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The Choice between an Annuity and a Lump-Sum: Results from Swiss Pension Funds*

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Abstract

This paper uses unique micro data from Swiss employer-based pension plans to study the annuitization decision at retirement. The administrative nature of our data, though limited with respect to individual background characteristics, allows us to analyze real choices over large retirement balances, rather than subjectively reported intentions to annuitize. We find a strong and robust impact of a utility-based measure of the annuity's value (computed within a life-cycle framework) on individual annuitization rates. Low accumulation of retirement assets is strongly associated with the choice of the lump sum, presumably due to the availability of means-tested social assistance. The sponsor's default option, in most cases the annuity, is also found to be highly influential in the decision to annuitize.

Jel–Classification: D91, H55, J26

Keywords: Annuity Puzzle, Occupational Pension, Annuity, Lump Sum

1 Introduction

An annuity is the only contract that guarantees income right up to the point of death. Nonetheless, international numbers show that only a small minority of individuals voluntarily purchases an annuity. A number of explanations have been put forward to explain this so-called *Annuity Puzzle*. First, the price of the annuity might be too high as a consequence of load factors, which in turn may be due to administrative costs, not fully competitive markets, and information asymmetries. Second, the desire to annuitize may be weakened by bequest motives, and precautionary savings to cover spending boosts (like health expenditures). Third, intra-family risk sharing may act as a partial substitute for the insurance implied by an annuity. In the presence of such motives, the existence of a first pillar that provides a basic income stream further diminishes the demand for the annuity. Notwithstanding all of these factors, it is not easy to reconcile the low annuitization rate with the much higher predicted rate even under more realistic conditions.

Despite the importance of the issue and the increasing involvement of the private sector in pension provision, there is surprisingly little empirical evidence on why individuals (do not) annuitize the accumulated pension capital at retirement. To the best of our knowledge there are only two contributions that empirically study the annuitization choice. The first one is presented by Hurd, Lillard and Panis (1998), who analyze pension cash-outs in the US using Health and Retirement Survey (HRS) data. The second contribution to the empirical literature is provided by Brown (2001), who explicitly merges the empirical work with simulation based models of utility valuation, using HRS data. In both studies the preference for lump sum pension settlements turns out to be a very persistent empirical result.

The main reason for the limited amount of empirical analyses of the payout phase seems to be a lack of reliable data. Without a sufficient level of voluntary annuitization, many potential data sources are of little use. Private annuity contractors and pension sponsors, moreover, are often reluctant to disclose individual choices. Funded mandatory pension schemes, which may act as an alternative source of data, are still immature in most countries, and consequently cannot alleviate the scarcity of data yet.

This paper contributes to the existing empirical literature in that it directly examines individual decisions to annuitize or to cash out pension wealth. The empirical analysis is based on unique micro administrative records from ten Swiss pension sponsors. It includes real choices over the use of substantial amounts of retirement savings (approximately $ 400,000 on average), as a consequence of the fact that in Switzerland occupational pensions constitute a second mandatory pillar and account for roughly half of retirement income on average.

The Swiss data has many advantages over alternative data sources. First, it includes actual choices with respect to mandatory insurance and not just the intention to annuitize in voluntary plans. Second, it provides reliable and complete information on pension plan details, which is not usually present in survey data. This allows us to price the annuity with respect to age, gender and marital status. Third, it is field data and generally involves large stakes. We can therefore expect individuals to spend more time and effort in thinking about their choice than in a laboratory setting. Fourth, although the data is not entirely representative for Switzerland, it exhibits similar average stakes, annuitization rates and retirement patterns. This is partly due to the fact that the entire workforce of a company is covered in a given period. As individuals do not have a choice between different pension providers in Switzerland (apart from the fact that they may choose their employer), the selection bias is thus presumably smaller than in comparable studies. Nonetheless, the data suffers from a number of shortcomings, notably a lack of information on non-pension wealth and limited individual information.

To account for the fact that an annuity also provides insurance against outliving one's assets, we compute for each individual the utility-value of the annuity in a life-cycle framework for different levels of risk aversion. This so-called *annuity equivalent wealth*, a measure developed by Brown and Poterba (2000), takes into account that insurance requirements differ by gender, marital status, and the level of pre-existing annuities.

We show that, in line with other empirical studies, the annuity equivalent wealth is the most important determinant of the annuitization decision. We also find sizeable differences among companies: Individuals often choose the standard option offered by the company or seem to follow their peers. Moreover, our analysis demonstrates that small stocks of old age capital are much more likely to be withdrawn as a lump sum. This may be due to higher rates of time preference.

More importantly, for low levels of capital, it may be optimal to spend down the resources to qualify for means-tested social assistance.

The paper is organized as follows. Section 2 provides a brief description of the Swiss pension system, with an emphasis on the characteristics relevant for the objective of our analysis. The potential determinants of the demand of alternative pay-out options upon retirement are analyzed in Section 3. The data are presented and discussed in Section 4. Section 5 reports the results from several empirical specifications, and Section 6 concludes.

2 Background Information on the Swiss (Occupational) Pension System

Switzerland's pension system has two main pillars, a publicly financed pay-as-you-go scheme and a mandatory fully-funded occupational pension scheme.[1] Figure 1 gives a first overview of the benefit structure for a typical individual. Its components will be explained in greater detail below. The *first pillar* aims at providing a basic retirement income. It is financed by a proportional payroll tax on all labor income and general government revenues. The statutory retirement age is 65 for men and currently 64 for women.[2] As shown in Figure 1, there is a weak tax-benefit link for lower and lower-middle income individuals. However, a majority of workers with an uninterrupted working career (which is the case for most male individuals in our sample) qualifies for a benefit at or close to the maximum yearly amount of SFR 25,800 ($\approx$ \$20,000 or €16,000) for singles and SFR 38,700 ($\approx$ \$30,000 or €24,000) for couples. First pillar benefits are indexed to the mean between inflation and nominal wage growth, and always paid out as life-long annuities.

The *second pillar* is a mandatory, employer-based, fully funded occupational

[1] A detailed description of the Swiss social security system can be found in Queissar and Vittas (2000, especially concerning institutional details), and Bütler (2004, for the second pillar).

[2] Until 2003 (that is for most women in our sample), the applicable female retirement age was 62. 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.

pension scheme. Its main goal is to maintain the pre-retirement living standards, together with the benefits from the first pillar. Occupational pensions typically insure income above a certain threshold level.[3] By law, occupational pension funds are required to insure income up to a maximum threshold. This is called the mandatory part and is subject to stringent regulation. A typical benefit structure is represented by the line "OccPens (min)" in Figure 1. Most companies (such as all of the firms in our sample), however, cover the total income above the lower threshold level. Such a scheme would be represented by the line "OccPens (eff)" in Figure 1. This part is called the super-mandatory part of the second pillar and is almost free from regulatory constraints.

Figure 1

Contributions to the second pillar are essentially proportional to insured income (with the exception of a small base income at the entry income level as is shown in Figure 1). By law, the employer pays at least half. These old-age credits are accumulated as retirement assets and bear interest.[4] The accrued capital is fully transferable (including the employer's part) when insured individuals change employers. By law, the full 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 working lifetime, and is, therefore, a good proxy for lifetime income. This feature of the Swiss pension system will be useful to impute first pillar benefits in the empirical analysis.

When an individual retires, the accumulated capital can be withdrawn either as a monthly life-long annuity or as a lump sum (or a mix of the two), provided that the pension fund allows for the full/partial lump sum option. In general, occupational pension benefits are nominal annuities, and are strictly proportional to accumulated retirement assets. In defined contribution plans, the old-age capital K is translated into a yearly pension B, using a so-called conversion factor γ_{J}, which is independent of gender and marital status, but usually depends on the

[3] In 2006, the threshold was SFR 19,350 ($\approx$ \$15,500 or €12,000). It explains the considerably lower coverage of female workers, who often work part-time and have lower average wages than men.

