

Bütler, Monika; Staubli, Stefan; Peijnenburg, Kim

Conference Paper

Do means-tested benefits reduce the demand for annuities? - Evidence from Switzerland

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2010: Ökonomie der Familie - Session: Income Risk, Savings and Intergenerational Links, No. A14-V3

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Bütler, Monika; Staubli, Stefan; Peijnenburg, Kim (2010) : Do means-tested benefits reduce the demand for annuities? - Evidence from Switzerland, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2010: Ökonomie der Familie - Session: Income Risk, Savings and Intergenerational Links, No. A14-V3, Verein für Socialpolitik, Frankfurt a. M.

This Version is available at:

<https://hdl.handle.net/10419/37525>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Do means-tested benefits reduce the demand for
annuities? - Evidence from Switzerland

MONIKA BÜTLER

SEW-HSG Universität St. Gallen, CEPR, CESIfo & Netspar

KIM PEIJNENBURG

Tilburg University, CentER

STEFAN STAUBLI

SEW-HSG Universität St. Gallen & Netspar

January 8, 2010

Do means-tested benefits reduce the demand for annuities? - Evidence from Switzerland

Abstract

Most industrialized countries provide a subsistence level consumption floor in old age, usually in the form of means-tested benefits or income supplements. The availability of such means-tested payments creates an incentive to optimally cash out (occupational) pension wealth for low and middle income earners. In case the guaranteed old-age income exceeds first-pillar benefits, individuals with low wealth find it unambiguously optimal to cash out, because the annuity income from pension wealth reduces the means tested benefits one for one. Agents with intermediate wealth levels weigh the advantages from annuitization, namely the longevity risk insurance and a smooth consumption pattern, against the disadvantage, which is giving up "free" wealth in the form of means-tested benefits. We analyze optimal annuity demand and consumption/savings decisions in a realistic life-cycle model under a social security scheme in which means-tested benefits can be claimed if income falls below a certain subsistence level. The model is calibrated to Switzerland, which is an interesting case because it combines generous means-tested benefits with a large second pillar in which accumulated pension wealth can be cashed out at retirement. We show that the predicted annuitization rates are roughly consistent with the cash-out patterns observed in Switzerland. Means-tested benefits can reduce the annuitization levels substantially, which can generate both non-negligible welfare losses and high government expenditures.

Jel-Classification: D81, D91, G23, J26

Keywords: Means-Tested Benefits, Occupational Pension, Annuity

1 Introduction

An important result of Yaari's (1965) seminal paper is that a life cycle consumer without a bequest motive who faces a mortality risk should always choose to annuitize his entire wealth, provided the annuity market is actuarially fair. Brown et al. (2005) argue that positive, but not complete annuitization remains optimal even with market incompleteness and liquidity constraints. They also show that the case for annuitization remains strong in the presence of bequest motives and under habit formations. However, when international numbers are analyzed, it is apparent that when given a choice, only a minority do so voluntarily even in countries in which the pre-existing annuitization implied by the public pension system is small. This raises questions with regard to the adequacy of income provided in old age in many countries: As a consequence of unfavorable demographic and financially imbalanced social security systems, public pension annuity payments are declining and fully funded systems, which typically do not mandate annuitization are playing a greater role.

The lack of voluntary annuitization is puzzling given the numerous theoretical findings following the seminal paper of (Yaari (1965)), which all suggest sizeable benefits to annuitization. A great amount of literature has attempted to shed light on the "annuity puzzle"¹, but it has failed to present a convincing general explanation. Adverse selection and administrative loads (Mitchell et al. (1999)), the existence of first-pillar annuities (Dushi and Webb (2004)), intra-family risk-sharing (Brown and Poterba (2000)), bequest motives (Inkmann et al. (2008) and Brown (2001)), and a desire to insure against expenditure spikes Peijnenburg et al. (2009) can rationalize the preference for the lump sum to some degree. Nonetheless, the low annuitization rates remain hard to reconcile with economic theory. Recent work on the determinants of individual cash-out behavior includes

¹See Brown (2007a), for an excellent review of this literature.

not fully rational behavior.²

In this paper we consider one potential explanation of low voluntary annuitization rates that has hitherto been neglected. A guaranteed minimum income creates an implicit insurance against the financial consequences of longevity and might therefore reduce annuity demand. Most countries offer an implicit consumption floor to their old citizens, in most cases by means-tested benefits and income supplements. Australia, for example, relies entirely on means-tested benefits in the public old-age provision. Most countries have a minimal level of income they guarantee to their retired citizens.

Such means-tested benefits can have unintended consequences. The individuals may have a strong incentive to cash-out accumulated pension wealth even if full annuitization were optimal in the absence of a consumption-floor. The Swiss case nicely illustrates the situation. Maximal first pillar benefits amount to roughly 2,000 CHF per month. As this was deemed to be insufficient for a decent living in old age, occupational pension plans were mandated in 1985. At the same time, there are also means-tested supplements to first pillar benefits that lift the available income to roughly 3'000 CHF a month. An individual with a monthly second pillar benefit of less than 1,000 CHF a month (which corresponds to accumulated occupational pension wealth of approximately 170,000 CHF) is always better off withdrawing the money upon retirement, spending it quickly (taking into account eligibility constraints) and then applying for means-tested benefits.

