High Pension Wealth Triggers Early Retirement even in a Funded Scheme*

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August 15, 2005

Abstract

Early retirement is predominantly considered to be the result of incentives set by social security and the tax system. But the Swiss example demonstrates that the incidence of early retirement has dramatically increased even in the absence of institutional changes. We

*This research was supported by grants of the Swiss National Science Foundation (subside no 1214–67875.02) and the "Bureau de l'Egalité des Chances" (Université de Lausanne, fonds no 2656958). We would like to thank Rob Alessie, Peter Diamond, Richard Disney, Randall Filer, Nicole Jonker, Kristin Kleinjans, Volker Meier, James Poterba, Regina Riphahn, Susann Rohwedder, seminar participants at the Universities of Basel, Utrecht, Zürich, and the MIT, as well as conference participants in Munich (CESifo Area Conference on Public Sector Economics), Amsterdam (RTN on Economics of Ageing and DNB Research Conference on "Household behavior and financial decision-making"), Madrid (EEA), and Copenhagen (CEBR/CESifo) for their helpful suggestions and comments. Any errors are our responsibility.

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argue that the wealth effect also plays an important role in the retirement decision for middle and high income earners. An actuarially fair, but mandatory funded system with a relatively high replacement rate may thus contribute to a low labor market participation rate of elderly workers.

We provide evidence using a unique dataset on individual retirement decisions in Swiss pension funds, allowing us to perfectly control for pension scheme details. Our findings suggest that affordability is a key determinant in the retirement decisions. The higher the accumulated pension capital, the earlier men, and — to a smaller extent — women, tend to leave the work force. The fact that early retirement has become much more prevalent in the last 15 years is a further indicator of the importance of a wealth effect as the maturing the Swiss mandatory funded pension system over that period has led to an increase in the effective replacement rates for middle and high income earners.

Jel–Classification: D91, H55

Keywords: Occupational Pension, Retirement Decision, Wealth Effect, Duration Models

1 Introduction

The increase in early retirement is a widespread phenomenon throughout Europe, causing financial distress to almost all public pension systems. In most countries, the main reason for this effect seems clear: High replacement ratios and high implicit tax rates on working beyond a certain age induce workers to opt for an early exit out of the labor market. But early retirement is also prevalent — albeit to a lesser degree — in Switzerland, where implicit tax rates on working on in old age are virtually zero within the first pillar, and zero to low in most second pillar schemes. Like in many other countries, the retirement age has fallen in the last decade despite the fact that institutional incentives (statutory retirement age, pension accrual rates, replacement rates and other factors) have stayed basically unchanged. Even more striking is the fact, that — in contrast to most other countries — early retirement is more prevalent for middle and high income earners than for lower income groups.

What seems to emerge from the empirical literature is that a higher lifetime income raises the retirement age, while higher pension benefits reduces it. The two income concepts are not unrelated, however, as a higher lifetime income may also lead to a higher pension income. While the role of incentives for the retirement decision has attracted a lot of attention, there is much less empirical evidence on the importance of pension wealth, notably not for middle and high income individuals. This is not surprising, given the fact that high replacement rates and strong retirement incentives usually go hand in hand, and are much more important for low income earners.

We claim that high pension wealth may also have a strong effect for middle and high income workers, even in the absence of negative incentives. We use a unique dataset of individual retirement decisions, provided by a number of privately run (but publicly mandated) pension funds in Switzerland. The provided data allow us to isolate the impact of accumulated pension wealth on the timing of retirement, as we can control for all company specific pension plan details, including implicit and explicit individual incentives for early retirement. Due to the fact that the second pillar has been mandatory since 1985 (and had been offered by a majority of companies even before that

year), differences in accumulated capital at retirement within the same cohort closely mirror differences in lifetime income within the same cohort. Unlike in most other countries, the Swiss pension scheme displays replacement rates that are similar across income groups.

We find that the incidence of early retirement has increased considerably over the last decade, despite the fact that there were no institutional changes throughout that period. Due to an increase in the effective replacement rate within Switzerland's second pillar, more people are now able to accumulate sufficient funds to pay for an early labor market exit than one or two decades ago. Within the same generation wealthier men tend to leave the work force earlier, even if we control for the mentioned time trend. Lower income workers, on the other hand, often work up to the legal retirement age even in pension funds in which early retirement packages are relatively generous. In these cases the need to generate income seems to be the only explanation for working up to the statutory retirement year.

Our results suggest that the reason for early retirement does not solely lie in the incentive structure implied by public pension plans. In the presence of sufficient funds, the preference for leisure in old age seems to be a dominating driving force for leaving employment. Many poorer individuals only keep working because they cannot afford to retire.

2 Background

2.1 The Swiss social security system

Switzerland's pension system is composed of three pillars, of which the first and second are of approximately equal importance.[1] The first pillar is a predominantly pay-as-you-go (PAYG) system, and aims at providing a basic subsistence level of income to all retired residents in Switzerland. The second pillar is a mandatory, employer-based, fully funded occupational pension scheme. The statutory retirement age is 65 for men and currently 64 for

[1] A detailed description of all aspects of the Swiss social security system is beyond the scope of this paper. The interested reader is referred to Queissar & Vittas (2000, especially concerning institutional details) and Bütler (2004, for the second pillar).

women. Until 2003 (i.e., for the women in our sample), the applicable female retirement had been 62.[2]

The main goal of the occupational pension system is to maintain the pre-retirement living standard, together with the benefits stemming from the first pillar. As the latter provides a basic level of income, the second pillar only insures income above a certain threshold level, which is equal to the amount of a yearly maximum single first pillar pension[3]. While there is in principle also a maximum insured income, most companies do not implement it. All companies in our sample cover the whole income above the lower threshold level.

Contributions, of which the employer has to pay at least half, are strictly proportional to the insured income.[4] These old-age credits are accumulated as retirement assets and bear interest. The minimum interest rate is determined by the Swiss Federal Council. Upon attainment of the retirement age, the accumulated capital can be withdrawn either as a monthly life-long annuity — this is the standard option — or as a lump sum (or a mix of the two), provided the pension fund allows for the full lump sum option.

The accrued capital is fully portable when the insured individual changes the employer. By law, an employee changing the firm gets the total accumulated contributions (including the employer's part). This sum has to be paid into the new fund, with very few exceptions (self–employment under certain conditions, or those who leave the country for good). The total amount of money at retirement has thus been accumulated over the entire work life and is, therefore, a good proxy for lifetime income. Old age pension benefits are strictly proportional to the accumulated retirement assets (plus accrued interest). The accumulated capital is translated into a yearly pension using a

[2]Note that retirement at 65/64 is not mandatory by law, but reaching age 65 for men or age 64 for women is rather an eligibility condition for claiming public pension benefits. Most labor contracts specify a retirement age that coincides with the eligibility age.

[3]In 2004, this threshold was: 25'320 CHF $\approx$ 17'000 EURO $\approx$ 18'500 USD. This threshold explains the much lower coverage for female workers, who often work part-time and have lower average wages than men.

[4]The law specifies minimum contribution rates that increase with age (from 7% at age 25 to 18% from age 55 onwards), but the pension fund can deviate from this pattern as long as the same contribution rate is attained on average.

fixed conversion factor, irrespective of gender and marital status. The legal conversion factor had been constant at 7.2% from 1985 to 2004. The second pillar mandates joint annuities. When a retired individual dies, his surviving spouse receives a benefit amounting to 60% of the previous pension, his dependent children a benefit of up to 20% each. As a consequence of survivor benefits and differential mortality, the money value of an annuity is approximately 25% lower for non-married men than for both women and married men.

Most pension funds aim at a replacement rate of approximately 50% to 60% of the insured income. Together with the income from the first pillar, and the fact that there are no social security deductions on pension benefits, the net replacement rate *before* taxes amounts to at least 70-80% even for high income groups. Due to progressivity of federal and cantonal taxes in Switzerland, and the availability of additional children pension benefits, the effective net replacement rate can be well above 100% for an individual with an uninterrupted working career, as Table 1 illustrates.

Early retirement options are now offered by many companies. In some cases, this simply amounts to an actuarially fair reduction of the conversion factor in the case of early withdrawals. In others, more generous early retirement packages exist, including additional payments to make up for first pillar benefits up to the legal retirement age. Take up rates for early second pillar benefits are very high. On average, the observed retirement in occupational plans is substantially below the statutory age even in funds that do not subsidize early retirement explicitly.[5]

2.2 Retirement and Life-time Income

Using various sources of evidence, Costa (1998) argues that the decrease in the average retirement age in the US during the last century can be attributed to a great extent to a wealth/income effect. Bloom, Canning & Moore (2004)

[5]The first pillar did not avail early retirement schemes until very recently. Since then the take-up rates of these early benefits have been small. Presumably this is due to the fact, that many second pillar pension plans allow an anticipation of benefits at actuarially fair rates (or better). This latter option is administratively more convenient for most beneficiaries.

present a theoretical life-cycle approach in which a higher life-time income reduces the retirement age *ceteris paribus*, while better health and a longer life-span lead to a longer work period, albeit in a less than proportional way. Empirical country studies, to be found in Gruber & Wise (2004), show that a higher (life-time) income raises the retirement age (probably by a lower disutility of work), while higher pension benefits reduces it. Which of the two effects dominates when the retirement income is very strongly related to lifetime income, as in the Swiss case, is not clear, however.