[4] For the mandatory part, there is a minimum interest rate requirement, which is determined by the Swiss Federal Council.

retirement age J, so that $B = \gamma_J K$. A similar conversion is also implicitly applied to defined benefit plans. Due to the strong regulation of the occupational pension scheme, the factual difference between plans labeled as "defined contributions" and "defined benefit" schemes are small.

In case of early retirement, many plans offer a scheme that allows the beneficiary to receive a bridging pension until the statutory retirement age (and thus the eligibility age for first pillar pension benefits) is reached. The total amount of anticipated benefits drawn must then be repaid to the fund (usually by means of an actuarially fair reduction in the level of benefits).

The Swiss second pillar mandates joint and survivor annuities for married individuals (unless the retirement capital is paid out as a lump sum). Dependent children receive a benefit of up to 20 percent each, even if the main claimant is still alive. When a retired individual dies, his or her surviving spouse receives a benefit amounting to 60 percent of the previous pension. Given a certain capital stock upon retirement, the resulting pension benefit is independent of gender, marital status or the age difference between eligible spouses. Thus single individuals do not get higher benefits to compensate for the absence of eligible survivors.

In case the combined pension income is not sufficient to cover the basic needs in old age, means-tested supplemental benefits can be claimed. These additional benefits usually lead to an income that is above the poverty threshold. Figure 1 demonstrates that individuals who receive the maximum benefits out of the first pillar, but no second pillar income, for example, already qualify for such supplemental benefits. The availability of means-tested supplemental benefits may create an incentive to cash out occupational pension wealth. Some cantonal governments, the providers of such additional benefits, have started to credit the corresponding wealth against the supplemental benefits, even if the capital has already been depleted. But as wealth is only counted if it exceeds a certain threshold, the incentive to cash out remains strong for sufficiently low levels of first pillar benefits and second pillar capital.

3 Potential Determinants of the Demand for Different Pay-out Options

This section briefly summarizes the potential determinants postulated in the theoretical literature as to whether to annuitize retirement wealth or to cash it out. These factors, which are discussed in the light of the data at hand, will then be used (jointly with other individual background characteristics) in the empirical analysis.

3.1 The Annuity's Value

A traditional measure of an annuity's value is its "money's worth ratio" (MWR), defined as the ratio between the expected present value of its promised payments and initial premium cost. If the MWR equals 1, the consumer can expect to get back what she paid in, in addition to longevity and investment insurance. The difference between an annuity premium and its MWR is usually explained by adverse selection and administrative costs.[5] The MWR is a good indicator in assessing both the performance of annuity markets and the presence of adverse selection. However, as the MWR implicitly assumes risk-neutrality, it is not necessarily an appropriate measure to compare an annuity with alternative pay-out options. As a consequence of the insurance against longevity an annuity provides, its utility value may well exceed the money's worth of its promised payments.

To properly analyze the demand for annuities, Brown and Poterba (2000) and Brown (2001) developed a utility based measure, called *annuity equivalent wealth* (AEW): The AEW is defined as the amount of additional wealth that individuals accessing the annuity markets would need to maintain the same utility level if the annuity markets were to close. An individual (or a couple) is assumed to solve an expected utility maximization problem, subject to budget constraints that depend on whether or not annuities are available. The methodology adopted by Brown and Poterba (2000) is based on dynamic programming. It consists of three consecutive steps: Solving the maximization problem when annuitization

[5]MWRs of annuities have been used in a number of earlier studies, including Friedman and Warshawsky (1990), Mitchell et al. (1999), Brown and Poterba (2000), and Finkelstein and Poterba (2002).

is available, then repeating the exercise when annuitization is not available, and finally computing the annuity equivalent wealth itself by comparing the utility levels reached in the two alternative scenarios.

We follow Brown and Poterba's (2000) approach in our analysis and use the annuity equivalent wealth for each individual using three levels of risk aversion (including risk neutrality). The dynamic program behind the computation of AEW is summarized in the Appendix. Its calibration is explained in Section 4.4. Bear in mind that a high annuity equivalent wealth measure may be due to either a low annuity price (implying a low load factor) or a highly required insurance. The higher the AEW, the stronger the demand for an annuity is expected to be.

3.2 The Role of Retirement Wealth

Means-tested supplemental benefits in the first pillar create an incentive to exploit assets, and, more importantly, to cash out (small) accumulated second pillar wealth. An annuity, even small, is detrimental to the eligibility for social assistance. With a few exceptions (as explained in Section 2), wealth is only taken into account when it exceeds a certain threshold level (SFR 25,000 $\approx$ \$ 20,000 or €15,000 for singles, SFR 40,000 $\approx$ \$ 32,000 or €24,000 for couples), while regular income is taken into account starting with the first Swiss franc.

Ideally the availability of means-tested supplemental benefits should be incorporated in a utility measure of the annuity's value. However, the large regional differences in dealing with the depletion of lump sum payments and, more importantly, the missing information about non-pension wealth, prevent us from doing so. As an alternative, we analyze the (common) polar case of zero non-pension wealth and no crediting of already spent occupational pension capital towards means-tested benefits. This gives us an upper bound for the level of retirement capital for which such a cash-out strategy would be beneficial.

Figure 2 illustrates the utility differences between a complete annuitization and the full lump sum, measured in equivalent consumption differences for two values of risk aversion and two phased withdrawal plans (5 percent and 10 percent per year). As it is easily seen in Figure 2 for a single man, the depletion of the second pillar capital stock can be an optimal response when he has a relatively low second pillar income. For levels of retirement wealth around SFR 120,000, for example, choosing the lump sum and consuming it in chunks of SFR 12,000 yearly

(10 percent withdrawal) dominates the annuity by an amount that corresponds to an 8 percent difference in consumption per year. The relative advantage of the lump sum would be even more pronounced for higher rates of time preference.

Figure 2

The results depicted in Figure 2 are potentially reinforced by the finding that small outcomes are discounted at a higher rate than greater ones are, as is documented in many earlier studies.[6] A high rate of time preference would imply, at the same time, a lower capital stock at retirement (low investment in education or training) and a higher propensity to cash out. For low levels of capital, the annuity may thus not appear to be high enough to be considered an option.

Summarizing, means-tested income support and differences in discount rates (including differential mortality) reduce the propensity to annuitize. With these two factors at play, the probability of choosing the lump sum can be expected to decrease with an increasing amount of accumulated capital for low and moderate levels of retirement wealth.

3.3 Tax-treatment

The annuity is subject to normal income tax rates. The tax treatment for capital options varies greatly in the different cantons (the Swiss states). In some cantons, a flat tax is applied to the capital payment. In others the tax rate on a lump sum payment corresponds to the average tax rate on an annuity that would result from the accumulated capital stock.[7] Additional income from other sources, including the first pillar, increases the effective marginal tax rate under the annuity option, but is never taken into account for the lump sum. Taken together the present value of the lump sum's total tax bill is almost always smaller and increases at a lower rate than an annuity's tax burden, especially for larger capital stocks. The tax treatment is expected to lower the demand for an annuity at relatively high levels of capital.

[6] See Ainslie and Varda Haendel (1983), Thaler (1981), Loewenstein (1987) and Frederick et al. (2002), among others.

[7] We do not have any information on the individual's canton of residence which would allow us to exploit regional differences. As Swiss cantons are small in area, the location of the firm is a bad proxy for residence.

For married women at retirement the tax treatment of the capital option is particularly attractive. As the household is the tax entity, the second earner faces a higher marginal tax rate for the annuity, but again not for the lump sum. Married women can therefore be expected to have a larger incentive to cash out.