While the incentives for individuals with low pension wealth are clear, for middle-income individuals there is a trade-off. The retiree weighs the benefits from taking the lump-sum, "free" means tested benefits after withdrawal, against

²See, for example, Brown et al. (2008) who find that people are more likely to annuitize when the choice is presented to them in a consumption framework than when it is presented in an investment framework. Other behavioral explanations such as mental accounting are examined in Hu and Scott (2007) and Brown (2007*b*).

the disadvantages, not receiving the wealth enhancing mortality credit and a smooth consumption pattern. In this paper we analyze optimal annuity demand and consumption/savings decisions in a realistic life-cycle model under a social security scheme in which means-tested benefits can be claimed if income falls below a certain subsistence level. The model also includes inflation risk and equity risk, and allows for differential tax treatments of annuity payments versus lump-sum withdrawals.

The model is calibrated to Switzerland. The Swiss case is an ideal case to evaluate the impact of means-tested benefits on the annuitization rate of retired individual for a number of reasons. First, it combines a relatively low level of pre-existing annuitization by the first pillar by a generous means-tested consumption floor. Second, most individuals have accumulated a large capital stock at retirement through the mandatory occupational pension scheme. The average Swiss retiree has a capital stock of approximately 300,000 to 400,000 CHF which translates into a second pillar income that approximately equals first pillar benefits. By law, at least 25% can be withdrawn as a lump-sum, but most plans do not limit the fraction that can be cashed out or apply a higher limit. Third, and in contrast to other countries, a relatively high fraction of individuals voluntarily annuitize their pension wealth. Using individual retirement decisions from autonomous pension funds and insurance companies, Bütler and Teppa (2007) and Bütler et al. (2009) show, among other things, that the propensity to annuitize increases in pension wealth, which is consistent with the incentives of means-tested benefits.

In a last step, we compare the resulting predictions from our simulated and calibrated model with the observed individual annuitization decisions from a large number of Swiss occupational pension providers. While the data is relatively poor on background characteristics, notably non-pension wealth, it allows us to trace empirical annuitization behavior for a large range of accumulated pension wealth. The simulation also take into account first pillar benefits and the full tax

schedule for both the annuity and the lump-sum. Taking everything together, we show that the predicted annuitization rates as a function of pension wealth are remarkably close to the average cash out patterns observed in Switzerland. As this comparison ignores non-pension wealth, we also will use additional information on the empirical distribution of non-pension wealth from other sources.

The paper proceeds as follows. Section 2 gives an overview of the Swiss pension system and explains the calculation of means-tested benefits. Section 3 describes the life-cycle model used for the simulations. Section 4 summarizes the data and presents descriptive statistics. Section 5 presents the results. Finally, section 6 draws conclusions.

2 Institutional Background

2.1 The Swiss Pension System and the Second Pillar

The Swiss pension system is based on the approximately equally important first and second pillar. The first pillar is a pay-as-you-go (PAYG) system and aims at providing a basic subsistence level of income to all retired residents in Switzerland. Benefits depend on the number of years contributed and on the average working income. The statutory retirement age is 64 for women and 65 for men. At the earliest women can claim first pillar benefits at 62 and men at 63, subject to a reduction in benefits of 6.8 percent per year. Working beyond age 64/65 is possible, but most work contracts specify a retirement age that coincides with the statutory retirement age.

The second pillar, compulsory for all employees with annual earnings above roughly 24,000 CHF (\approx \$ 24,000), is an employer-based, fully funded occupational pension scheme. Currently around 96 percent of working men and 83 percent of working women are covered by an occupational pension plan. Introduced in 1985, the main goal of the second pillar is to maintain pre-retirement income.

Including income from the first pillar, the target replacement rate of most pension funds is approximately 50-60 percent of insured income, corresponding to a net replacement rate of 70-80 percent.

Employers can choose between different organizational structures for the occupational pension plan. The two polar cases are setting up a completely autonomous pension fund and outsourcing the scheme to an insurance company, which is relatively common particularly among small and medium sized companies. Contributions to the pension plan correspond to a certain fraction of the salary of which the employer has to pay at least half. When an employee starts working at another company, he receives all of the accumulated contributions (including the employer's part). The full sum has to be paid into a new fund. The total amount of assets at retirement has thus been accumulated over the entire working life and is a good proxy for lifetime income.

The accrued retirement capital can be withdrawn either as a monthly life-long annuity (including a 60 percent survivor benefit), a lump sum or a mix of the two options. In some plans the cash-out limit is equal to 50 or 25 percent (the legal minimum) of accumulated capital. Depending on the regulation of the pension The individual must declare his choice between three months and three years prior to the effective withdrawal date depending on insurer regulations. Many pension insurers define a default option for the case when the beneficiary does not make an active choice.