Standard economic theory predicts that workers choose their consumption and labor supply profiles so as to maximize an intertemporal utility function with respect to a lifetime budget constraint. If the adjustment for early retirement were the same for everybody and in the absence of (capital market) distortions, richer individuals should then retire later due to their higher life expectancy (and a potentially lower disutility of labor). But people are neither fully rational, nor are markets complete. One of the rationales for introducing social security in the first place was the fear that people might not be able to accumulate sufficient funds for retirement. Forcing individuals to contribute to a pension scheme (in the form of taxes or earmarked savings) reduces this inefficiency and might lead to an ex post more efficient allocation of lifetime resources. Typically replacement rates of social security systems decrease with pre-retirement income to account for the fact that the level of retirement income deemed sufficient to cover the needs in old age increases less than proportionally with income (or may even be constant).

For the sake of the argument, let us assume that the "necessary" pension income increases indeed less than proportionately with pre-retirement income. If this is reflected in the effective replacement rate pattern, as was typical in Switzerland 20 years ago, one would not expect to see much difference in the behavior across individuals with different incomes. But when pension benefits are approximately proportional to pre-retirement income, it takes longer to reach a sufficient level of pension income for the poor than for middle/high income individuals. As of today, net replacement rates in Switzerland are nearly constant across income groups, as Table 1 illustrates. Based on this argument, we can expect an increase in the incidence of early retirement over the last 20 years among middle and high income earners

relative to low income workers. Within the same generation, the impact of life-time income on the retirement decision is ambiguous. A higher income usually implies a lower disutility of work, reducing the incentive to retire. But if replacement rates are approximately independent of pre-retirement income, richer individuals can afford an earlier exit out of the labor market.

Now let us consider the impact of credit market restrictions: If people are constraint, or simply reluctant to borrow, a high replacement rate could lead to an over-accumulation of capital compared to the desired level of pension assets. To offset this effect, people could retire earlier than desired in the absence of a pension system. If this effect was strong enough, people would want to retire at the earliest possible age, at which a withdrawal of benefits is possible. It is not *a priori* clear, what would be the impact of life time income in this context. Again, if the minimum level of retirement benefits increases in a less than proportional way with pre-retirement income, people with higher income reach the target at a lower replacement rate, i.e., at an earlier age. Note, however, that richer individuals are also unlikely to be credit constraint. This latter effect is only relevant if people are reluctant to borrow out of non-pension wealth.

How likely is over-saving within the second pillar in Switzerland? Pretty likely, if one considers the large final net replacement rates even for very high income levels. Taking into account that expenditure needs may fall after retirement due to an increase in home production (as reported by Rohwedder & Hurd (2003)), pension benefits are very likely to be higher than the desired level.[6] Thus, a distortion of optimal individual allocations induced by the scheme at younger ages may lead to a suboptimally low retirement age.

2.3 Related literature

The bulk of the previous research has concentrated on the role of social security systems and their incentives in explaining the retirement decision

[6]Hurd & Rohwedder (2003) point out that the empirically observed drop in spending at retirement may theoretically be well within the spirit of the life cycle model and fully consistent with forward-looking behavior. Their empirical estimates suggest that the decline in consumption is mainly due to substitution of market-expenses for goods and services by home production.

of older workers. Kotlikoff (1979) shows that the provision of social security will not affect the retirement decision under the assumption of perfect capital markets, actuarial fairness and known lifespan, as pensions are equivalent to private savings. Crawford & Lilien (1981) show that a progressive system tends to advance retirement for low-income workers. Social security also has an impact upon the labor supply decision and on the allocation of labor and consumption over the life cycle. Craig & Batina (1991) simulate the strengths of such effects and demonstrate how the introduction of a social security program acts as a disincentive to supply labor in the later stages of life.

While there is a strong consensus on the impact of incentives created by old age insurance on the retirement decision, the quantitative effect is measured using various approaches. These include the "lifetime budget constraint" approach (Burtless & Hausman, 1978; Hausman & Wise, 1980; Burtless, 1986), the "option value" approach (Lazear & Moore, 1988; Stock & Wise, 1990), the "hazard model" approach (Diamond & Hausman, 1984; Hausman & Wise, 1985), or, more recently, the "structural dynamic programming" approach (Rust, 1995; Stern, 1997; Bingley & Lanot, 2004). Hazard model approaches in which the retirement decision is treated as a dynamic discrete choice have been used in Miniaci (1998) for Italy, Antolin & Scarpetta (1998) for Germany, Mastrogiacomo, Alessie & Lindeboom (2002) for the Netherlands, and Maestas (2004) for US.

The timing of withdrawal from the labor force may be influenced by other factors, like one's own health, the desire to pursue different activities, or, if married, a partner's work status. Poor health is consistently mentioned in the literature as a reason for retirement, particularly before recent trends toward early retirement resulting from corporate and pension/social security incentives (Howe & Manning 1987; Monette, 1996). Overall, poor health is associated to lower satisfaction in retirement (Encel & Studencki, 1996; Sharpley, Gordon & Jacobs, 1996). However, a couple of specific studies on Switzerland provide a somewhat different evidence: Balthazar *et al.* (2003) find that health status is significant only in some of their model specifications; Gaillard *et al.* (2003) show that health status has no significant effect on early retirement. Retirement may also be affected by the willingness to increase

social participation in later life, by having contact with friends and family which promote physical and psychological health (Teshuva, Stanislavsky & Kendig 1994).

Moreover, the decision to retire may be jointly taken within a household, so that husbands and wives tend to retire at the same time, irrespective of their age. A number of studies for several countries (Gustman & Steinmeier, 1994; Blau, 1998; Jimenez-Martin et al., 1999; An et al., 2004 among others) find empirical evidence of the importance of coordination of retirement dates, and provide similarity of tastes, complementarity of leisure, sharing of household finances, health factors, correlation of unobserved tastes as possible explanations. Huang (1988) & Hurd (1990) report that both partners retire within the same month in 6-8 percent of their sample, within one year in 24-28 percent. Zweimüller et al. (1996) find a high and positive correlation of unobservable factors in the retirement process of both spouses. Dorn & Sousa-Poza (2005) provide additional empirical evidence for Switzerland. The authors find that people with a non-active partner retire more frequently than those who live alone, while having a partner who is still working reduces the probability of early retirement.

For some people, retirement may not mean total withdrawal from all paid employment, but only retirement from a specific work career as pointed out by Encel & Studencki (1996), Monette (1996) and Maestas (2004). This turns out to be particularly true for those with higher education and professional or managerial skills. Dorn & Sousa-Poza (2005) find similar evidence for Switzerland: about 30% of all early retirees continue working after retirement – and mostly for the same employer. For the pension funds, we consider in this paper, we do not have individuals who continue working for the same employer. However, we cannot exclude that they continue working in some other way.

3 Data and empirical strategy

3.1 The data

We use data collected at the individual level from 15 Swiss companies, both public and private, active in several industrial branches. The dataset includes the national public railway company, civil servants in two cantons, several industry firms, as well as clothing and food firms. We use only observations with retirement year 1990 and later, due to lack of sufficient information for earlier years. The novel aspect of this data is that it is not survey data (as in Dorn & Sousa-Poza (2005), for example), but comes from administrative records. This allows us to control for all company specific pension scheme details, including individual retirement plans.

The dataset consists of 8452 individuals. For each of them, we have one observation which includes the date (or year) of birth, the marital status, the date (or year) of retirement, the yearly pension payments (base level), as well as additional temporary benefits. Note that the individual decisions we analyze are observed at different points in time. On the firm level, we are also provided with details of early retirement plans, in particular the availability of first pillar replacement packages.[7] By means of such company details we were able to impute the annuity at the retirement date and in the future for all individuals. Unfortunately, we do not have direct information about past income streams for most companies. As outlined before, however, the accumulated pension capital, and thus the derived annuity, is approximately proportional to the level of pre-retirement income above the threshold level as specified in the law.

As reported in Table 2, females and males represent 36.5 and 63.5 percent of the sample, respectively. The distribution of marital status is very different

[7]Some of the relevant information for the project had to be imputed from other sources (regulation of pension fund) or from a combination of available data. In many cases, the information could only be gathered from a personal interview with the responsible pension fund manager. Some firms have also provided us with information about the number of children under 18/25, the amount withdrawn as a lump sum (if this option is available), the total capital accumulated at retirement, and an indicator whether the individual has chosen a non-standard retirement option.

for men and women: the great majority of men is married at retirement (85.4 percent versus 52.6 percent for women), whereas the fraction of women living alone sum up to almost 50 percent.

The sample consists of individuals whose age at retirement ranges from 55 to 70. We explicitly exclude all observations for which the path to retirement passes through a period of disability benefits, although this may bias retirement hazards downwards for groups of individuals more affected by disability. The reason for excluding disability induced retirement is data (non-)availability in some cases, and very few observations for funds for which we do have the relevant information.

