, Band 7: Arbeit und Lebensstandard, Spektrum Akademischer Verlag, Heidelberg u.a.: 78-81.

BMGS (Hrsg.) (2003), Nachhaltigkeit in der Finanzierung der Sozialen Sicherungssysteme: Bericht der Kommission, Bundesministerium für Gesundheit und Soziales, Berlin.

Börsch-Supan, A. (2004), Faire Abschläge in der gesetzlichen Rentenversicherung, Sozialer Fortschritt 10: 258-261.

Börsch-Supan, A./R. Schnabel (1998), Social Security and Declining Labor-Force Participation in Germany, American Economic Review, 88 (2): 173-178.

Börsch-Supan, A./A. Reil-Held/C.B. Wilke (2004), Der Nachhaltigkeitsfaktor und andere Formelmodifikationen zur langfristigen Stabilisierung des Beitragssatzes zur GRV, Ausschuss für Gesundheit und Soziale Sicherung, Ausschussdrucksache 0453A, 15. Wahlperiode.

Börsch-Supan, A./C.B. Wilke (2004), The German Public Pension System: How it was, how it will be, NBER Working Paper 10525.

Chiang, C.L. (1984), The Life Table and its Applications, Krieger Publishing, Malabar.

Davey Smith, G./C.L. Hart/D.J. Hole/P.K. MacKinnon/C.R. Gillis/G.C.M. Watt/D. Blane/V.M. Hawthorne (1998), Education and occupational social class: which is the more important indicator of mortality risk?, Journal of Epidemiology and Community Health 52(3): 153-160.

Doblhammer, G. (2000), Reproductive History and Mortality Later in Life: A Comparative Study of England and Wales and Austria, Population Studies 54(2): 169-176.

DRB (Hrsg.) (2007a), Deutsche Rentenversicherung in Zahlen 2007, Deutsche Rentenversicherung Bund, Berlin.

DRB (2007b), Rentenzugangsstatisik, Deutsche Rentenversicherung Bund, www.fdz-rv.de.

Frosch, K. (2007), Zu alt für einen neuen Job? – Altersspezifische Wiederbeschäftigungschancen nach Verlust des Arbeitsplatzes, Wirtschaftspolitische Blätter, 4: 641-656.

von Gaudecker, H.-M./R.D. Scholz (2006), Lifetime Earnings and Life Expectancy, MPIDR Working Paper 2006-008.

Haynes, S.G./A.J. McMichael/H.A. Tyroler (1978), Survival after early and normal retirement, Journal of Gerontology 33(2): 269-278.