3.4 Bequest Motives

An important result of Yaari's (1965) seminal paper is that a life-cycle consumer who faces a mortality risk, but has no bequest motive, should always choose to annuitize her entire wealth, provided the annuity market is actuarially fair. Bequests can be voluntary, if a parent household cares not only about its own lifetime consumption but also about the consumption of its descendants (e.g., Becker, 1974; Barro, 1974; Hurd, 1989). Davidoff, Brown and Diamond (2005) show that positive, but not complete, annuitization remains optimal even in the presence of bequest motives. Empirical findings on the effect of bequests on individual economic decisions are somewhat mixed and inconclusive.[8]

There is no information on the existence or the number of children in our data. The only information available is the number of dependent children who qualify for supplemental benefits. For obvious reasons such eligible children are much more common in retired men than retired women. If minor children are present, the bequest motive is very likely to be dominated by the present value of supplemental benefits and the high present value of the survivor benefit of a presumably much younger spouse.[9]

The only indirect way to "test" for the existence of a bequest motive is to compare singles with divorced and widowed individuals. Out of wedlock births are rare in Switzerland (especially for the age group in our sample), so very few singles can be expected to have children. In contrast, divorcees and widow(er)s (as the parents of the baby-boomer generation) are likely to have children. A lower annuitization rate in this latter group compared to singles could therefore be a vague indication of the existence of a bequest motive. But divorced and widowed individuals also have a higher remarriage probability than singles. In

[8]See Bernheim (1991), Laitner and Juster (1996), Hurd (1989), and Brown (2001) among others.

[9]Note that the survivor benefit is independent of the surviving spouse's age. The annuity equivalent wealth of an annuity is thus higher for individuals with younger spouses.

that some spousal survivor benefits are mandatorily granted by law even in the case of a late marriage, we would expect divorced/widowed men to annuitize more at the margin in the absence of a bequest motive. This feature potentially increases the power of the comparison: Even an equal annuitization rate is not inconsistent with a desire to leave a bequest, and a lower annuitization rate for divorced/widowed individuals than for singles would strengthen the point in favor of a bequest motive.

4 The Data

4.1 The Data, Sample Restrictions and Limitations

We use data collected at the individual level from ten Swiss companies, both public and private, active in several areas of the economy.[10] The novel aspect of our data is that it is not survey data, but comes from administrative records. This allows us to control for all company specific pension scheme details, including individual retirement plans. For the companies in our sample, we were given information about all retired individuals within a given year.

We restricted our sample in several ways. First, we only use observations with retirement between the years of 1996 and 2006, due to lack of sufficient information for earlier years. Second, we had to exclude several contacted companies for various reasons, including obviously flawed data sets (for example firms which only reported individuals who cashed out). In some companies, the capital option was only introduced recently, and the number of observations was too small. Several very small pension funds were excluded as they displayed too little variation with respect to the level of annuitization chosen by the insured individuals.[11] The exclusion of these latter companies accounts for less than 5

[10] In the initial phase of the project, some 200 companies were contacted, but only a few of them were willing to share their data. Not surprisingly, some of those that provided data imposed confidentiality restrictions ranging from not naming the company to not making the data publicly available.

[11] As this piece of information was conveyed over the phone, we were unable to check the validity of this assertion, except in three cases for which we had data. In most cases, all retirees chose to cash-out, despite the annuity being the default option. Pension fund managers usually explain the phenomenon with peer effects and an implicit standard option ("it has always been done like that"). Over the years, the effective standard option may therefore indeed deviate

percent of all observations. Many of these firms had less than 10 retirements over the last decade.

The final dataset consists of 4,544 individuals. For each of them, we have one observation which includes the date (or year) of birth, the date (or year) of retirement, the yearly pension payments (base level) and/or the accumulated capital stock, as well as additional temporary benefits. Not all companies report marital status and the number of dependent children under age 18/25.[12] Table 1 presents the summary information for our data sample. The average age at retirement is 62, and 86 percent of individuals are males. More than 80 percent of those for which marital status is available are married.

We do not have direct information about past income streams. However, as outlined before in Section 2, the accumulated pension capital is approximately proportional to the level of average pre-retirement income above the threshold level as specified by law. Similarly, we do not have any information about additional retirement income and non-pension wealth. As Figure 1 shows, first pillar retirement income does not vary widely across individuals covered by the second pillar. Other sources of retirement income are, however, generally unknown.

For the empirical analysis we use the actual pension wealth at the time of the decision. We have also experimented with different measures for pension wealth at the statutory retirement age (in place of actual retirement age), by using firm specific information on conversion factors, early retirement plans and other benefits. Our results turn out to be very robust as to the way pension wealth is constructed.

At the firm level, we are provided with the details of retirement plans, in particular the availability of first pillar replacement packages. The effective conversion factor (γ), i.e., the factor at which accumulated capital is converted into an annuity, depends on the individual's age at retirement and company specific retirement schemes. Using the information provided by the pension fund we can exactly define the applicable conversion factor for all individuals.

Table 1

from the default option of the fund. For one of the companies in our final sample (company D), the fund representative also confirmed this effect.

[12]Marital status is known for 4,151 individuals; the number of dependent children is reported for 3,866 individuals.

4.2 Selection and Representativeness

Although there is no choice of pension sponsors in Switzerland (as it is linked to the employer), we cannot fully exclude self-selection into pension plans. The occupational pension scheme is likely to be an integral part of the employment decision, by way of the large stake in the second pillar and a tight labor market. If individual observable characteristics tend to be very similar within a given firm and vary decidedly across firms, then one might suspect that they are also similar in terms of those unobservables that enter into the error term in the regressions. This might indeed be an issue, because individual observations are being treated as independent when in fact the error term may be correlated across individuals within a given company. To address this point, we look at the standard deviations of the observable characteristics we control for in the empirical part of the paper and of the computed AEW measures, both within and across firms. Table 2 suggests that there is as much variation within companies as in the whole sample population.

Table 2

Our data is a non-random sample of employers in Switzerland even if the elimination of very small companies is only a minor problem. The industry sector, for example, is overrepresented. Due to choice of pension sponsors (underrepresentation of service sector), men are overrepresented in our sample. The same is true for observations under defined benefits (DB); DB plans only cover approximately 20 percent of the workforce, but 57 percent of the individuals in our sample.

Despite the potential non-representativeness of our data, the average retirement ages (by gender), as well as the amount of capital stock at retirement, correspond very well to the observed age and the average old age balances, respectively, obtained from other data sources, such as the Swiss Labor Force Survey. The annuitization rate of 84.5 percent is higher than rough estimates of the overall annuitization rate in Switzerland. There are no good estimates for the latter, but aggregate data suggest that approximately 20 percent of accumulated capital is cashed out. The lower cash-out probability in our data is likely to be a consequence of the underrepresentation of female beneficiaries and defined contribution plans, both of which show lower annuitization rates.

4.3 The Dependent Variable

The administrative archive we are provided with contains information about how individuals received their pension benefits upon retirement. Those approaching retirement can choose between an annuity and a (partial and/or full) lump sum payment. The variable "capital annuitized" is defined as the proportion of an individual's total retirement capital withdrawn as an annuity. It is a fractional response variable that includes as polar cases the full annuity (upper bound = 1) or the full lump sum payment (lower bound = 0).

Table 3 reports a number of relative frequencies of the choice variable, classified by annuity or partial/full lump sum, and by several demographic and socio-economic characteristics. The p-values refer to χ^2 of the null hypothesis that the distribution of preference over the three possible options is independent of the different values of a characteristic. Differences in preferences are strongly significant along gender, marital status, and company dimensions. The annuity is by far the most preferred option in approximately 72 percent of all cases. It is the most preferred option among singles (almost 80 percent). Women choose the (full) lump sum payment more than men (19.68 percent versus 8.73 percent).

Differences are strongly significant with regard to the company dimension, suggesting a relevant role of the pension fund in the individual's annuitization decision. Nine out of ten companies provide an annuity as the default option, and allow for a partial or full lump sum payment as an alternative. The remaining company provides a lump sum payment (amounting to the last working year's salary) as the standard option. Table 3 shows that overall the standard option is preferred by more than 2/3 of the sample. For six companies this percentage is even greater, reaching a maximum of 93.33 percent (company G). For two companies (company C and company H) preferences between options are for the most part evenly distributed, with the default predominating slightly. In only one case (company D) is the alternative option preferred over the default (74.19 percent vs. 25.81 percent).