While 13.2% of women and 14.6% of men retire exactly at their statutory retirement age, 25.6% of women and 27.2% of men retire in an interval of 3 months around their statutory retirement age. This is probably a better measure as many people prefer to retire at the end of the month or year. The fraction of people retiring early within the included pension plans greatly exceeds the corresponding fraction for the whole population, in which 55% of all men and 44% of women retired early in 2002.[8]

There have been important changes in the retirement behavior over the last 15 years. Figure 1 depicts the distributions of the age at retirement for men and women for three different sub-periods (1990-1994, 1995-1999, 2000-2003). The distribution of the age at retirement has a peak at the respective (current) statutory/eligibility retirement age of 65 (men) and 62 (women).[9] For the second time period the profile for men has another peak around age 62, which is the age at which some pension funds offer early retirement benefits — sometimes even full — even for men. This peak becomes the most prominent one in the third period. We also notice another peak at age 60. This is often the lowest age for which early retirement packages are offered at relatively good conditions. It is interesting to note that a sizeable fraction of women work beyond the statutory retirement age, though this number has clearly decreased over time. The most striking feature of these distributions

[8]Recall that, in general, low income people (and to some extent self-employed) are not covered by second pillar pension plans. This might be a first indicator that individuals who retire early do so because they can afford it.

[9]For all women in the sample, 62 was the relevant eligibility age for first pillar benefits.

is a clear shift of the retirement decision to lower ages for both men and women. This decrease is particularly strong from 1995-1999 to 2000-2003.

3.2 Construction of income and incentive measures

We proxy lifetime income by a measure of second pillar income that is equivalent across companies. To do this, we first construct a measure for accumulated capital at the statutory retirement age, by using firm specific information on conversion factors, early retirement plans and other benefits.[10] The variable "annuity" corresponds to the yearly pension at *the regular retirement age* if all capital were fully annuitized, including the annuitized value of any lump sum payment upon retirement. To account for economic growth and inflation, these numbers are deflated by the nominal Swiss GDP (base year 2000).

Table 2 shows that there are large differences in annuity levels across gender and marital status, with women getting approximately half the amount of men on average. The only exception are singles, for which females fare better. This can be explained by the fact that single women are more likely to be well educated than average women, whereas the contrary is the case for men. Recall that, due to the legal requirement to transfer pension capital from a previous to the current employer, second pillar capital or income is a good proxy for lifetime income. Nonetheless, individual data on retirement wealth cannot convey an exact picture of a person's entire wealth position as the latter depends on additional income and wealth by the spouse, especially for women.

We also construct a variable that captures the individual incentives for early retirement in each of the considered plans. As we do not have income data for all companies, we cannot directly calculate an increase in pension

[10] To compute the increase in the retirement capital between the observed retirement age and the statutory retirement age, we need a measure of the relevant wage for that period. As we do not always know the wage prior to the (early) retirement decision, we had to impute it from the accumulated capital, using information on company specific contribution rates, the average wage growth and (if available) other benefits. We have experimented with different versions of imputation, but the results turned out to be very robust.

wealth or an option value of working one more year. What we can compute, however, is the implicit marginal increase in the conversion factor if working an additional year, taking into account all additional benefits that the retired individual can claim when choosing an early exit out of the labor market. Many pension funds offer such benefits to bridge the years until first pillar benefits can be claimed. Upon reaching the statutory retirement age, the individual has to pay back a certain fraction of the received benefits. In most companies, the entire amount has to be paid back.

An actuarially fair increase in the conversion factor CF would be approximately 0.2 percentage point per year.[11] As there is very little variation in this number across companies and retirement ages, we only use the implicit change to the conversion factor that is due to any complementary supplemental benefits paid out over the next year in case of early retirement. This change is computed as $\frac{-B_{\text{sup}}}{K} * CF$, where K is the accumulated capital stock at the time of the retirement, and B_{sup} is the part of additional benefits (over the next year) that is non-repayable. It is obvious that non-refundable 1st pillar replacement benefits are relatively more attractive to low-income individuals as they constitute a higher fraction of their accumulated pension wealth.

3.3 The empirical strategy

We use survival analysis for our empirical analysis. Survival-time data documents spans of time (duration) ending in an event, called "failure". The failure event in our case corresponds to entering retirement. The hazard rate in t gives the hazard of retiring in t conditional on being in the labor force and not having retired yet until t. Similarly, the survival function gives the probability of continuing working in t. We first compute non-parametric empirical survival functions, and then analyze the influence of covariates using the semi-parametric Cox proportional hazard model.

[11] Using Swiss mortality tables an actuarially fair reduction of advancing retirement by one year is 6.8 percent. Taking into account that the accumulated capital also bears an interest r, the increase in the conversion factor CF can be computed as $CF\left(1 - \frac{(1+r)}{(1+0.068)}\right)$ in the absence of supplemental benefits.

We chose to analyze men and women separately. As is obvious from Figure 1, retirement behavior is very different for men and women. For individuals retiring before 2004, the eligibility age for old age benefits as well as many conditions within company pension plans (notably early retirement conditions) are also different across gender. Moreover, women are more likely than men to experience discontinuous work histories, be influenced by family responsibilities, be exposed to social roles beyond the work force, encounter financial instability, and live in retirement for a longer period of time.

As a measure of pension wealth, we use the log of the yearly annuity (variable "ln(annuity)") as well as its square (variable "ln(annuity)^2") to capture potential nonlinear effects. The variable "ln(annuity)" increases during the relevant period. We account for this fact by treating the two annuity variables as time-varying, and interact them with a linear increasing function of the time axis of the model.[12] The time variation is also one way to correct for the slight violation of the proportional hazard assumption in case of "ln(annuity)". To demonstrate the robustness of our results, we report results with and without time trend.

Time is bound to play another important role despite the fact that the proxy for average life-time income has been deflated. The effective replacement rate has increased due to a maturation of the system in most companies. This effect is captured by dummies for the retirement year.[13] Obviously, as will be outlined below, year dummies may also pick up macroeconomic conditions. An alternative explanation to retirement year effects in a maturing system would be differential behavior across cohorts. We have thus included cohort dummies and experimented with a variety of different specification, including 3 or 4 birth years per cohort or following features of our data set as well as historical events. Including cohort dummies implies excluding retire-

[12]The Cox proportional hazard model does not assume a specific probability distribution for the time until an event occurs. It assumes that the hazard functions of any two individuals are proportional over time, even if the values of one or more covariates are different. For example, if the hazard function of a married person is twice as high as the hazard function of a non-married person, this should be the case for all possible ages at retirement. We use a graphical test of the proportional hazard assumption (log-log plots).

[13]Alternatively, we have also worked with a linear retirement year trend, but, as the results are basically identical, we do not report the outcomes.

ment year dummies due to the high correlation between the two variables.

A set of dummy variables captures the marital status of the individuals in our data set. We include dummies for "married", "widowed" and "divorced/separated" which we compare to the base "singles".[14] We also add a dummy variable for the pension plan type "defined benefit" (DB = 1).

As pension plans differ considerably across pension funds and in order to also capture changes of company pension plans that may have influenced people's decision to retire or not, we always include company dummies in our estimates. For the largest companies in the sample, estimations for men are reported on the firm level as well.

At first sight, all retirement ages are observable, i.e., there is no obvious censoring in the data. However, although not required by law, many companies force people to retire by contractual agreements at the age eligible for first pillar benefits at the latest. A late or early retirement presumably is the result of the interaction of several reasons and options, whereas a retirement at the statutory age is rather an automatic act without further careful considerations. This means that we observe the eligibility age in such cases, although the person might have chosen to work longer, had she been free to do so. A visual inspection of the histograms in Figure 1, with obvious peaks at 65 (men) and 62 (women) seems to support the incidence of an important bias at ages 65 and 62 for men and women, respectively. As a consequence, we choose to mark all observations with retirement ages around the eligibility age as censored, i.e., we treat them as if we did not know the reason why these individuals had retired at that age. We have experimented with various intervals around the eligibility age, finding very small differences in estimation outcomes. Results are reported for a censoring interval of "eligibility age $\pm$ 3 months". As a robustness check, we also present estimations with all data points marked uncensored.

To classify the different estimations with respect to censoring and the

[14]The test of the proportional hazard assumption turned out to not be violated for these variables, except at the statutory retirement age of 62 for women and 65 for men (this was also the case for the variables "ln(annuity)" and "ln(annuity)^2"). As already mentioned, this effect is not surprising given the fact that contractual agreements often force people to retire at this age.

impact of the retirement year, the following notation has been chosen:

I	=	no time trend, no censoring
II	=	with time trend, no censoring
III	=	no time trend, with censoring
IV	=	with time trend, with censoring

In parenthesis, we add the gender (m = men, f = women), as well as the number of the company or the retirement year if applicable.