Occupational pension annuities are strictly proportional to the accumulated retirement assets (contributions made during the working lifetime plus accrued interest). The capital K is translated into a yearly nominal annuity B using the so-called *conversion rate* γ : $B = \gamma K$. The conversion rate is independent of marital status, but depends on retirement age and gender. The law stipulates a minimum conversion rate, which is currently 7.05 percent but will be lowered continuously to 6.8 percent in 2015. Pension funds are requested to index pension benefits to inflation if the financial situation of the fund allows for this. At

present, only few funds are able to index pensions to inflation mainly due to high liabilities created by a very high conversion factor in the mandatory part.

2.2 Means-tested supplemental benefits in Switzerland

Introduced in 1966 means-tested supplemental benefits may be claimed as part of the first pillar in case the total income does not cover basic needs in old age. These additional benefits usually result in an income that is above the poverty threshold. Eligibility for benefits is limited to individuals that receive an old-age or disability pension, live in Switzerland and have Swiss or EU citizenship or have been living in Switzerland for at least 10 years. As shown in figure 1, the fraction of retired and disabled individuals claiming means-tested benefits has grown from 13 percent in 1993 to 16.3 percent in 2008. The extension of the beneficiary population is primarily due to a large increase in the share of disability recipients with means-tested benefits. On the other hand, over the same time span the fraction of retirees receiving means-tested benefits has remained constant at 12 percent.

Figure 1

The yearly means-tested supplemental benefits correspond to the difference between applicable expenditures and income. If the income exceeds the expenditures no means-tested benefits are paid. For those with applicable expenditures larger than income, benefits covers at least the health insurance premium. For married applicants expenditures and income of the spouse are taken into account as well. In addition, a child allowance is granted for each child below age 18 or until finishing schooling (at most age 25). The exact amount depends on the number of children: the child allowance per child is 9,480 CHF for the first two children, 6,250 CHF for the third and the fourth child, and 3,260 CHF for each additional child.

The applicable income used in the calculations of means-tested supplemental benefits is the sum of pension income, investment income, and earnings plus one tenth of the wealth exceeding a threshold level of 25,000 CHF for singles and 40,000 CHF for married applicants. To reduce the implicit tax on earnings, only two thirds of the earnings less social security contributions and an exemption of 1,000 CHF for singles and 1,500 CHF for married claimants are taken into account.

Importantly, the calculation of the relevant income can also include hypothetical income that an individual could have earned but chose not to. For example, a hypothetical interest income is added to the applicable income if the applicant holds a large sum of cash. The applicable income also incorporates relinquished wealth such as donations and, in case of married applicants, hypothetical earnings for the non-working spouse, if he or she is below the statutory retirement age. In addition, expenditures without a direct service in return are added to the applicable income. The legal definition of a service in return has prompted many law cases and as a result has become very broad in content. For example, travel expenses are not considered income increasing. The sum of past expenditures without service in return and past relinquished wealth is added to today's wealth after being reduced by 10,000 CHF per year. Hence, a donation of 50,000 CHF three years ago increases today's wealth by 20,000 CHF.

The relevant annual expenditures consist of a cost-of-living allowance of 18,144 CHF (\approx 16,800) for singles and 27,216 CHF for married applicants, a health insurance premium of up to 4,500 CHF per person, i.e. 9,000 CHF for married applicants, and rent or interest payments for the mortgage of up to 13,200 CHF for singles and 15,000 CHF for married applicants. Summing up all the applicable expenditures, means-tested supplemental benefits guarantee an income of 36,000 CHF for singles and 51,000 CHF for married individuals (without children), which is well above the poverty level.

Table 1

As shown in table 1, average annual means-tested supplemental benefits for retired beneficiaries in 2008 were 9,600 CHF for singles and 13,800 CHF for married beneficiaries. The cost-of-living allowance, the health insurance premium, and rent payments are the largest categories on the expenditure side, while interest payments on mortgages are negligible. Because the value of a home is taken into account in the calculation of means-tested benefits, home owners rarely qualify for means-tested benefits. The main source of income, other than means-tested benefits, are first pillar benefits.

2.3 Means-tested benefits and the annuitization decision

Means-tested supplemental benefits in the first pillar create an incentive to cash out (small) accumulated second pillar wealth. Given that pension income is fully taken into account in the calculation of means-tested benefits, an annuity, even small, is detrimental to the eligibility for means-tested benefits. On the other hand, only one tenth of the wealth exceeding the threshold level of 25,000 CHF for singles and 40,000 CHF for couples, respectively, is taken into consideration and as long as the individual gets a service in return, the depleted capital is not credited against the supplemental benefits. Moreover, since the plan eligibility age for benefits is typically below the statutory retirement age, the lump sum can be used to finance early retirement. Once the statutory retirement age is reached, means-tested benefits can be claimed.

Assuming zero non-pension wealth, an individual that is single and expected to receive the maximum first pillar pension of approximately 24,000 CHF upon retirement, should always choose the lump sum, draw it down, and then apply for means-tested benefits if the occupational pension wealth W satisfies

$$24,000 + CF * W < 36,000, \quad (1)$$

where CF denotes the conversion factor. Setting the CF to 7.2 percent, the above relationship holds for $W \leq 167,000$ CHF. Intuitively, even if the individuals annuitizes his entire occupational pension wealth, the total income is still lower than the means-tested benefits. While the incentives for individuals with low pension wealth are clear, for middle-income individuals there is a trade-off. The retiree weighs the benefits from taking the lump-sum, “free” means tested benefits after withdrawal, against the disadvantages, not receiving the wealth enhancing mortality credit and a smooth consumption pattern.