Table 3

4.4 Computation and Calibration of AEW

According to Brown (2001), four main factors are essential to compute an AEW for annuities in a life-cycle framework: risk aversion, fraction of pre-annuitized total wealth, mortality risk, and marital status. As explained in greater detail in the Appendix, the AEW is computed based on a full annuitization of the accumulated occupational retirement capital. By applying the individual's conversion factor, we can compute the exact annuity amount for each individual, i.e., it is not necessary to impute administrative costs or other load factors. We use a constant annual interest rate of 3 percent and a rate of time preference of $\rho = 0.03$.

The analysis closely follows Brown and Poterba's (2000) and Brown's (2001) dynamic program to solve for the AEW, including a constant relative risk aversion (CRRA) utility. As administrative sources provided us with our data, we are unable to parameterize the degree of risk aversion or the time preference by means of survey data. We therefore compute AEWs with three different coefficients of relative risk aversion equal to 0, 2 and 4.

Unfortunately the data does not contain information on individual total wealth. Social security benefits (annuities from the PAYG first pillar), on the other hand, can be deduced from the accumulated pension wealth as follows: Pension plans aim at replacing a certain fraction (in general 50 to 60 percent) of average pre-retirement income above the coordination offset, provided the individual works until the statutory retirement age. Using pension plan details on accrual rates, target replacement rates and conversion factors, we can then compute the approximate level of average pre-retirement income. By applying the official benefit formula of the first pillar (assuming an uninterrupted career), the social security benefits can be directly calculated.[13] Social security benefits for married couples are 1.5 times greater than for singles as long as the spouse is alive.[14] While the computation of first pillar annuities can be assumed to be fairly accurate for men (mostly having had a traditional uninterrupted career), it is more imperfect for women due to career breaks, the availability of childcare credits (that are counted as social security contributions) and the clearly higher importance of the spouse's income and wealth. As the first pillar's benefit structure is relatively flat,

[13] This benefit formula is depicted for single individuals in Figure 1.

[14] Due to recent changes in first pillar legislation, using the factor 1.5 is no longer appropriate for younger individuals, but it is still accurate for the individuals in our sample.

however, the imputation errors can be assumed to be of secondary importance.

We use mortality tables by cohort, gender and marital status, as well as mortality improvement rates computed by the Swiss statistical office in ten year intervals. The pension fund tables do not distinguish mortality rates by marital status. However, due to the occupational pension scheme's high coverage, the survival probabilities of the annuitant population are very close to those of the general population.

The AEW is computed for both married and non-married individuals. As we do not have any information about the age difference between the spouses, we assume a difference of four years, which corresponds to the statistical average in this age group. Note that for married women the AEW measures are less reliable, as we do not have any information about the husband's annuity income and wealth, which represent important determinants of the AEWs. For married women, our measure is likely to overstate the value of the annuity. The AEW of divorced and widowed individuals should also be interpreted prudently, as their remarriage probability can be expected to be higher than that for singles. Dependent children would considerably increase the (utility) value of the annuity in two ways: First, by the substantial supplemental benefits they draw when the main beneficiary chooses the annuity, and, second, by a higher present value of a presumably much younger spouse. Unfortunately, we lack sufficient information (age of spouse and children) to quantify its impact directly.

Table 4 reports the summary statistics for the AEW measures by gender and marital status for the full sample. As a robustness check we also show a subsample of individuals who retired within one year of the statutory retirement age. In the case of risk neutrality, married individuals have much higher AEW values than non-married ones. For men, the difference is very big (0.3) and is mainly a consequence of a uniform conversion that implies a free survivor component, and — to a smaller degree — lower mortality. The difference goes down as risk aversion increases due to the higher insurance requirements of non-married individuals. There also is not much of a difference in AEW values between the full sample and the restricted sample.

The numbers mirror results of previous studies (notably Brown and Poterba (2000)) in terms of the impact of risk aversion, and — to some degree — marital status, but they are strikingly high. This is a consequence of too high conversion

rates (partially mandated by law) and relatively low interest rates. For the period of our data, the pension funds financed the excess benefits primarily by running down reserves. In the meantime, conversion rates have been adjusted downwards, especially in the super-mandatory part of the second pillar.

Table 4

5 Specification and Empirical Results

This section presents the results of a two-limit Tobit analysis applied to the pooled sample. Unlike traditional regression coefficients, the Tobit coefficients cannot be directly interpreted as estimates of the magnitude of the marginal effects of changes in the explanatory variables on the expected value of the dependent variable. In a Tobit equation, estimated coefficients include the influence of the regressor on both the intensity of annuitization and the probability to annuitize. Therefore, we will present the results also in terms of marginal effects.

Table 5 reports the results of a *baseline specification* on the entire sample of individuals for three different levels of risk aversion. Specification (I) includes the annuity equivalent wealth only, which allows us to explore the value of the annuity by itself, without controlling for other covariates that include additional sources of variation. Specification (II) also controls for gender, while in (III) marital status is added. In all three specifications, both company and retirement year dummies are included.[15]

For an intermediate level of risk aversion (coefficient of relative risk aversion CRRA=2), Table 6 presents the results of an *extended model*, including the level of pension wealth (in SFR 100,000) and its square to capture potential non-monotonic relationships, and the presence of dependent children. We also split the category "non-married" into singles (the reference group) and divorced/widowed individuals in an attempt to assess the role of bequest motives.

[15]Both company and retirement year dummies are always jointly significant at the 1 percent level. Being part of company F (the only company for which the standard option is a partial lump sum payment) increases the fraction of capital withdrawn as a lump sum payment by more than 30 percent. We could not identify a compelling rationale for the observed withdrawal pattern in the data. In private conversations, the pension fund manager of the company attributed the differences to the popularity of the standard option, which had been in place even before the second pillar became mandatory.

The value of CRRA = 2 was chosen for several reasons: First, as Table 5 reveals, a specification with CRRA=2 always reaches the highest log-likelihood value. Second, it is close to empirical estimates of risk aversion. In a model with an intertemporally additive utility function, Kapteyn and Teppa (2003) estimate an average value for the coefficient of relative risk aversion equal to 1.94 using survey data from the Netherlands. Larger estimates are found in related studies based on US data. Third, even if the degree of risk aversion is indeed higher in reality, our AEW measures overstate the true insurance need, in that non-pension wealth is not accounted for in its computation.

5.1 The Value of the Annuity

Using a *measure of the annuity equivalent wealth* as the only covariate (specification (I)), in the case of risk neutrality the effect of the AEW on the decision to annuitize is not significant and has a negative sign. However, in the presence of risk aversion, estimates become significant and positive. The magnitude of the marginal effects is robust across different values of risk aversion: A one percentage point increase in AEW would lead to a marginal 0.53 percentage point increase in the annuitization rate when the degree of risk aversion takes on the value of 2, and to a marginal 0.44 percentage point increase at a higher level of risk aversion (CRRA = 4). These values are in line with Brown's (2001): In a similar specification, he estimates a 0.61 percentage point increase in the reported intention to annuitize as a response of a one percentage point increase in his AEW measure. As the annuities in our sample are not actuarially fair with respect to gender and marital status, it is crucial to control for these two attributes.

Controlling for gender alters the impact of the annuity value on the annuitization decisions substantially. Even in the case of risk neutrality, adding gender reverses the coefficient and the marginal effect of the annuity equivalent wealth from negative to positive. In the presence of some level of risk aversion, controlling for gender almost doubles the estimated marginal effect of the annuity value. A one percentage point increase in AEW would now translate into a marginal 1.09 (0.76) percentage point increase in the annuitization rate when the degree of risk aversion takes on the value of 2 (4). The higher impact of AEW measures is driven by female retirees: The significant interaction term indicates that the marginal impact of the annuity value on the annuitization decisions is much

smaller for men than for women. Quantitatively, a one percentage point increase in AEW would result into a marginal 0.24 (0.40) percentage point increase in the annuitization rate for men when the degree of risk aversion is 2 (4). The separate analysis by gender in Table 7 confirms the substantially different impact of AEW on the annuitization decision between men and women. The marginal effects indicate that a one percentage point increase in AEW renders a 0.44 percentage point increase in the annuitization rate for men, however a 1.64 percentage point increase for women.