4 Empirical results

4.1 Non-parametric estimation results

We have computed Kaplan-Meier survival function estimates for different subsets of the data (always by gender). These Kaplan-Meier curves, depicting the probability of not retiring up to a certain age, are reported without censoring.[15]

Figure 2 shows the estimates for the three time periods 1990-1994, 1995-1999, 2000-2003. In line with Figure 1, we observe a clear downward shift in the survival function for both women and men. The huge downward jumps at 62 for women and 65 for men, respectively, have been replaced by many smaller jumps over all concerned ages. Figure 3 displays the results for individuals retiring between 2000 and 2003 as a function of the marital status.[16] For both women and men, the probability of still working after age 55 is lowest for single individuals. Note, however, that single females are also the richest women in the sample, while single men have the lowest average annuity of all male retirees. So interpreting the figures without disentangling the effects of marital status and income is delicate. Married men tend to stay

[15]The results do not differ very much if censoring is taken into account. The only difference is around the eligibility age of 62 and 65 years for women and men, respectively. As these observations are considered as censored, we do not observe a downward jump in the survival probability at this point, but rather at the end of the censoring interval.

[16]Estimates of other periods look similar (not reported here). It is important to do the analysis by period as different aspects, notably changes in the distribution of the marital status over time, may interact and influence the results.

in the labor force longer, while married women show an exit pattern similar to single women. Divorced women and widows tend to work longer.

Figure 4 shows the estimated survival function by retirement income quartile, again for the period 2000 to 2003. For both men and women, the lowest retirement income quartile tends to stay longest in the work force, at least until the statutory retirement age.[17] The retirement behavior as a function of income is monotonic for women, but clearly not for men. Men in the middle income range tend to retire earlier than both richer and poorer men. It seems as if income played a larger role for the retirement decision of women than for men. However, retirement income is also very much correlated with the family status for women, but far less for men. It is thus important to control for marital status to assess the impact of income.

4.2 Cox proportional hazard estimation results

Tables 3 to 7 summarize the estimation results for various specifications for women and men. The results are displayed as hazard ratios. A hazard ratio greater than 1 means that a marginal increase in the covariate increases the hazard to retire. If it is smaller than 1, a marginal increase in the covariate decreases the hazard to retire.[18] Estimated coefficients for retirement dummies are not reported in the tables, but are summarized in Figure 5. The number of stars (*) for retirement year and cohort dummies in the tables indicate the level of significance for a majority of the estimated hazard coefficients: 10%, 5%, and 1% levels of significance for a majority of coefficients are marked with (*), (**), and (***), respectively.

To assess the sensitivity of our results, we have conducted regressions with various subsets of the data. Table 7 reports results on the firm level for men for the companies for which we had enough observations to carry out

[17] It is worth mentioning again, that second pillar retirement income is roughly proportional to lifetime income above a certain income level in Switzerland. The term "income" thus stands for both retirement income and average lifetime labor income.

[18] In case of dummy variable the results have an even more precise interpretation: If the hazard ratio is bigger than 1, a unit increase in the covariate increases the hazard rate by *(hazard ratio - 1)* $\times$ 100% . If it is smaller than 1, a unit increase cuts the hazard rate to *(1 - hazard ratio)* $\times$ 100%.

separate estimations. The estimation results do not differ greatly from the overall regressions, but due to the much smaller number of observations the significance levels are lower. The same is true for estimations per retirement year (not reported here).

Including a time trend for the "ln(annuity)" and/or censoring alters the results only in a quantitative way. The time trend decreases the hazard ratio of the "ln(annuity)" variables (which is obvious, as capturing the trend should lower the net effect), but barely changes the hazard ratios of the other variables. Censoring the observations close to the statutory retirement year increases the hazard ratio for "ln(annuity)", as uncensored estimations ignore the fact that poorer individuals might have wanted to work longer, but were not allowed to do so.

4.2.1 Retirement year and cohort effects

The retirement year is highly significant in all regressions, showing the dramatic increase in the incidence of early retirement during the last 15 years (Tables 3 and 5). This is also shown by the estimated coefficients on retirement year dummies in Figure 5. There are, however, large fluctuations in exit rates across the participating pension funds (see the discussion on company effects below). The reasons for the latter are not entirely clear. It could well be that market conditions lead firms to advertise early retirement options more clearly, although the retirement decisions were not officially declared as down-sizing measures.

Cohort dummies are always highly significant regardless of the specification (Tables 4 and 6). We cannot assign a change in the behavior to any cohort specificity. The results of the estimations with cohort dummies are very close to those with retirement year dummies, which implies that the latter already capture possible changes in the behavior.[19].

[19]The reported cohort dummies follow historical events and hence are the same for the analysis of men and women. More precisely, the dummies mark the birth years: < 1933 (years of great depression), 1933-1938 (pre world war II period), 1939-1945 (world war II), > 1945 (post world war II period).

4.2.2 Pension plan incentives

Not surprisingly, the marginal increase of the conversion factor has a negative and very significant effect on the retirement decision. The effect is particularly strong for men. It is important to note that pension scheme incentives only play a role in six of the analyzed companies. For all others, there is no built-in incentive to retire early, as any adjustments to the attained benefit level are actuarially fair. The wealth effect remains very strong when accounting for early retirement incentives.

The indicator variable "defined benefits" has a somewhat ambiguous effect. It is highly significant and > 1 in the estimations for men, but not for women. Unlike women, men involved in a plan with defined benefits tend to retire earlier than those in defined contribution plans. It is possible that additional elements of the defined benefit schemes, for which we could not control, imply a higher incentive to retire early than then the factors we have reported. One possible explanation is that many DB plans allow individuals to retire at full benefits after a certain length of company membership (30 or 35 years, in general). This would explain the differential impact of the DB variable on men and women, as the latter are far less likely to have an uninterrupted working career.

4.2.3 Lifetime income

Pension wealth, as a proxy for lifetime income, has a strong impact on the retirement decisions for men and women. As the corresponding hazard ratio is greater than one, a higher lifetime income induces earlier retirement. The impact is slightly non-monotonic for men; up to a very high income level, a higher annuity (and thus a higher average lifetime income) leads to an earlier retirement, although lower life-expectancy for lower income workers should lead to the opposite outcome. For men, this affordability effect is much stronger at lower incomes than for women. The estimated peaks in the hazard ratio are at a second pillar income of 50'700 (45'600) Sfr for regressions without time trend (with time trend) and no censoring, and 124'500

(114'800) Sfr for estimations with censoring.[20] This corresponds to a yearly pre-retirement income of at least 100'000 SFR (≈ 64'500 EU or 80'000 $). The dependency of the hazard ratio on income for men is also depicted in Figure 6. It is important to stress that a median retirement income from the second pillar is clearly above the median income of *all* retirees, as low-income earners are not covered by the second pillar.

Affordability thus seems to be a key determinant of male and female retirement behavior. There is a tendency to retire as soon as the financial situation permits (and as soon as early retirement plans are available). Very rich men, but not women, retire somewhat later, possibly due to the attractiveness of the job.

4.2.4 Marital status

The role of the marital status is different for men and women. Married, widowed and divorced men tend to retire *later* than single men. There are no obvious (statistically significant) differences in retirement behavior between the former three groups, when controlling for income. Married women, on the other hand, tend to have a higher exit rate than single, widowed and divorced women. For men (and unlike women), the decisive factor in the retirement behavior seems to be the presence or absence of family ties.[21] The opposite impact of being married for men and women seems to hint at a joint retirement decision. As wives are younger on average than husbands,[22] the couple can coordinate the passage into retirement by a longer working spell of the husband or an earlier labor market exit of the wife. The second reason may be financial considerations. The overwhelming majority of today's elderly couples have followed a traditional role model, in which the husband

[20] 50'700 (45'600) Sfr correspond to approximately 32'700 (29'400) EURO or 40'600 (36'500) US$, 124'500 (114'800) Sfr to approximately 80'200 (74'000) EURO or 99'700 (91'900) US$.

[21] The importance of family ties (particularly for men) seems to be important for another retirement decisions, the choice between an annuity and a lump sum (see Bütler and Teppa (2004)). Single men are more likely to choose the annuity option, despite the lower implied money value of the annuity. A possible reasons is that the annuity may be the only form of insurance available to men without strong family ties.

[22] The age difference in Switzerland is approximately 4 years.

is the main (or even the only) bread-winner who has to care not only for himself, but also for his wife and children (who may still be at school). In the same spirit, married women may have lower financial needs due to their husbands' income, and can thus retire earlier than other women. Divorced women have a lower retirement hazard even if one controls for income. Most of these women in our sample have suffered from a previous divorce law that was strongly biased in favor of the main (male) bread winner with respect to the allocation of retirement assets accumulated during marriage. A third potential explanation for the difference in retirement behavior of men are large differences in longevity between married and non-married men in favor of the former. If reductions to benefits for early retirement are actuarially fair, it is simply not optimal for married men to retire before the statutory age. This effect is reinforced by the joint annuity model in Switzerland, as early retirement would also entail a reduction of future benefits for the surviving wife.

4.2.5 Macroeconomic conditions and company differences

An obvious candidate for the increase in early retirement would be changes in macroeconomic conditions, such as unemployment rates and GDP growth.[23] We, therefore, included information about GDP growth and unemployment (using different alternative specifications, such as total unemployment rate, unemployment rate by gender, unemployment rate only for persons older than 55, as well as their lagged values.). However, experimenting with macroeconomic variables, we could not identify any such predictor for the observed tendency to retire early in both the retirement year dummy and the cohort dummy specifications. This feature of the data is also mirrored in the fluctuations in the exit rate over the years for the different companies (see Table 7 and Figure 5). In most cases no cause for a big fluctuation could be identified. It could well be that due to financial difficulty of a firm or higher returns on invested pension capital, more people were induced to take up

[23]During the time we analyzed, the total unemployment rate significantly rose from 0.5% in 1990 to 5.2% in 1997 , then subsequently fell to 1.7% until 2001, and rose again afterwards. GDP growth increased from -0.8% in 1990 to 3.6% in 2001, and fell again afterwards.

early retirement, although this was not publicly admitted.