The example above is for illustrative purpose and ignore many important factors that have an effect on the annuitization decision. First, the eligibility for means-tested benefits depends on the *total* wealth and not only on pension wealth. Therefore, even for low levels of pension wealth taking the annuity may be optimal if the non-pension wealth is very high. Second, the annuity is subject to normal income tax rates, while in most Swiss cantons the lump sum is taxed only once (at retirement). Hence, 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 the annuity’s tax burden, especially for larger capital stocks. Third, since annuities are typically not indexed to inflation, uncertainty about future prices reduces the demand for an annuity. Forth, the desire to annuitize may be weakened by bequest motives. In the next section, we present a life-cycle model that incorporates all these aspects of the annuitization decision.

3 The retirement phase life-cycle model

3.1 Individual's preferences and constraints

We consider a life-cycle investor during retirement with age $t \in 1, \dots, T$, where $t = 1$ is the retirement age and T is the maximum age possible. The individual's preferences are presented by a time-separable, constant relative risk aversion utility function and the individual derives utility from real consumption, C_t . More formally, the objective of the retiree is to maximize the following function

$$V = E_1 \left[\sum_{t=1}^T \beta^{t-1} \left(\left(\prod_{s=1}^t p_s \right) \frac{C_t^{1-\gamma}}{1-\gamma} \right) \right], \quad (2)$$

where β is the time preference discount factor, γ denotes the level of risk aversion, and C_t is the real amount of wealth consumed at the beginning of period t . The probability of surviving to age t , conditional on having lived to period $t - 1$ is indicated by p_t . We define the nominal consumption as $\bar{C}_t = C_t \Pi_t$, where Π_t is the price index at time t .

The individual invests a fraction w_t in equity, which yields a gross nominal return of R_{t+1} . The remainder of the wealth is invested in a riskless bond and the return on this bond is denoted by R_t^f . The intertemporal budget constraint of the individual is, in nominal terms, equal to

$$W_{t+1} = (W_t + A_t + Y_t - \bar{C}_t)(1 + R_t^f + (R_{t+1} - R_t^f)w_t), \quad (3)$$

where W_t is the amount of financial wealth at time t , A_t is the income from the first pillar, and Y_t is the annual annuity income from the second pillar. The timing of decisions is as follows. First the individual receives his annuity income from both pillars, decides how much to consume and subsequently invests the remaining wealth. In case the annuity income plus wealth at the beginning of the period is lower than the minimum consumption level, the individual receives a subsistence consumption level. The decision frequency is annually.

The individual faces a number of constraints on the consumption and investment decisions. First, we assume that the retiree faces borrowing and short-sales constraints

$$w_t \geq 0 \text{ and } w_t \leq 1. \quad (4)$$

Second, we impose that the investor is liquidity constrained

$$\bar{C}_t \leq W_t, \quad (5)$$

which implies that the individual cannot borrow against future annuity income to increase consumption today.

3.2 Financial market

The asset menu of an investor consists of a riskless one-year nominal bond and a risky stock. The return on the stock is normally distributed with an annual mean nominal return μ_R and a standard deviation σ_R . The interest rate dynamics are described by an Ornstein-Uhlenbeck process

$$dr_t = -a(r_t - \mu_r)dt + \sigma_r dQ_t, \quad (6)$$

where r_t is the instantaneous short rate and a indicates the mean reversion coefficient. μ_r is the long run mean of the instantaneous short rate, σ_r denotes the instantaneous standard deviation of the short interest rate, and dQ_t are the innovations. The yield on a risk-free bond with maturity h is a function of the instantaneous short rate in the following manner:

$$R_t^{f(h)} = -\frac{1}{h} \log(A(h)) + \frac{1}{h} B(h)r_t, \quad (7)$$

where $A(h)$ and $B(h)$ are scalars and h is the maturity of the bond.

In our market, inflation is modeled as follows. For the instantaneous *expected* inflation rate we assume

$$d\pi_t = -\alpha(\pi_t - \mu_\pi)dt + \sigma_\pi dZ_t, \quad (8)$$

where α is the mean reversion parameter, μ_π is long run expected inflation, σ_π is the standard deviation of the expected inflation, and dZ_t are the innovations. Subsequently the price index Π follows from

$$\Pi_{t+dt} = \Pi_t \exp(\pi_{t+dt} + \sigma_\Pi dB_t), \quad (9)$$

where dB_t are the innovations to the price index. We assume there is a positive relation between the expected inflation and the instantaneous short interest rate, that is the correlation coefficient between Z_t and B_t is positive.

The second pillar wealth can be transformed into an annuity income, taken as a lump sum, or a combination of both. The annuity income is given by

$$Y = PR_0 f, \quad (10)$$

where PR_0 is the amount of second pillar wealth annuitized and f is the conversion rate.