On the other hand, being male *per se* significantly increases the annuitization rate at the margin in the presence of risk aversion. The estimated marginal effects are very similar in magnitude across the two specifications when assuming risk aversion. The higher cash out rates for women most likely mirror the availability of alternative sources of income and insurance (husband, family, child-care credits in the first pillar), for which we are unable to control for.

When both *gender and marital status* are used as additional controls, estimates of the AEW's impact become statistically significant even in the case of risk neutrality. Moreover, the magnitudes of the marginal effects of the annuity value for the three levels of risk aversion converge: In particular, the estimated marginal effects in the risk neutrality framework become considerably higher than before (1.27 and 0.22 for women and men, respectively) and quite in line with the values found for the risk aversion scenarios. For the risk aversion cases, a one percentage point increase in the AEW leads to a marginal percentage point increase in the annuitization rate of 1.57 and 1.19 for levels of risk aversion of 2 and 4, respectively. Similarly, the marginal effect for the gender dummy in the risk neutrality case becomes not only significant at the 0.01 level, but also very close in magnitude to the corresponding values estimated with some degree of risk aversion (0.97 and 0.98, respectively).

Table 5

5.2 Retirement Wealth Effects and Bequest Motives

Table 6 presents the results of an "augmented" version of the model: Specification (IV) takes into account the level of pension wealth, while specification (V) includes additional socio-economic controls in an attempt to capture bequest

motives. Specification (V) is also used for a separate analysis by gender reported in Table 7. As outlined above, the analysis is restricted to the moderate level of risk aversion scenario, i.e., an AEW measure calibrated with a CRRA of 2.

The *capital stock at retirement* and its square are jointly significantly different from zero (at the 0.01 level). Coefficient estimates indicate that the marginal wealth effect is positive, but rather small. Quantitatively, a SFR 100,000 increase in pension wealth is associated with a 1 percentage point increase in the rate of annuitization. The implied capital functions take on an inverse-U shape: The annuitization probability is maximized at a value of pension wealth stock equaling approximately SFR 650,000. For values of pension wealth exceeding this level (this applies to approximately 30 percent of men and 5 percent of women in our sample), the annuitization rate starts decreasing with the amount of retirement capital. Women have a steeper capital function than men do, as Table 7 demonstrates: A SFR 100,000 increase in pension wealth leads to a 6 percentage point increase in the annuitization rate, and the annuitization probability is maximized at approximately SFR 450,000 pension wealth. A large majority (87 %) of female retirees is below that level, however, mainly as a consequence of lower wages and discontinuous working careers. These empirical findings are quite in line with theoretical predictions highlighted in Section 3.2. High cash-out rates with low balances are consistent with both a high discount rate, and the possibility to claim means-tested benefits after the depletion of capital stock. Similarly, higher cash-out rates with high balances can be explained with alternative investment opportunities, lesser requirements for life-long insurance and the preferential tax treatment of lump sum withdrawals in most cantons.

Table 7 shows that both married and divorced/widowed men significantly cash out more than singles, with an impact at the margin of 6 percent and 1 percent, respectively. The latter is interesting, as divorced/widowed are more likely to have children (increasing the propensity to cash out under a bequest motive), and also have a higher remarriage probability than singles (increasing the demand for an annuity). In the absence of a bequest motive, divorced and widowed men should choose a higher annuitization rate at the margin. The higher cash-out rates for this latter group compared to singles could therefore be interpreted as an indication for the existence of a bequest motive. The limitation of our data set, however, does not allow us to exclude other explanations for this

behavior, in particular non-observed differences in non-pension wealth.

For women, results are less clear cut: Married women have a significantly stronger preference for the annuity (11 percent marginal effect) than single women do, but the estimated coefficient for divorcees/widowers is statistically not significantly different from zero. The former result is somewhat surprising, given the tax advantage of the lump sum with the higher likelihood of having additional sources of income in the household. Again, the lack of background data does not allow us to interpret this finding in more depth.

Having (at least) one dependent child leads to a significant increase in the expected proportion of capital withdrawn as an annuity by 6 percent.[16] As argued in Section 3.4, this result does not rule out a bequest motive: The availability of sizeable supplemental benefits for younger children and the high present value of survivor benefits (due to a younger spouse) is very likely to dominate the bequest motive.

Adding pension wealth and more background information (marital status and dependent children) does not substantially change the impact of the annuity equivalent wealth on the annuitization rate. A one percentage point increase in AEW leads to a marginal percentage point increase in the annuitization rate equal to 1.5 for women and 0.5 for men. These findings are rather consistent with Brown's (2001), who finds a one-to-one relationship between his annuity equivalent wealth measure and the individual intention to annuitize their DC wealth at retirement for men and women together. However, the reported difference between men and women should be interpreted with diligence due to the limited reliability of the AEW measures for women in our data.

Table 6

Table 7

[16]Recall that only 5 percent of the individuals have at least one child aged less than 18/25 years. This implies that there is very little variation for this variable in our sample. In the age-group of our data, most married men can be expected to have children (see Brown, 2001 for a discussion of this aspect).

6 Conclusions

To the best of our knowledge, our paper is the first to provide empirical evidence on real rather than voluntary annuitization decisions. Our study is based on a unique data set of individual decisions made with regard to the Swiss second pillar. Several novel aspects are incorporated. First, the analysis is based on administrative records made available by ten Swiss employer-based pension funds. The limited flexibility of the administrative data is compensated for by the fact that it allows to deal with real choices rather than subjectively reported intentions to annuitize. Second, the Swiss case is particularly interesting as occupational pensions are mandatory. Moreover, more than two thirds of the retirees annuitize, contrary to most of the evidence behind the so called annuity puzzle. Third, the individual decisions involve very large amounts of money (approximately $ 400,000 on average). This makes us confident that individuals spend relatively more time and effort during their decision-making process than the time spent answering survey questions from a questionnaire on hypothetical choices.

As an annuity provides insurance against outliving one's assets in old age, the empirical analysis uses a utility-based measure of an annuity's wealth. Borrowing the methodology from Brown and Poterba (2000), and Brown (2001) the annuity equivalent wealth (AEW) is computed within a life-cycle framework for three levels of risk aversion, including risk neutrality. In general, utility based measures with risk aversion do a better job in explaining the variation in the choice between an annuity and a lump sum. Their impact on the decision to annuitize is both strong and robust: For a coefficient of risk aversion equal to 2, a one percentage point increase in AEW would lead to a 1.5 percentage point increase in the annuitization rate for women and to a 0.5 percent increase in the annuitization rate for men, at the margin. This result is roughly in line with previous empirical evidence, notably with Brown (2001), who reports a one-to-one relationship in his analysis for men and women pooled.

Low accumulation of retirement assets is strongly associated with the choice of a lump sum. One potential reason for this relationship (also found in Hurd, Lillard and Panis, 1998) is differences in the rate of time preference across individuals. High discounting may at the same time explain the low capital stock at retirement and a preference for the lump sum. There is, however, an additional

reason inherent in the Swiss social security system. Once the capital stock is depleted (the law even allows some savings), the individual can claim supplemental benefits. Up to a certain capital stock, this is likely to be the best option even in terms of utility.

Our results are inconclusive as for the existence of a bequest motive, mostly due to the limited background information in our data. We do find, however, that divorced and widowed men (who are much more likely to have children) have a higher propensity to cash out than singles at the margin, although divorced and widowed men have a higher remarriage rate and should therefore choose the annuity more often.