- Hirschenauer, F. (2007), Regionale Arbeitsmarktlage der Älteren: Arbeiten bis 65 - längst noch nicht die Regel, IAB Kurzbericht 25, Nürnberg.
- Hoffmann, R. (2006), Socioeconomic Differences in Old Age Mortality in Denmark and the USA, Dissertation, Universität Rostock.
- Hubrich, S./T. Tivig (2006), Betriebsrenten im Altersversicherungssystem Deutschlands: Eine Betrachtung aus volkswirtschaftlicher Sicht, Deutscher Universitätsverlag, Wiesbaden.
- Hupfeld, S. (2006), Longevity and Redistribution in the German Pension System, Diskussionspapier der Forschergruppe "Heterogene Arbeit: Positive und Normative Aspekte der Qualifikationsstruktur der Arbeit" 06/10.
- Kaldybajewa, K./E. Kruse (2006), Eine neue vorgezogene, abschlagsfreie Altersrente für besonders langjährig Versicherte mit 45 Versicherungsjahren? Statistische Fakten, Hintergründe und Bewertungen zu diesem Vorschlag, RVaktuell 11: 434-448.
- Kaldybajewa, K./E. Kruse (2007), Altersteilzeit immer beliebter: Statistische Fakten, Interpretationen und Bewertungen, RVaktuell 8: 244-253.
- Kohli, M./H. Künemund (1996), Nachbarberufliche Tätigkeitsfelder: Konzepte, Forschungslage, Empirie, Kohlhammer, Stuttgart.
- Kortmann, K. (2003), Situation und Entwicklung der betrieblichen Altersversorgung in Privatwirtschaft und öffentlichem Dienst 2001 - 2003, Endbericht, Studie im Auftrag des Bundesministeriums für Gesundheit und Soziale Sicherung, Infratest Sozialforschung, München.
- Kreyenfeld, .M./T. Mika (2006), Die "Biographiedaten" der DRV: Analysemöglichkeiten im Bereich Fertilität und Familie, Deutsche Rentenversicherung 9/10: 583-608.
- Kroker, R./J. Pimpertz (2003), Belastungsneutrale Abschläge bei Frühverrentung, iw-trends 4.
- Kühntopf, S./T. Tivig (2006), Renteneintrittsalter und Lebensdauer: Was kostet die Frühverrentung?, Thuenen-Series of Applied Economic Theory, Working Paper 64, Universität Rostock.
- Kühntopf, S./T. Tivig (2007a), Frühverrentungsabschläge und Lebensdauer nach Renteneintritt, Wirtschaftspolitische Blätter, 4: 807-819.
- Kühntopf, S./T. Tivig (2007b), Länger arbeiten, länger leben? Eine erste Studie für Deutschland, DGD-Tagungsband zur Jahrestagung "Alter und Arbeitsmarkt" (forthcoming).
- Luy, M. (2006), Mortality tempo-adjustment: an empirical application, Demographic Research 15: 561-590.
- Mokdad, A.H./J.S. Marks/D.F. Stroup/J.L. Gerberding (2004), Actual Causes of Death in the United States, 2000, Journal of the American Medical Association 291: 1238-1245.
- Morris, J.K./D.G. Cook/A.G. Shaper (1994), Loss of employment and mortality, British Medical Journal 308: 1135-1139.
- Ohsmann, S./U. Stolz/R. Thiede (2003), Rentenabschläge bei vorgezogenem Rentenbeginn: Welche Abschlagssätze sind richtig?, Die Angestelltenversicherung 4: 171-179.

- Ohsmann, S./U. Stolz/R. Thiede (2004), Rentenabschläge bei vorzeitigem Rentenbeginn: Was ist versicherungsmathematisch fair?, Sozialer Fortschritt 10: 267-271.
- Opfermann, H./C. Grobecker/E. Krack-Roberg (2006), Auswirkung der Bereinigung des Ausländerzentralregisters auf die amtliche Ausländerstatistik, Wirtschaft und Statistik 5: 480-494.
- Pimpertz, J. (2004), Wie hoch sollten Rentenabschläge bemessen sein?, Sozialer Fortschritt 10: 262-267.
- Prognos AG (Hrsg.) (2003), Auswirkungen veränderter Rahmenbedingungen auf die Finanzen der gesetzlichen Rentenversicherung, Bericht für den Verband Deutscher Rentenversicherungsträger, Basel.
- Sorlie, P.D./E. Backlund/J.B. Keller (1995), US mortality by economic, demographic, and social characteristics: the National Longitudinal Mortality Study, American Journal of Public Health 85(7): 903-905.
- Statistisches Bundesamt (Hrsg.) (2006), 11. koordinierte Bevölkerungsvorausbe-
rechnung: Annahmen und Ergebnisse, Wiesbaden.
- Tivig, T. et al. (Hrsg.) (2005), Deutschland im Demografischen Wandel – Fakten und Trends 2005, Rostocker Zentrum zur Erforschung des Demografischen Wandels, Rostock.
- Tivig, T./P. Hetze (Hrsg.) (2007), Deutschland im Demografischen Wandel, Rostocker Zentrum zur Erforschung des Demografischen Wandels, Rostock.
- Tsai, S.P./J.K. Wendt/R.P. Donnelly/G. de Jong/F.S. Ahmed (2005), Age at retirement and long term survival of an industrial population: prospective cohort study, British Medical Journal 331: 995.
- Waldron, H. (2001), Links between early Retirement and Mortality, ORES Working Paper 93.
- Werding, Martin (2007), Versicherungsmathematisch korrekte Rentenabschläge für die gesetzliche Rentenversicherung, ifo Schnelldienst 60 (16): 19-32.
- Wübbecke, C. (2005), Der Übergang in den Rentenbezug im Spannungsfeld betrieblicher Personal- und staatlicher Sozialpolitik, Beiträge zur Arbeitsmarkt- und Berufsforschung 290, Nürnberg.