3.3 Numerical method for solving the life-cycle problem

Due to the richness and complexity of the model it cannot be solved analytically hence we employ numerical techniques instead. We use the method proposed by Brandt et al. (2005) and Carroll (2006) with several extensions added by Koijen et al. (2009). Brandt et al. (2005) adopt a simulation-based method which can deal with many exogenous state variables. In our case $X_t = (R_t^f, \pi_t)$ is the relevant exogenous state variable. Wealth acts as an endogenous state variable. For this reason, following Carroll (2006), we specify a grid for wealth *after* (annuity) income, expenses due to background risk, and consumption. As a result, it is not required to do numerical rootfinding to find the optimal consumption decision.

The optimization problem is solved via dynamic programming and we proceed backwards to find the optimal investment and consumption strategy. In the last period the individual consumes all wealth available. The value function at time

T equals:

$$J_T(W_T, R_T^f, \pi_T) = \frac{W_T^{1-\gamma}}{1-\gamma}. \quad (11)$$

The value function satisfies the Bellman equation at all other points in time,

$$V_t(W_t, R_t^f, \pi_t) = \max_{w_t, C_t} \left(\frac{C_t^{1-\gamma}}{1-\gamma} + \beta p_{t+1} E_t(V_{t+1}(W_{t+1}, R_{t+1}^f, \pi_{t+1})) \right). \quad (12)$$

In each period we find the optimal asset weights by setting the first order condition equal to zero

$$E_t(C_{t+1}^{*\gamma} (R_{t+1} - R_t^f) / \Pi_{t+1}) = 0, \quad (13)$$

where C_{t+1}^* denotes the optimal real consumption level. Because we solve the optimization problem via backwards recursion we know C_{t+1}^* at time $t+1$. Furthermore we simulate the exogenous state variables for N trajectories and T time periods hence we can calculate the realizations of the Euler conditions, $C_{t+1}^{*\gamma} (R_{t+1} - R_t^f) / \Pi_{t+1}$. We regress these realizations on a polynomial expansion in the state variables to obtain an approximation of the conditional expectation of the Euler condition

$$E \left(C_{t+1}^{*\gamma} (R_{t+1} - R_t^f) / \Pi_{t+1} \right) \simeq \tilde{X}_p' \theta_h. \quad (14)$$

In addition we employ a further extension introduced in Kojien et al. (2009). They found that the regression coefficients θ_h are smooth functions of the asset weights and consequently we approximate the regression coefficients θ_h by projecting them further on polynomial expansion in the asset weights:

$$\theta_h' \simeq g(w) \psi. \quad (15)$$

The Euler condition must be set to zero to find the optimal asset weights

$$\tilde{X}_p' \psi g(w)' = 0. \quad (16)$$

The procedure to determine the optimal consumption strategy is similar to the optimal asset weights. The Euler condition for optimal consumption is determined via regressing the realizations of marginal utility on the state variables.

In this manner the optimal consumption for every trajectory, time period, and wealth grid point is determined.

3.4 Benchmark parameters

In the previous paragraphs we presented the specification of the life-cycle model. In this section we set the parameter values for the benchmark case. The time preference discount factor, β , is set equal to 0.96 and the risk aversion coefficient γ is assumed to be 5. The equity return is normally distributed with a mean annual nominal return of 8% and an annual standard deviation of 20%, which is in accordance with historical stock performance. The mean instantaneous short rate is set equal to 4%, the standard deviation to 1%, and the mean reversion parameter to 0.15. The correlation between the instantaneous short rate with the expected inflation is 0.4. The parameters on the inflation dynamics are estimated from data from the Swiss National Bank. Mean inflation is equal to 1.79%, the standard deviation of the instantaneous inflation rate is equal to 1.12%, the standard deviation of the price index equals 1.11%, and the mean reversion coefficient equals 0.165. Time ranges from $t = 1$ to time $T = 36$, which corresponds to age 65 and 100 respectively. The number of simulated paths N is equal to 1000. The survival probabilities are the current female survival probabilities in Switzerland and are obtained from the Human Mortality Database.³ We assume a certain death at age 100. The conversion rate to determine the annuity income is 7.2%.

4 Data and Descriptive Statistics

We use administrative records at the individual level from several Swiss companies with an autonomous pension funds and several large Swiss insurance companies that provide occupational pension plans for small and medium sized enterprises.

³We refer for further information to the website, www.mortality.org.

For the companies in our sample, we were given information about all employees who retired over the period 1996 to 2006. Each individual is observed only once at retirement. The main sample consists of 23,637 men and 8,432 women.

The data contains information at the individual level on the date of birth, the retirement date, annuitization decision, amount of accumulated capital stock, and conversion factor as well as company specific pension scheme information such as default and cash-out options. Since the amount of means-tested benefits depends on the *total* net wealth, information on non-pension wealth is important for our model. Because this information is not collected by the insurance companies, we use asset data from the Survey of Health, Aging and Retirement in Europe (SHARE). We focus on the data collected for Switzerland in 2003.