In addition to the marginal impact of different determinants of the annuitization decision, both the high overall annuitization rates and the differences between companies in our date are worth mentioning. Both of which seem to be driven in part by the design of the sponsor's default option, in most cases the annuity. The former is also a consequence of very high annuity values for the period analyzed in the data. Our paper suggests that defaulting workers into an annuitization of retirement balances would decrease the fraction cashed out and increase longevity insurance, a major concern for many policy makers.

This paper also emphasizes the importance of adopting a life-cycle utility perspective in properly assessing the many forces behind the choice of how retirement assets are and should be paid out. Our example of a potential moral hazard impact of means-tested social assistance illustrates that individuals take into account many other aspects in addition to a simple comparison of present value.

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A Computation of the Annuity Equivalent Wealth

We use the methodology of Brown and Poterba (2000) to develop a measure of an annuity's wealth, but adapted to the Swiss pension system. As in Brown and Poterba, we consider single individuals and couples separately. In both cases, we assume that bequest motives are absent.

The individual or couple is assumed to start off with an initial amount of accumulated wealth W_0. As we do not have any information on non-pension wealth, we assume that the initial wealth is equivalent to the accumulated pension wealth K. In what follows, two scenarios are compared:

Full annuitization: The individual or the couple's eligible person annuitizes the entire pension wealth K. As a consequence the initial capital W_0 is equal to zero. In exchange for K, (s)he gets a lifelong nominal annuity, $B_t = \gamma K$, where γ depends on the individual's age and the company for which (s)he works. In case of death of a couple's main claimant, the surviving spouse gets a reduced lifelong annuity, $B_t = \lambda\gamma K$.

Full lump sum: The entire capital stock is cashed out, leaving the individual or the couple without any additional benefit from the second pillar, i.e., $B_t = 0$. The initial capital is equal to the entire pension capital, $W_0 = K$.

In line with the common practice of all pension funds in our sample, we assume that first pillar benefits are paid out from the time of retirement, with first pillar benefits adjusted in an actuarially fair manner. Both the single individual's and the couple's optimization plan are subject to constraints. We assume that there is a non-negativity constraint on wealth in every period, i.e. $W_t \geq 0, \forall t$. The individual's or couple's wealth evolves as

$$W_{t+1} = (W_t - C_t + S_t + B_t)(1 + r),$$

where C_t denotes consumption expenditures, S_t first pillar benefits and B_t occupational benefits if any.

A.1 Singles

The value function of a single individual at time t is denoted by $V_t(W_t)$; it represents the present discounted value of expected utility evaluated along the optimal

path,

$$V_t(W_t) \equiv \max_{C_t} E_t \left[\sum_{t=0}^{\infty} S_t \frac{u(C_t)}{(1+\rho)^t} \right] \tag{1}$$

and is subject to the constraints mentioned above. $u(C_t)$ represents the one-period felicity function, ρ the personal discount rate, and S_t the probability to survive to period t, conditional on being alive at time 0. The value function then satisfies the following recursive Bellman equation,

$$\max_{C_t} V_t(W_t) = \max_{C_t} u(C_t) + \frac{1}{1+\rho} \Pr[\text{alive}](t+1) V_{t+1}(W_{t+1}), \tag{2}$$

where $\Pr[\text{alive}](t+1)$ is the conditional survival probability from period t to period $(t+1)$. To compute the AEW, the two hypothetical alternative polar cases are compared. In the first case, the individual fully annuitizes K and reaches a maximum utility of V^*. In the full lump sum case without an occupational pension, the corresponding utility is V. We then calculate the amount of additional wealth ΔW the individual must receive in this latter case to reach the same utility level V^* as in the full annuitization scenario.

$$V(K + \Delta W | B_t = 0, \ \forall t) = V^*$$

The resulting AEW is then

$$AEW = \frac{K + \Delta W}{K}$$

A.2 Married Couples

In Brown and Poterba (2000), the total consumption of the couple consists of a weighted combination (with parameter δ) of the husband's consumption (superscript m) and that of the wife (f). The utility function is a weighted combination (with parameter ψ) of the utility function of the husband and that of the wife. The corresponding Bellman equation (only shown for the state in which both members of the couple are still alive) is then:

$$\max_{C_t^m, C_t^f} V_t^c(W_t) = \max_{C_t^m, C_t^f} u^m(C_t^m + \delta C_t^f) + \psi u^f(C_t^f + \delta C_t^m) + \tag{3}$$

$$+\frac{1}{1+\rho}\Pr[m \text{ alive}, \ f \text{ dead}](t+1)V_{t+1}^m(W_{t+1}) + \tag{4}$$

$$+\frac{1}{1+\rho}\Pr[m \text{ dead}, \ f \text{ alive}](t+1)V_{t+1}^f(W_{t+1}) + \tag{5}$$

$$+\frac{1}{1+\rho}\Pr[m \text{ alive}, \ f \text{ alive}](t+1)V_{t+1}^c(W_{t+1}) \tag{6}$$

where V_{t+1}^m and V_{t+1}^f represent the value functions for the states in which the male and the female, respectively, are the surviving spouse. Here, $\Pr[\cdot](t+1)$ are the conditional transition probabilities to the different states from period t to period $(t+1)$.

When the couple is considered as a single decision unit, the couple's utility function simplifies to C_t^c. Note that even when the couple is treated as a single decision unit, we have to take note of the different (survival) states in the Bellman equation due to differential mortality by gender and marital status. The procedure for computing the AEW for couples is the same as that for singles.

A.3 Sources of Variation

Following Brown (2001), we investigate the sources of variation in the AEW measures, by running OLS regressions having the AEW as dependent variable and controlling for the variables used in the dynamic programming algorithms used to calculate the AEW itself. Both company and retirement year dummies are included in all regressions, as company plans differ from each other and some plans have changed over the time analyzed. Table 8 reports the results, in terms of coefficients, robust standard errors and t-values. All controls are highly significant, as a consequence of the fact that they are used for computing the AEW measures. The R-squared differ considerably across AEWs, ranging from 0.68 for AEW4 to 0.99 for AEW0. In case of risk neutrality the variables used in the computation capture virtually the total variation of AEW, which is not surprising, given that this measure basically compares the two option in (linear) present value terms. By adding a certain degree of risk aversion, the variables used in the computation explain only a fraction of the total variation of AEW.

The value of annuitization is lower for males than for females, and higher for married individuals only in the risk neutrality scenario. When adding some degree of risk aversion, the estimated coefficients for married individuals get positive and remain statistically strongly significant. We also find that the higher the age at retirement, the lower the value of the annuity.

Table 8

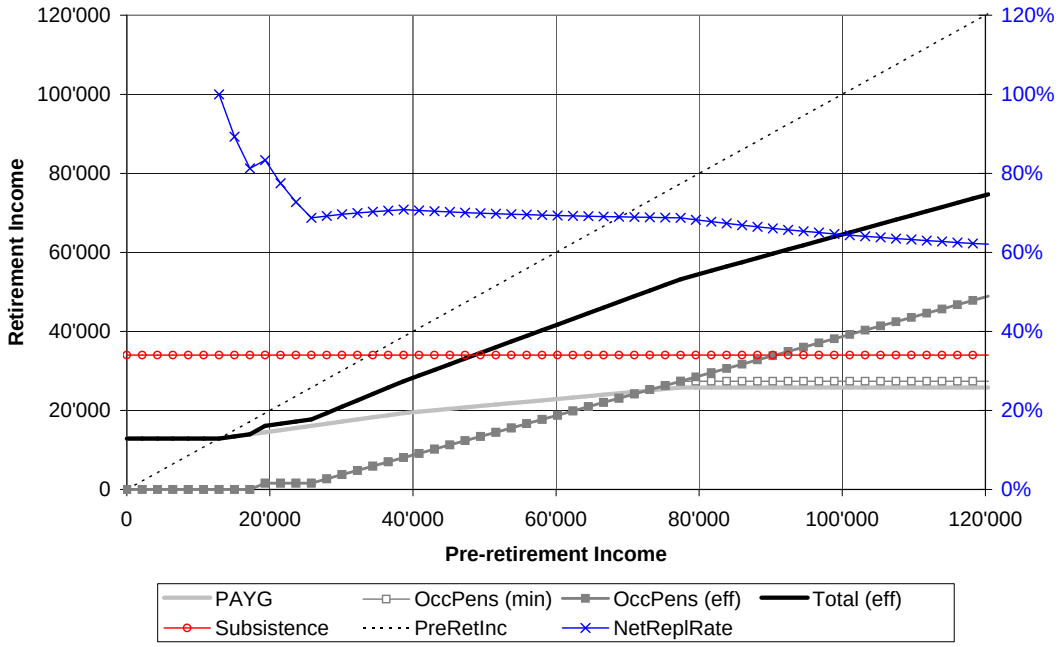

Figure 1: *Annual retirement benefits and the gross replacement rate as a function of gross pre-retirement income for a single person. The subsistence line depicts the maximum income an individual is entitled to by claiming means tested benefits. PAYG benefits and subsistence levels (per person) are slightly lower for married individuals, mirroring couples' lower living costs.*