4.3 Other potential determinants of early retirement

There are, of course, many other determinants for which an impact on the retirement decision can be anticipated, like health status, mortality differences or the number of dependent children at retirement. A bad health status is likely to induce early retirement regardless of the amount of annuity the person could get.[24] Mortality differences may have an impact on both the timing of retirement and the choice of the payout option. As differences in mortality are usually private knowledge, the best we can do is to include proxies like life-time income (the rich live longer than the poor), and marital status (married men live longer than singles).

The impact of having dependent children on the retirement decision is unclear, *a priori*. People may want to keep on working to be able to finance their children's expenses. But they also might want to benefit from the generous additional benefits for children (even if reduced due to early retirement) as long as they are still eligible. The overall effect will depend on the financial situation of a family as well as the age of the children. Unfortunately, our data do not allow us to control for any of these variables directly.[25] We cannot control for post-retirement employment either.

5 Conclusions

Reversing early retirement trends has become a major policy issue in most European countries. It is clear that incentives set by the social security system will be key in this exercise. But there might be other determinants

[24] Through the fact that health is usually negatively correlated with (lifetime) income, it is not completely absent from our analysis. It may be the case that less healthy individuals might prefer to retire early, but cannot afford to do so. It is hoped that more complete data sets may help to clarify this issue in the future.

[25] We have run the regressions with a small sub-sample of individuals in companies that reported the number and age of children. The results are inconclusive due to the small number of individuals with children. In none of the estimations, the effect of children on the retirement probability was significant.

of early retirement that are equally important. If the preference for leisure in old age is sufficiently strong, for example, even negative implicit tax rates on staying in the labor force might not induce people to work much longer if they have sufficient funds to live on when old. Our paper has aimed to shed some light on the importance of this wealth effect on the retirement decision of middle und high income earners covered by a fully funded pension plan.

The main findings from our exercise can be summarized as follows. Firstly, the tendency to retire early in Switzerland has increased parallel to the maturing of the fully funded second pillar, despite the absence of changes to the incentive structure of the pension system. The effect is more pronounced for men than for women, and was found to be especially strong in the last few years. Secondly, affordability seems to be a key determinant for the retirement decision, in particular for men. Richer men (as measured by life-time labor income) retire earlier than poorer men. For women, the effect of income on the likelihood to exit the labor force is also positive, but weaker than for men. This wealth interpretation may also partially explain the increase in early retirement over the last 15 years, as Switzerland's second pillar has matured over this period, leading to higher effective replacement rates. The effective net replacement rates in Switzerland are so high now that the after retirement income is close to, or even higher than average pre-retirement income. If people are credit constraint or reluctant to offset this over-saving by accumulating debt, the rational response might be an earlier exit from the labor market. Thirdly, despite data limitations, we find that marital status is another key determinant for retirement decisions. Married women tend to retire earlier than other women, while divorced and separated women clearly work longer, probably due to financial constraints. For men, the main difference is between singles, who retire earlier on average, and non-singles. This hints at the importance of family ties (and of potential financial liabilities for children and (ex-)wives) for men. The findings also suggest that the retirement decisions of husband and wife are interdependent.

We believe that our findings have important policy implications. High replacement rates may not only have strong effects on low income workers, but also on high income earners even when explicit early retirement incentives are unimportant. A shift to a (more) funded system, as discussed in many

countries, typically increases the replacement rate of high income earners relative to that of lower income individuals as it strengthens the link between life-time earnings and future pensions. As a consequence, this policy could have a detrimental effect on the labor force participation of the better qualified workers. If such an outcome is in the interest of the country is doubtful at best.

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Before retirement						
Gross income	50		100		200	
Marital status	sing	m+2	sing	m+2	sing	m+2
Net income	41	44	73	80	135	147
After retirement						
I = First pillar	20	36	25	46	25	46
II = Second pillar	12	17	37	52	87	122
Net (I + II - tax)	30	52	55	89	92	139
Replacement rates						
Gross	0.65	1.07	0.63	0.98	0.56	0.84
Net	0.75	1.18	0.75	1.11	0.71	0.98

Table 1: *Pension benefits as a function of pre-retirement income (in 1000 Swiss Francs) and marital status (sing = single, m+2 = married with two children under 18/25). The computations are based on the following (realistic) assumptions: For the married with two minor children case, it is assumed that the spouse (for obvious reasons, the wife) is too young to claim her own benefits. The pension fund replaces 50% of coordinated income (= income - 25'300) with no upper income limit. Children benefits are 40% (first pillar) and 20% (second pillar) of the main claimant's benefits each. The tax base is the city of Zürich.*

Variable	**Obs.**	**in %**	**Median**	**Mean**	**(Std.)**
Age at retirement	*8452*		*62.0*	*62.0*	*(2.67)*
female	3084	36.5	62.0	60.9	(2.58)
single	500	16.2	61.1	60.7	
married	1621	52.6	61.1	60.7	
widowed	279	9.1	62.0	61.4	
divorced / separated	684	22.2	62.0	61.4	
male	5368	63.5	62.5	62.4	(2.60)
single	293	5.5	62.0	61.7	
married	4587	85.4	62.6	62.5	
widowed	161	3.0	63.0	62.9	
divorced / separated	327	6.1	62.0	62.2	
Statutory retir. age (±3 month)	*2248*	*26.6*			
female	789	25.6			
male	1459	27.2			
Annuity deflated	*8452*		*35'422*	*41'016*	*(32789)*
female	3084		21'730	28'315	(23378)
single	500		40'783	41'649	
married	1621		17'610	26'155	
widowed	279		14'246	21'650	
divorced / separated	684		21'498	26'404	
male	5368		41'191	48'313	(35115)
single	293		35'126	38'356	
married	4587		42'594	49'613	
widowed	161		33'077	43'001	
divorced / separated	327		35'518	41'613	
Defined benefits	8452			0.767	(0.423)
Δ *Conversion factor*	8452		0	-0.006	(0.048)

Table 2: *Summary statistics for some relevant variables*

Covariate	**I(m)** Haz. Ratio *(p–value)*	**II(m)** Haz. Ratio *(p–value)*	**III(m)** Haz. Ratio *(p–value)*	**IV(m)** Haz. Ratio *(p–value)*
married	0.7879	0.7914	0.6789	0.6809
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
widowed	0.7333	0.7345	0.6534	0.6536
	(0.003)	*(0.003)*	*(0.001)*	*(0.001)*
divorced/separated	0.8528	0.8533	0.7907	0.7907
	(0.068)	*(0.069)*	*(0.019)*	*(0.019)*
defined benefits	1.3298	1.3168	1.4807	1.4585
	(0.051)	*(0.001)*	*(0.035)*	*(0.001)*
conversion factor	0.0003	0.0003	0.0001	0.0001
(marginal increase)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
ln(annuity)	5.6252	1.0283	7.7040	1.0336
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
$\ln(\text{annuity})^2$	0.9233	0.9986	0.9167	0.9986
	(0.000)	*(0.000)*	*(0.001)*	*(0.000)*
retirement year	YES	YES	YES	YES
(dummies)	*(***)*	*(***)*	*(***)*	*(***)*
company dummies	YES	YES	YES	YES
max hazard	50'700 Sfr	45'600 Sfr	124'500 Sfr	114'800 Sfr
time trend	NO	YES	NO	YES
censoring	NO	NO	YES	YES
log p-lik.	-40563.26	-40566.05	-30186.11	-30190.88
observations	5367	5367	5367	5367
failures	5367	5367	3908	3908

Table 3: *Cox proportional hazard regression for men using* retirement year *dummies. The variables "ln(annuity)" and "ln(annuity)^2" have been interacted with a linear time trend (if time trend = YES). Data censored for age at retirement 64.75-65.25 (if censoring = YES).*

Covariate	**I(m)** Haz. Ratio *(p–value)*	**II(m)** Haz. Ratio *(p–value)*	**III(m)** Haz. Ratio *(p–value)*	**IV(m)** Haz. Ratio *(p–value)*
married	0.8174	0.8202	0.7205	0.7220
	(0.003)	*(0.003)*	*(0.000)*	*(0.000)*
widowed	0.7768	0.7775	0.7009	0.7002
	(0.021)	*(0.022)*	*(0.009)*	*(0.009)*
divorced/separated	0.8497	0.8499	0.7924	0.7916
	(0.061)	*(0.061)*	*(0.028)*	*(0.027)*
defined benefits	1.0955	1.8574	1.9247	1.9455
	(0.421)	*(0.000)*	*(0.000)*	*(0.000)*
conversion factor	0.0007	0.0007	0.0002	0.0003
(marginal increase)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
ln(annuity)	3.0519	1.0188	1.2359	1.0033
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
$\ln(\text{annuity})^2$	0.9497	0.9991	—	—
	(0.000)	*(0.000)*		
cohort dummies	YES	YES	YES	YES
	(***)	*(***)*	*(***)*	*(***)*
company dummies	YES	YES	YES	YES
max hazard	49'900 Sfr	41'400 Sfr	—	—
time trend	NO	YES	NO	YES
censoring	NO	NO	YES	YES
log p-lik.	-39226.80	-39227.80	-28836.44	-28839.81
observations	5367	5367	5367	5367
failures	5367	5367	3908	3908