Table 2

Table 2 reports key statistics for the variables of interest. Early retirement, starting at age 55 as well as working beyond planned retirement is possible. However, the average retirement age is close to the statutory retirement age of 65 for men and currently 64 for women. The statutory retirement age for women was 62 before 2001, but was increased to 63 in 2001 and 64 in 2005, respectively. With regard to early retirement, the conversion rate is reduced by approximately 0.3 percent for each month, while it is raised by around 0.2 percent per month if retirement occurs after the statutory retirement age. A large fraction of the beneficiaries chose a polar option (full lump sum or full annuity). Liquid non-pension wealth (NPW) corresponds to the sum of values of on the bank accounts, government and corporate bonds, stocks, mutual funds, individual retirement accounts, contractual savings for housing, cars and life insurance policies minus financial liabilities. Illiquid NPW are defined as the sum of the values of the primary residence net of the mortgage, other real estate, and the owned share of own business. Finally, NPW is the sum of liquid and illiquid NPW.

Figure 2

Figure 2 illustrates the relationship between the pension wealth and the fraction that is taken as a lump sum for wealth levels below 700,000 CHF. The solid line represents the local linear fit between these two variables. Consistent with our prediction, the fraction of lump sum is very high for low levels of occupational pension wealth and decreases continuously for higher levels of second pillar wealth. This pattern can be viewed as informal evidence that means-tested benefits affect the annuitization decision.

5 Results

In the section we will determine the optimal fraction taken as a lump-sum via the life-cycle model and illustrate the trade-offs that retirees face. Furthermore we compare these findings with the observed annuitization decisions concerning the second pillar pension wealth of retirees. We find that we can match the actual pattern of annuitization well.

5.1 Optimal annuity demand via the life-cycle model

Whether to take a lump-sum or an annuity (or a combination) depends naturally on the consumption patterns that both options generate. To illustrate the trade off that retirees face, optimal consumption pattern are displayed in figure 3. The optimal consumption level if 100% is annuitized or if 100% is taken as a lump-sum is presented for two different wealth levels.⁴ If we focus on the graph on the left-hand side (pension wealth level of 180,000 CHF), we see that the consumption stream when the lump-sum is taken is much higher the first 15 years of retirement. After that the consumption is a bit lower compared to the full annuitization case, about 1,000 CHF lower. Because the annuity income that can be generated via

⁴Note that the optimal consumption strategy is to consume the entire annuity income, because in this illustrative example we assume that the only risk that individuals face is longevity risk.

annuitizing all wealth (37,000), differs only to a small extent from the guaranteed income (36,000), it is optimal to take the lump sum, and consume large amounts in the first retirement years. And subsequently apply for means-tested benefits in case the individual is still alive.

If we look at the consumption pattern if the wealth level is 250,000 CHF, we see that when the lump sum is taken the consumption level is only higher for a small amount of years, compared to the full annuitization case. Furthermore the difference between the annuity income (42,000 CHF) and the guaranteed level due to means-tested benefits (36,000 CHF) is much higher for this wealth level. Hence it is optimal to annuity everything.

Figure 3

The previous example was mainly for illustrative purposes, and simplified largely since inflation, equity, taxes, and non-pension wealth was excluded. In the next paragraphs inflation, equity, and taxes are included and we will determine the optimal annuity demand for individuals with different levels of non-pension wealth. The annuity demand depends not only on the means-tested benefits, but can also vary due to other factors such as the amount of non-pension wealth. In table 3 we display the optimal annuity demand for varying pension wealth levels and liquid non-pension wealth. We assume that the non-liquid non-pension wealth (NPW), such as housing, is below 25,000 CHF. For higher non-liquid NPW levels, the means-tested benefits would be reduced. Note that it is important to make a distinction between liquid NPW and non-liquid NPW, because liquid NPW can be drawn-down and afterwards a retiree can receive means-tested benefits. While non-liquid NPW, such as housing, can in most instances not be liquidated easily. Hence the implications for optimal annuity demand depend on whether the NPW is liquid or non-liquid.

First we focus on the optimal annuity demand for an agent without any non-pension wealth, which is displayed in the second column of table 3. In the table

can be seen that for pension wealth levels below 500,000 CHF, it is optimal to take the lump-sum and not annuitize. The reason is that for low pension wealth levels, means-tested benefits create an incentive to take the lump sum, draw it down, and apply for means-tested benefits. On the one hand annuitization is advantageous, because the agent receives the mortality credit, which generates additional wealth. On the other hand, the means-tested benefits induces the retiree to take the lump sum.

Table 3

When we compare the different columns, we see that the optimal annuity demand, increases with the amount of liquid non-pension wealth. For a retiree with 400,000 CHF of pension wealth and 100,000 CHF of liquid non-pension wealth it is optimal to annuitize 60%, while with a liquid non-pension wealth of 400,000 CHF, full annuitization is optimal. The intuition behind this finding is that individuals with higher liquid non-pension wealth, also have to draw down this additional wealth, to be able to apply for means-tested benefits. This would lead to an even more non-smooth consumption pattern in expectation (extremely high consumption in early years, much lower consumption later), which generates a welfare loss.