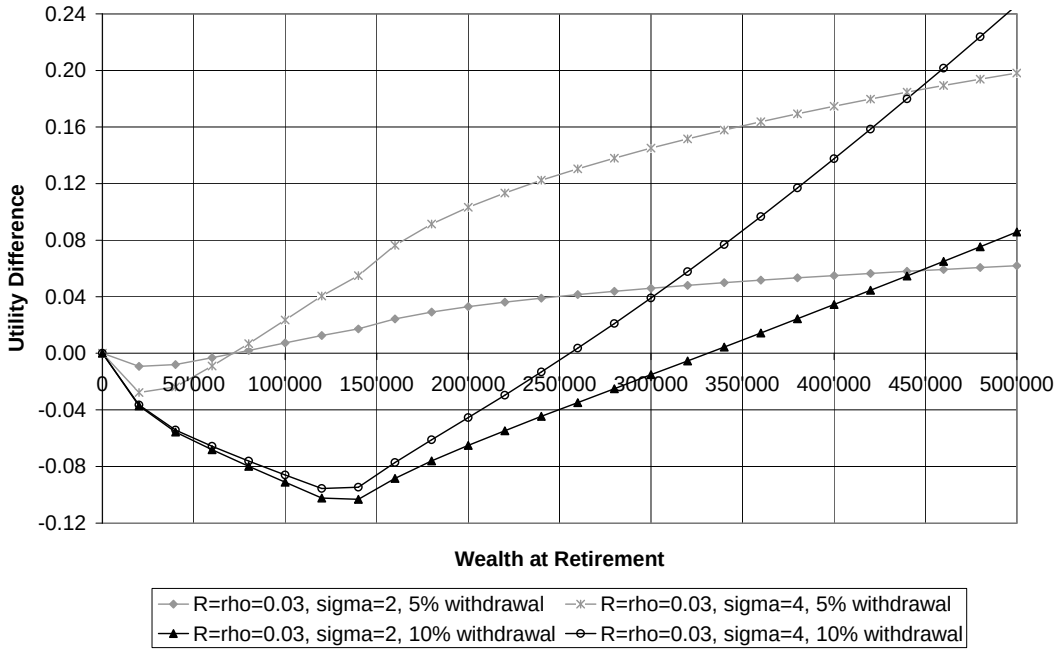

Figure 2: *Utility differences (measured in equivalent consumption) in favor of the annuity in the second pillar as a function of wealth for a single man. Assumptions: CIES utility with CRRA equal to 2 or 4, interest rate (R) = rate of time preference (ρ) = 0.03, two different phased withdrawal plans of accumulated wealth.*

variable	**mean**	**std.dev.**	**min**	**max**	**obs.**
age at retirement	61.75	1.90	55	68	4,544
marital status:					4,151
single	*7.5%*				*313*
married	*80.7%*				*3,345*
divorced/separated	*8.3%*				*345*
widowed	*3.5%*				*145*
gender (1 = male)	0.863	0.345	0	1	4,544
children ($\leq$ 18/25 y.)	0.066	0.315	0	4	3,866
total cap. at retirement	484,360	260,439	1,560	3,325,360	4,544
lump-sum capital	58,746	134,229	0	1,089,898	4,544
conversion factor γ	0.0667	0.0041	0.0555	0.077	4,544
defined benefits	0.573	0.495	0	1	4,544
capital annuitized (fraction)	0.778	0.376	0	1	4,544

Table 1: *Summary statistics for some relevant variables. (average capital: married men = 536,687 SFR; single men = 450,890 SFR; married women = 152,735 SFR; single women = 388,468 SFR)*

variable	**variation**	**std.dev.**	**obs.**	**empl.**
annuitization rate	overall	0.376	4544	10
	within	0.346		
gender	overall	0.345	4544	10
	within	0.306		
marital status	overall	0.904	4151	8
	within	0.896		
dep. children	overall	0.314	3877	7
	within	0.314		
capital stock at retirement	overall	2.604	4544	10
	within	2.372		
age at retirement	overall	1.899	4544	10
	within	1.723		
annuity equivalent	overall	0.110	4151	8
wealth (AEW0, CRRA = 0)	within	0.101		
annuity equivalent	overall	0.068	4151	8
wealth (AEW2, CRRA = 2)	within	0.051		
annuity equivalent	overall	0.078	4151	8
wealth (AEW4, CRRA = 4)	within	0.062		

Table 2: *Standard deviations of the observable characteristics controlled for in the empirical analysis and of computed AEW measures, both within and across firms are reported. Empl. = number of employers for which we have the relevant information*

characteristic or company	**annuity**	**partial L.S.**	**full L.S.**	**obs.**
female	68.16	12.16	19.68	625
male	73.18	18.09	8.73	3,919
p-value	*.000*			
single	79.55	13.10	7.35	313
married	73.92	17.05	9.02	3,348
sep. & div.	74.49	15.65	9.86	345
widowed	75.86	13.79	10.34	145
p-value	*.000*			
A (clothing)	69.64	13.09	17.27	359
B (public infrastructure) *(DB)*	84.68	14.57	0.75	2,265
C (industry)	50.79	25.13	24.07	378
D (food)	25.81	-	74.19	31
E (industry) *(DB)*	90.00	10	-	70
F (industry)	10.26	89.74	-	39
G (industry)	93.33	6.67	-	15
H (industry)	55.62	19.75	24.64	1,104
I (city)	71.43	-	28.57	14
K (communication) *(DB)*	82.16	17.84	-	269
p-value	*.000*			
Total sample	72.49	17.28	10.23	4,544

Table 3: *Relative frequencies of the choice variable, reported by demographic and socio-economic characteristics. The p-values refer to* χ^2*-tests of the null that the distribution of preference over the three possible options is the same across different values of a characteristic. The standard option of the pension fund is underlined. DB = company under defined benefit scheme.*