Table 4: *Cox proportional hazard regression for men using* cohort *dummies. The variables "ln(annuity)", "ln(annuity)^2" have been interacted with a linear time trend (if time trend = YES). Data censored for age at retirement 64.75-65.25 (if censoring = YES).*

Covariate	**I(f)** Haz. Ratio *(p–value)*	**II(f)** Haz. Ratio *(p–value)*	**III(f)** Haz. Ratio *(p–value)*	**IV(f)** Haz. Ratio *(p–value)*
married	1.1661	1.1512	1.2408	1.2255
	(0.019)	*(0.032)*	*(0.005)*	*(0.009)*
widowed	1.0071	0.9939	0.9857	0.9725
	(0.925)	*(0.935)*	*(0.879)*	*(0.769)*
divorced/separated	0.9268	0.9170	0.9148	0.9049
	(0.232)	*(0.174)*	*(0.236)*	*(0.185)*
defined benefit	0.8072	0.9014	0.3852	2.1845
	(0.079)	*(0.415)*	*(0.335)*	*(0.000)*
conversion factor	0.3469	0.3663	0.1278	0.1358
(marginal increase)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
ln(annuity)	1.1539	1.0020	1.2629	1.0035
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
retirement year	YES	YES	YES	YES
(dummies)	*(**)*	*(**)*	*(***)*	*(***)*
company dummies	YES	YES	YES	YES
time trend	NO	YES	NO	YES
censoring	NO	NO	YES	YES
log p-lik.	-21611.48	-21617.61	-15882.79	-15889.96
observations	3084	3084	3084	3084
failures	3084	3084	2295	2295

Table 5: *Cox proportional hazard regression for women using* retirement year *dummies. The variable "ln(annuity)" has been interacted with a linear time trend (if time trend = YES). Data censored for age at retirement 61.75-62.25 (if censoring = YES).*

Covariate	**I(f)** Haz. Ratio *(p–value)*	**II(f)** Haz. Ratio *(p–value)*	**III(f)** Haz. Ratio *(p–value)*	**IV(f)** Haz. Ratio *(p–value)*
married	1.0368	1.0258	1.1045	1.0931
	(0.555)	*(0.677)*	*(0.154)*	*(0.202)*
widowed	0.9976	0.9866	1.0023	0.9912
	(0.976)	*(0.866)*	*(0.981)*	*(0.928)*
divorced/separated	0.8598	0.8521	0.8701	0.8622
	(0.018)	*(0.013)*	*(0.061)*	*(0.046)*
defined benefits	0.9366	0.9574	0.5354	0.5478
	(0.348)	*(0.531)*	*(0.434)*	*(0.452)*
conversion factor	0.5611	0.5857	0.2046	0.2150
(marginal increase)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
ln(annuity)	1.0932	1.0012	1.1863	1.0025
	(0.000)	*(0.002)*	*(0.000)*	*(0.000)*
cohort dummies	YES	YES	YES	YES
	(***)	*(***)*	*(***)*	*(***)*
company dummies	YES	YES	YES	YES
time trend	NO	YES	NO	YES
censoring	NO	NO	YES	YES
log p-lik.	-20862.98	-20865.83	-15101.25	-15105.13
observations	3084	3084	3084	3084
failures	3084	3084	2295	2295

Table 6: *Cox proportional hazard regression for women using* cohort *dummies. The variable "ln(annuity)" has been interacted with a linear time trend (if time trend = YES). Data censored for age at retirement 61.75-62.25 (if censoring = YES).*

Covariate	**IV(m; 2)** Haz. Ratio *(p–value)*	**IV(m; 9)** Haz. Ratio *(p–value)*	**IV(m; 10)** Haz. Ratio *(p–value)*	**IV(m; 15)** Haz. Ratio *(p–value)*
married	0.5321	0.7148	0.7451	0.6110
	(0.000)	*(0.051)*	*(0.013)*	*(0.003)*
widowed	0.6732	0.9270	0.6936	0.6696
	(0.155)	*(0.779)*	*(0.072)*	*(0.092)*
divorced/separated	0.7138	0.9969	0.7922	0.6798
	(0.209)	*(0.990)*	*(0.157)*	*(0.076)*
conversion factor	0.0000	—	—	—
(marginal increase)	*(0.001)*			
ln(annuity)	1.0887	1.0025	1.0816	1.0056
	(0.026)	*(0.054)*	*(0.000)*	*(0.000)*
$\ln(\text{annuity})^2$	0.9965	—	0.9963	—
	(0.056)		*(0.000)*	
retirement year	YES (00–03)	YES (00–02)	YES (90–02)	YES (90–03)
(dummies)	*(**)*	*(*)*	*(**)*	*(**)*
benefit structure	DB	DC	DB	DB
max hazard	175'700 Sfr	—	44'200 Sfr	—
time trend	YES	YES	YES	YES
censoring	YES	YES	YES	YES
log p-lik.	-4032.40	-2926.48	-10224.31	-2893.79
observations	762	600	2135	937
failures	692	489	1510	460

Table 7: *Cox proportional hazard regression for men by company (4 largest companies). The variables "ln(annuity)" and "ln(annuity)^2" have been interacted with a linear time trend (if time trend = YES). Data censored for age at retirement 64.75-65.25 (if censoring = YES).*

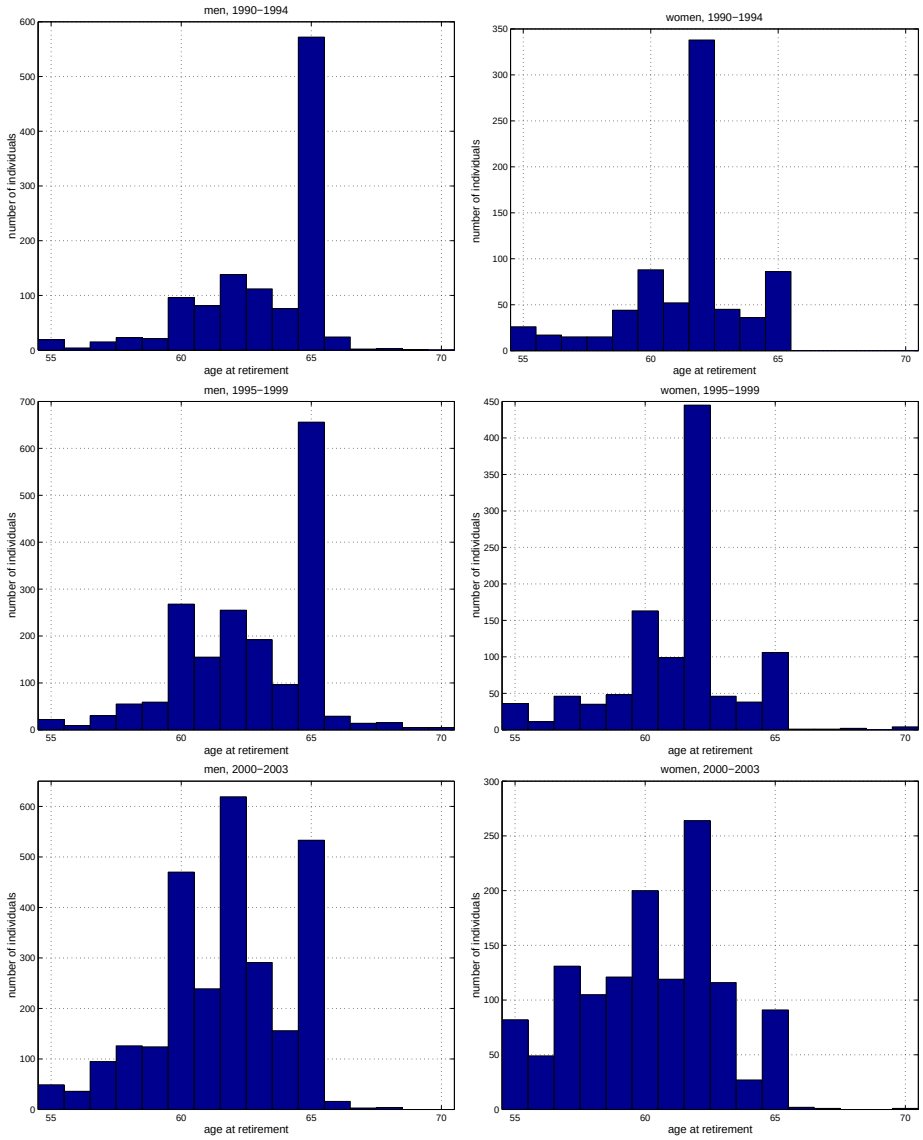

Figure 1: *Distributions of age at retirement for men (left-hand side) and for women (right-hand side)*