5.2 Comparing the optimal annuity demand with observed decisions

In the data description section we show that empirically the fraction taken as a lump-sum depends negatively on the amount of pension wealth. Individuals with low wealth levels are more likely to take the lump sum, while individuals with higher levels tend to annuitize (a part) of their pension wealth. We hypothesize that means-tested benefits reduce the annuity demand in Switzerland and can explain the annuitization pattern found. In figure 4 we compare the empirical

annuitization pattern with the optimal annuitization pattern determined via the life cycle model. The solid line is the fitted regression line of the empirically observed fraction taken as a lump-sum and the dashed-dotted line are the findings from the full life-cycle model including means-tested benefits. We see that both lines are very close; the life cycle model can replicate the annuitization patterns in Switzerland well.

Figure 4

It is important to note that the non-parametric regression line illustrates the relationship between pension wealth and the fraction taken as a lump-sum, on average. The tendency of individuals to take the lump-sum decreases if the pension wealth increases. However this does not mean that for instance the representative agent with a pension wealth of 400,000 CHF, takes 30% of his pension wealth as a lump-sum. Whether to take a lump-sum or annuity is to a certain degree more an "all-or-nothing" decision; an individual either annuitizes everything or takes everything as a lump-sum. Which is optimal depends on other characteristics; the amount of liquid non-pension wealth and illiquid non-pension wealth an individual has. We assumed that both are independent of each other and independent of pension wealth. The optimal annuity demand for varying levels of liquid and illiquid non-pension wealth is determined via the life-cycle model. Subsequently the distribution of the amount of liquid and illiquid non-pension wealth is estimated from the data in SHARE and used to determine the average optimal annuity demand. This is exactly what is shown in the dashed-dotted line in figure 4.

Furthermore we test the effect of means-tested benefits on optimal annuity demand, by excluding the means-tested benefits from the model. The results can be seen in figure 4, by comparing the findings from the model with MTB (dashed-dotted line) with the findings from the model without MTB (dotted line). The

fraction taken as a lump-sum increases substantially due to means-tested benefits; for a wealth level of 200,000 CHF this fraction increases by more than 35%.

Note that even without means-tested benefits, full annuitization is still not optimal. There are three reasons for this; (1) to receive the equity premium, (2) the II pillar annuity income is nominal, and (3) the differential tax treatment between annuity income and taking the lump-sum. To disentangle these 3 reasons, we systematically exclude or alter certain parts of the life-cycle model (We still need to do this). The third reason is the differential tax treatment between taking the lump-sum and annuitizing, which is shown in table 4. Both the annuity tax and the lump-sum tax increase with pension wealth. The fact that both taxes increase with pension wealth, creates an incentive to divide the pension wealth between the annuity and lump-sum to lower the overall amount of taxes payed.

Table 4

6 Conclusions

In this paper we examine the effect of means-tested benefits in old age on optimal annuitization decisions of individuals at retirement. These means-tested benefits, which are typically set up as poverty protection in old age, act like an additional insurance against the financial consequences of longevity. They may thus induce retirees to take the lump sum, draw it down and consume out of it, and subsequently apply for means-tested benefits when the lump sum is depleted. To quantify the impact of the incentive on the cash-out decision of individual, we construct a life-cycle model which is then calibrated to Switzerland, a country for which the incentive is particularly strong due to a combination of a high income floor and sizeable levels of pension wealth that can be cashed out.

The results from our life-cycle model indeed demonstrate that means-tested benefits substantially decrease the optimal annuity demand. Not surprisingly the

effect is more pronounced for low wealth levels. At the two extreme choices (no vs full annuitization), the individual compares the optimal consumption stream when all wealth is annuitized, with the consumption stream if he takes the lump sum. If the pension wealth level is low the annuity income generated does not differ much (or may even be smaller) than the means-tested benefits. Taking the lump-sum, consuming out of this, and then applying for means-tested benefits generates a higher consumption level. For high pension-wealth levels, on the other hand, the annuity income is much higher than the means-tested benefits. In that case the value of the longevity insurance implied by the annuity (also known as mortality credit) dominates the incentives of the means test.

In a second step we compare the results from the model with observed annuitization behavior. Our data consists of 32,000 individual retirement decisions provided by a number of Swiss pension funds. The simulated model can explain the observed annuitization pattern in Switzerland well. The annuity demand from the model not only decreases with pension wealth, but also generates a pattern that is remarkably close to the data both in terms of level and the correlation with wealth.

Although we derived the quantitative impact of means-tested benefits on the decision to annuitize for a single country, our results have further-reaching implications. A partial shift from first to second pillar income provision in old age, as discussed in many countries, has to be evaluated carefully with respect to incentives that are created when allowing individuals to cash out second pillar wealth. A generous protection against poverty in old age may generate a strong tendency to quickly deplete pension wealth and apply for means-tested benefits — and thus high costs for the welfare system.