		obs.	AEW0: CRRA=0 mean (std.dev.)	*min* *max*	AEW2: CRRA=2 mean (std.dev.)	*min* *max*	AEW4: CRRA=4 mean (std.dev.)	*min* *max*
men								
full sample	married	3016	1.259	*1.191*	1.354	*1.244*	1.386	*1.251*
			(0.049)	*1.364*	(0.055)	*1.477*	(0.058)	*1.518*
	single	201	0.954	*0.872*	1.285	*1.012*	1.362	*1.048*
			(0.037)	*1.029*	(0.062)	*1.429*	(0.067)	*1.524*
	div/wid	309	0.961	*0.884*	1.314	*1.063*	1.419	*1.142*
			(0.037)	*1.075*	(0.086)	*1.889*	(0.111)	*2.088*
stat RA ± 1	married	553	1.257	*1.193*	1.356	*1.245*	1.388	*1.251*
			(0.026)	*1.356*	(0.035)	*1.446*	(0.039)	*1.484*
	single	24	0.920	*0.872*	1.260	*1.121*	1.343	*1.203*
			(0.028)	*0.992*	(0.065)	*1.376*	(0.063)	*1.451*
	div/wid	45	0.935	*0.884*	1.287	*1.176*	1.400	*1.255*
			(0.026)	*0.995*	(0.042)	*1.361*	(0.053)	*1.530*
women								
full sample	married	332	1.293	*1.205*	1.327	*1.094*	1.328	*1.006*
			(0.042)	*1.383*	(0.059)	*1.444*	(0.067)	*1.458*
	single	112	1.231	*1.144*	1.441	*1.209*	1.479	*1.232*
			(0.041)	*1.341*	(0.053)	*1.559*	(0.064)	*1.614*
	div/wid	181	1.247	*1.179*	1.456	*1.287*	1.528	*1.287*
			(0.045)	*1.400*	(0.090)	*1.637*	(0.121)	*1.800*
stat RA ± 1	married	199	1.305	*1.205*	1.331	*1.167*	1.332	*1.128*
			(0.048)	*1.383*	(0.065)	*1.444*	(0.069)	*1.458*
	single	52	1.252	*1.196*	1.468	*1.287*	1.508	*1.287*
			(0.046)	*1.318*	(0.059)	*1.559*	(0.074)	*1.614*
	div/wid	134	1.250	*1.191*	1.532	*1.287*	1.462	*1.287*
			(0.046)	*1.371*	(0.122)	*1.800*	(0.095)	*1.637*

Table 4: *Summary statistics for measures of annuity equivalent wealth for different levels of risk aversion. The second group of numbers for each gender reports the values for individuals who retired around the statutory retirement age (plus/minus one year).*

	I			II			III		
variable	coeff.	marg.	p	coeff.	marg.	p	coeff.	marg.	p
	(s.e.)			(s.e.)		(s.e.)			
AEW0	-0.236	-0.037	.446	1.388	0.219	.425	8.054	1.275	.001
	(0.310)			(1.738)			(2.313)		
AEW0 x men				-1.574	-0.249	.364	-6.015	-0.952	.005
				(1.734)			(2.129)		
men				2.140	0.469	.333	8.008	0.965	.002
				(2.212)			(2.631)		
married							-0.895	-0.116	.000
							(0.195)		
married x men							0.216	0.035	.587
							(0.397)		
logLikelihood	-2808.5			-2807.0			-2795.9		
N.obs.	4,131			4,131			4,131		
AEW2	3.320	0.526	.000	6.880	1.092	.000	9.894	1.574	.000
	(0.644)			(0.952)			(1.352)		
AEW2 x men				-5.440	-0.864	.000	-7.446	-1.185	.000
				(1.130)			(1.416)		
men				7.773	0.964	.000	11.143	0.984	.000
				(1.561)			(2.023)		
married							0.702	0.128	.002
							(0.222)		
married x men							-0.883	-0.121	.000
							(0.252)		
logLikelihood	-2794.9			-2778.9			-2772.7		
N.obs.	4,131			4,131			4,131		
AEW4	2.830	0.448	.000	4.791	0.759	.000	7.511	1.192	.000
	(0.550)			(0.718)			(1.121)		
AEW4 x men				-3.980	-0.631	.000	-6.352	-1.008	.000
				(0.942)			(1.199)		
men				5.818	0.936	.000	9.678	0.977	.000
				(1.330)			(1.786)		
married							0.802	0.149	.001
							(0.242)		
married x men							-0.850	-0.117	.001
							(0.259)		
logLikelihood	-2794.6			-2783.0			-2777.3		
N.obs.	4,131			4,131			4,131		

Table 5: *Results from Tobit regressions for the full sample. The dependent variable is the proportion of an individual's total retirement capital withdrawn as an annuity. The coefficients from Tobit, marginal effects (evaluated at sample means), standard errors (s.e.) and p-values are reported. In all regressions, both company and retirement year dummies are included.*

	IV			V		
variable	coeff.	marg.	p	coeff.	marg.	p
	(s.e.)			(s.e.)		
AEW2	9.454	1.506	.000	9.842	1.557	.000
	(1.374)			(1.437)		
AEW2 x men	-7.080	-1.128	.000	-6.260	-0.990	.000
	(1.415)			(1.491)		
male	10.566	0.982	.000	9.767	0.977	.000
	(2.019)			(2.117)		
married	0.684	0.125	.002	0.790	0.146	.003
	(0.222)			(0.270)		
married x men	-0.883	-0.121	.000	-1.273	-0.163	.000
	(0.253)			(0.326)		
wealth (SFR100,000)	0.074	0.012	.011	0.061	0.010	.046
	(0.029)			(0.031)		
wealth squared	-0.006	-0.001	.001	-0.005	-0.001	.003
	(0.002)			(0.002)		
div/wid				0.011	0.000	.966
				(0.255)		
div/wid x men				-0.389	-0.015	.225
				(0.320)		
dep. children				0.474	0.064	.004
				(0.163)		
logLikelihood	-2766.9			-2575.1		
N. obs.	4,131			3,831		
max annuity at	641,112 SFR			585,339 SFR		

Table 6: *Results from Tobit regressions for the full sample. The dependent variable is the proportion of an individual's total retirement capital withdrawn as an annuity. The coefficients from Tobit, marginal effects (evaluated at sample means), standard errors (s.e.) and p-values are reported. In all regressions, both company and retirement year dummies are included.*

	men (V)			women (V)		
variable	coeff.	marg.	p	coeff.	Marg.	p
	(s.e.)			(s.e.)		
AEW2	2.729	0.442	.010	12.143	1.637	.000
	(1.057)			(3.230)		
married	-0.419	-0.060	.008	0.829	0.112	.059
	(0.159)			(0.439)		
div/wid	-0.354	-0.015	.056	-0.146	-0.003	.706
	(0.185)			(0.387)		
wealth (SFR100,000)	0.060	0.010	.053	0.456	0.061	.023
	(0.031)			(0.199)		
wealth squared	-0.005	-0.001	.008	-0.051	-0.007	.014
	(0.002)			(0.021)		
dep. children	0.437	0.061	.005			
	(0.155)					
logLikelihood	-2134.6			-434.4		
N. obs.	3,212			607		
max annuity at	646,875 SFR			446,618 SFR		

Table 7: *Results from Tobit regressions by gender. The dependent variable is the proportion of an individual's total retirement capital withdrawn as an annuity. The coefficients from Tobit, marginal effects (evaluated at sample means), standard errors (s.e.) and p-values are reported. In all regressions, both company and retirement year dummies are included.*

AEW0 (CRRA = 0)			Obs. 4,151
	Coeff.	Robust S.E.	t-value
male	-0.257	0.0015	-173.4
married	0.054	0.0012	44.5
male x married	0.245	0.0016	157.7
age at retirement	-0.029	0.0003	-99.1
conversion rate	18.760	0.1908	98.3
constant	1.764	0.0090	196.4
R-squared	0.990		

AEW2 (CRRA = 2)			Obs. 4,151
	Coeff.	Robust S.E.	t-value
male	-0.121	0.0045	-27.3
married	-0.120	0.0043	-28.2
male x married	0.167	0.0051	32.4
age at retirement	-0.029	0.0009	-31.5
conversion rate	20.150	0.6775	29.8
constant	1.892	0.0241	78.6
R-squared	0.774		

AEW4 (CRRA = 4)			Obs. 4,151
	Coeff.	Robust S.E.	t-value
male	-0.091	0.0065	-14.0
married	-0.176	0.0063	-28.1
male x married	0.161	0.0075	21.6
age at retirement	-0.027	0.0012	-22.2
conversion rate	19.170	0.9015	21.3
constant	1.865	0.0335	55.7
R-squared	0.680		

Table 8: *Results from the OLS regressions where the dependent variables are the AEW described in the text. The independent variables are the sources of variation in the dynamic programming algorithms used to calculate the AEW measures. In all regressions, company and retirement year dummies are included.*