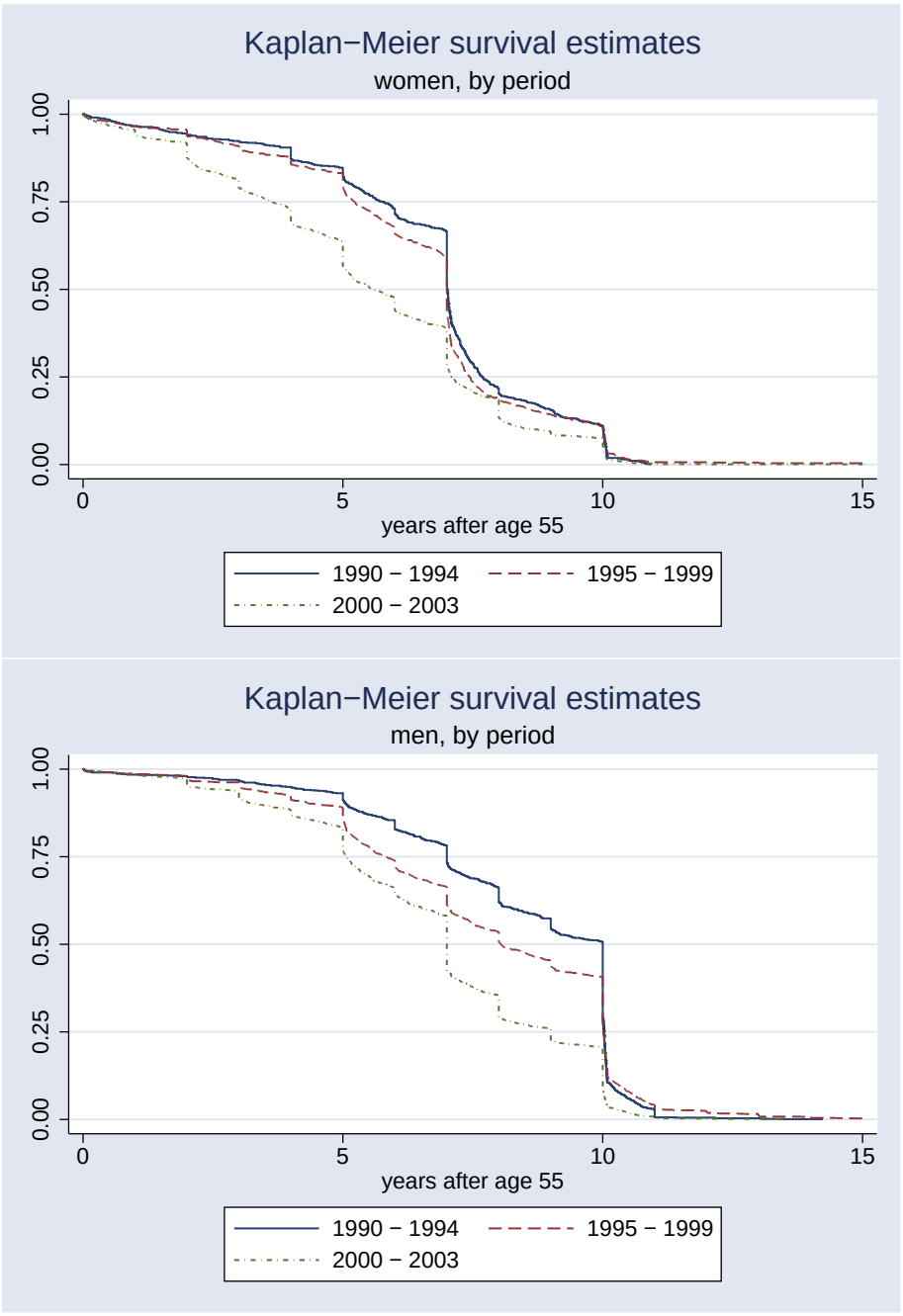

Figure 2: *Kaplan-Meier estimator without censoring by period for women (upper panel) and men (lower panel). The numbers on the horizontal axis denote the years after age 55.*

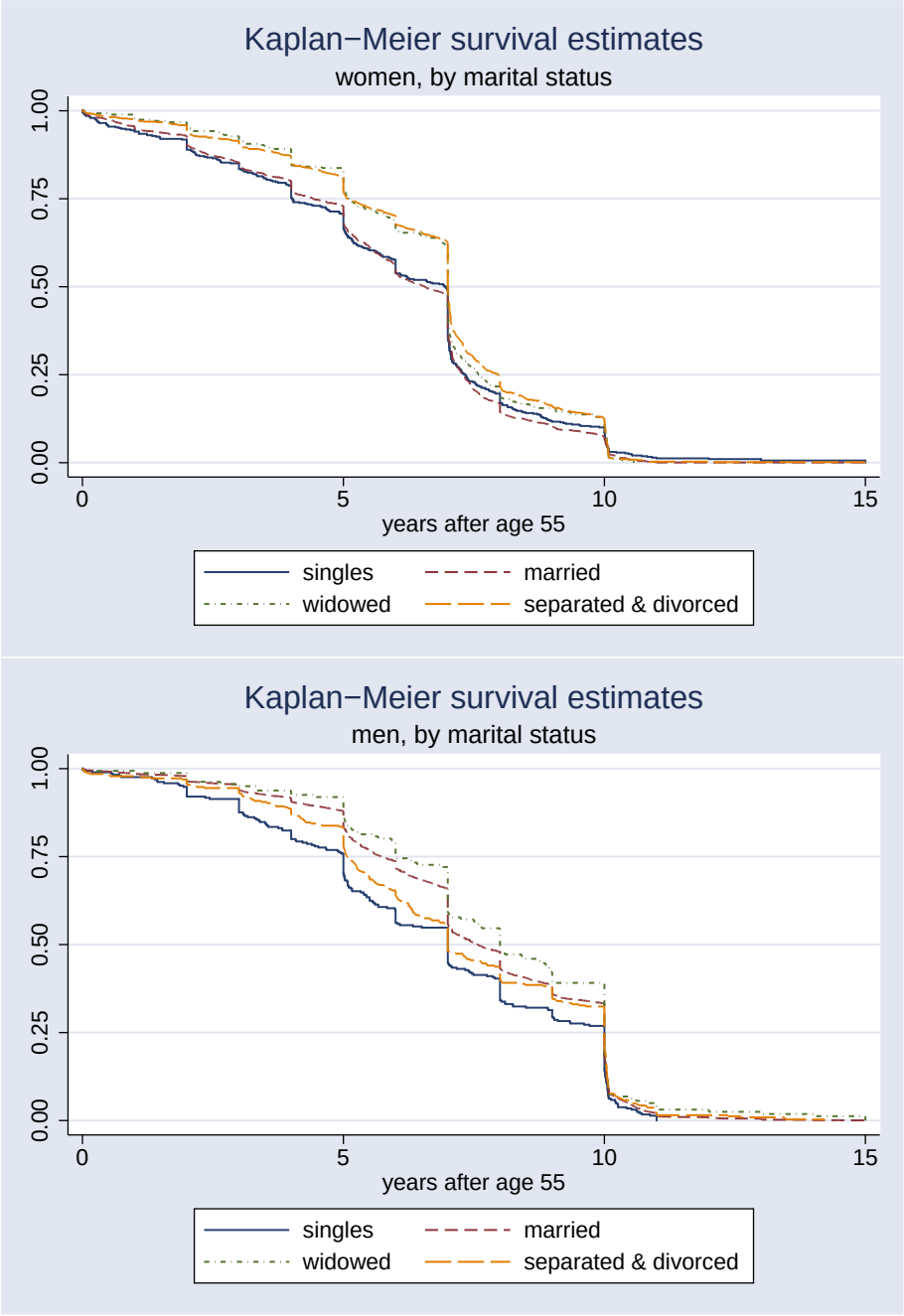

Figure 3: *Kaplan-Meier estimator without censoring for the period 2000-2003 by marital status for women (upper panel) and men (lower panel). The numbers on the horizontal axis denote the years after age 55.*

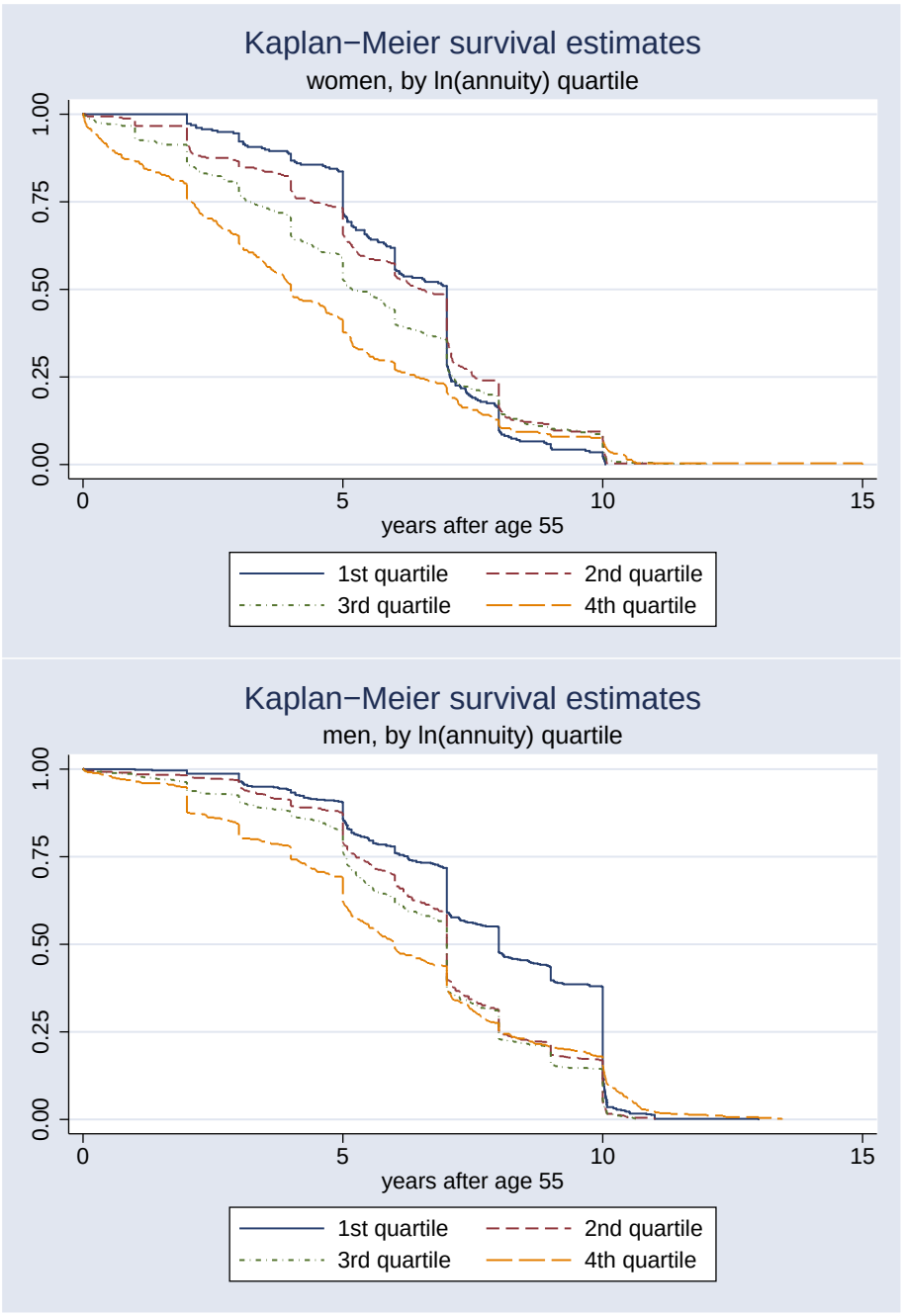

Figure 4: *Kaplan-Meier estimator without censoring for the period 2000-2003 by income quartiles for women (upper panel) and men (lower panel). The numbers on the horizontal axis denote the years after age 55.*

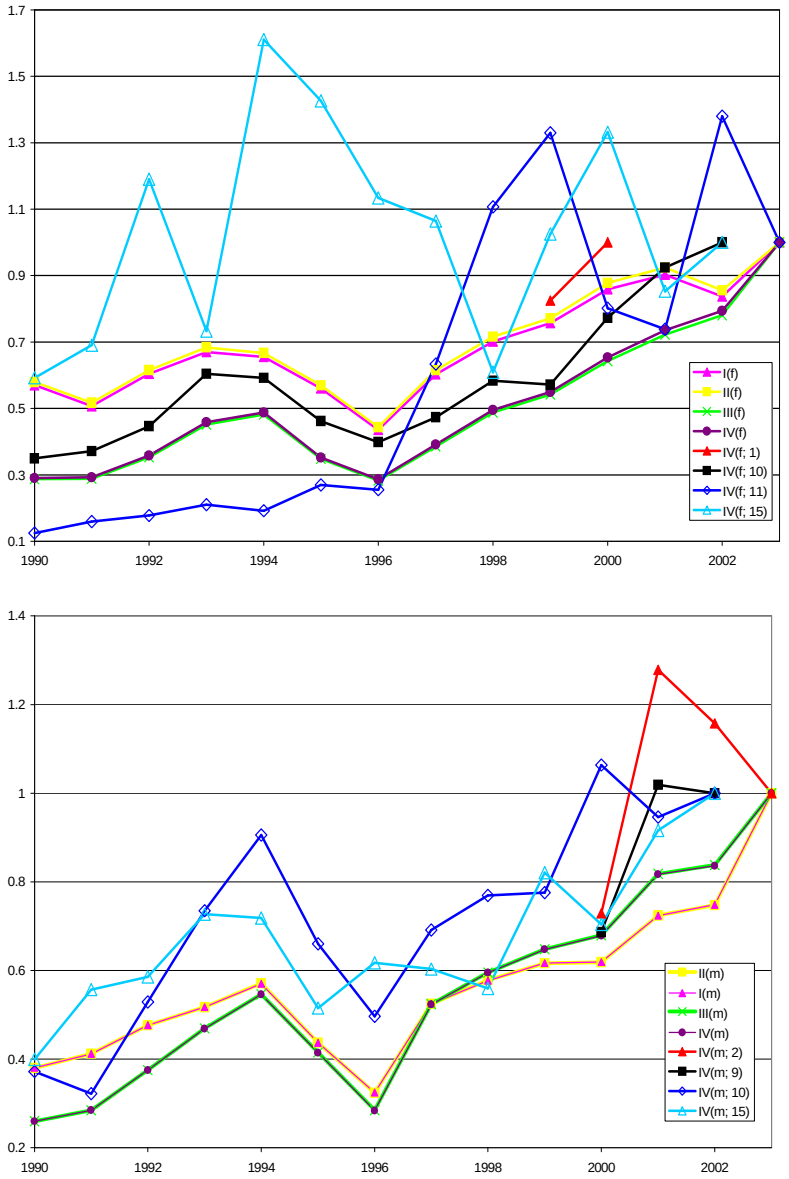

Figure 5: *Relative hazard rates for year of retirement (base year 2003). The upper and lower panels depict the relative hazards for women and men, respectively.*

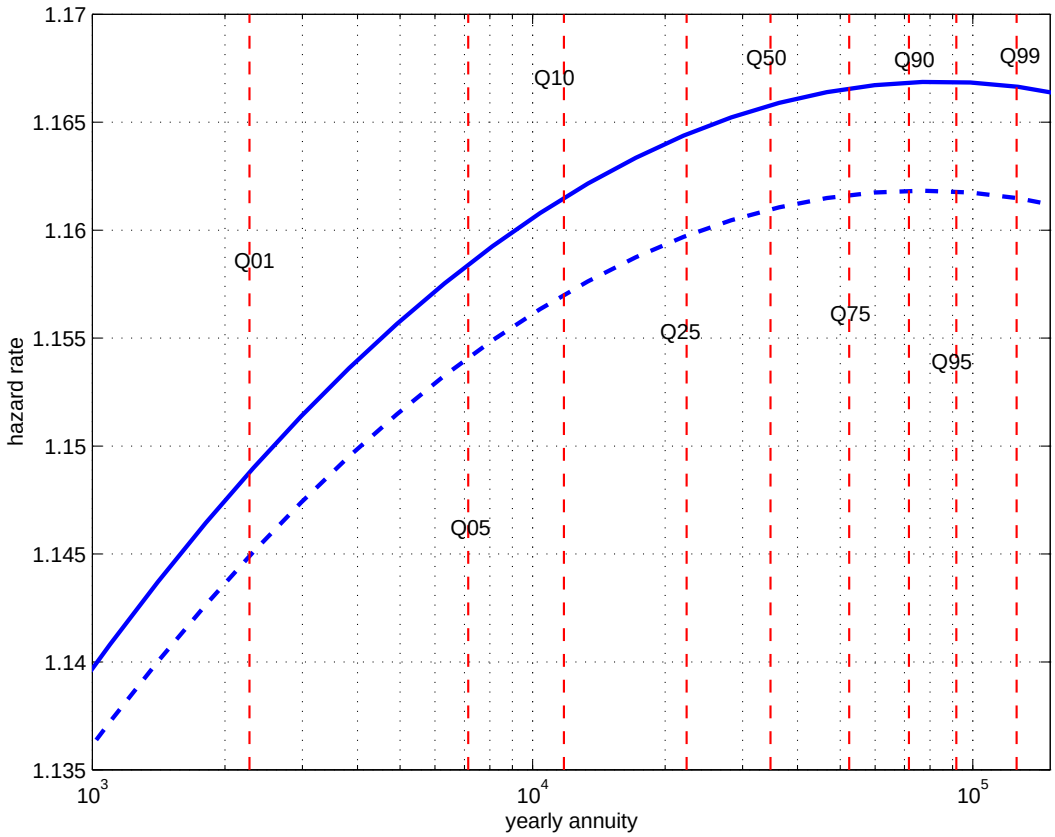

Figure 6: *Relative hazard rates for estimations II(m) (= dashed line) and IV(m) (= solid line) (with time trend) as a function of yearly deflated annuity (base = annuity of 1 SFR). 'Qx' denotes the xth quantile of the annuity distribution for men.*