References

- Brandt, M.W., A. Goyal, P. Santa-Clara, and J.R. Strond (2005): A Simulation Approach to Dynamic Portfolio Choice with an Application to Learning About Return Predictability, *The Review of Financial Studies*, Vol. 18, No. 3, pp. 831–873.
- Brown, Jeffery R. (2007a): Rational and Behavioral Perspectives on the Role of Annuities in Retirement Planning, *NBER Working Paper 13537*.
- Brown, Jeffery R., Jeffrey R. Kling, Sendhil Mullainathan, and Marian V. Wrobel (2008): Why don't People Insure Late Life Consumption? A Framing Explanation of the Under-Annuitization Puzzle, *American Economic Review Papers and Proceedings*, Vol. 98, No. 2, pp. 304–309.
- Brown, Jeffrey R., Thomas Davidoff, and Peter A. Diamond (2005): Annuities and Individual Welfare, *The American Economic Review*, Vol. 95, No. 5, pp. 1573–1590.
- Brown, J.R. (2001): Private Pensions, Mortality Risk, and the Decisions to Annuitize, *Journal of Public Economics*, Vol. 82, No. 1, pp. 29–62.
- Brown, J.R. (2007b): Rational and Behavioral Perspectives on the Role of Annuities in Retirement Planning. NBER Working paper.
- Brown, J.R. and J.M. Poterba (2000): Joint Life Annuities and Annuity Demand by Married Couples, *The Journal of Risk and Insurance*, Vol. 67, No. 4, pp. 527–553.
- Bütler, Monika, Stefan Staubli, and Maria Grazia Zito (2009): The Role of the Annuity's Value on the Decision (Not) to Annuitize: Evidence from a Large Policy Change, *mimeo*.

- Bütler, Monika and Federica Teppa (2007): The Choice Between an Annuity and a Lump-Sum: Results from Swiss Pension Funds, *Journal of Public Economics*, Vol. 91, pp. 1944–1966.
- Carroll, C.D. (2006): The Method of Endogenous Gridpoints for Solving Dynamic Stochastic Optimization Problems, *Economics Letters*, Vol. 91, No. 3, pp. 312–320.
- Dushi, I. and A. Webb (2004): Household Annuity Decisions: Simulations and Empirical Analyses, *Journal of Pension Economics and Finance*, Vol. 3, No. 2, pp. 109–143.
- Hu, W. and J.S. Scott (2007): Behavioral Obstacles to the Annuity Market. Working paper.
- Inkmann, J., P. Lopes, and A. Michaelides (2008): How Deep is the Annuity Market Participation Puzzle? Working paper.
- Koijen, R.S.J., T.E. Nijman, and B.J.M. Werker (2009): When Can Life-cycle Investors Benefit from Time-Varying Bond Risk Premia?, *Forthcoming The Review of Financial Studies*.
- Mitchell, Olivia, James Poterba, Mark Warshawsky, and Jeffery R. Brown (1999): New Evidence on the Money's Worth of Individual Annuities, *American Economic Review*, Vol. 89, No. 5, pp. 1299–1318.
- Peijnenburg, K., T. Nijman, and B.J.M. Werker (2009): Optimal Annuity Decisions with Background Risk and Equity Exposure During Retirement. Working paper.
- Yaari, Menahem (1965): Uncertain Lifetime, Life Insurance, and the Theory of the Consumer, *The Review of Economic Studies*, Vol. 32, No. 2, pp. 137–150.

Table 1: Average expenditures, income and means-tested benefits of retired recipients in 2008

Components	Single	Married
<u>Applicable expenditures</u>		
Cost-of-living allowance	18,144	27,216
Rent payment	9,852	11,664
Health insurance premium	3,996	7,956
Interest on mortgage	360	1,080
Other expenses	84	144
Total	32,436	48,060
<u>Applicable income</u>		
First pillar benefits	19,944	29,136
Other pension benefits	1,524	2,652
Wage income	84	1,248
Own rent	504	1,212
Investment income	288	492
Wealth consumption	636	804
Other income	180	108
Total	23,160	35,652
Means-tested benefits	9,612	13,812
Net wealth	20,140	30,668
Wealth (after deduction)	6,411	8,290

Note: Means-tested benefits correspond to the difference between applicable expenditures and income but cover at least the health insurance premium.

Table 2: Summary statistics

Variable	Mean	Median	S.D.	Min	Max
Age at retirement					
Men	63.9	65.0	1.9	55.0	70.7
Women	62.0	62.1	1.4	55.0	70.0
Conversion rate					
Mandatory Part	6.949	7.187	0.406	5.210	8.070
Supermandatory Part	6.756	7.055	0.547	4.737	8.043
Wealth					
Pension wealth	256,080	188,018	238,817	93	3,669,914
NPW (SHARE, N=175)	386,123	292,088	367,050	-53,594	1,499,153
Liquid NPW (SHARE, N=175)	168,190	80,268	247,343	-245,125	1,303,611
Illiquid NPW (SHARE, N=175)	217,933	143,397	256,581	-86,869	1,271,021
Share Annuity	0.479	0	0.500	0	1
Share Lump Sum	0.489	0	0.500	0	1
Share Mixed	0.032	0	0.176	0	1
Observations	32,069				

Notes: NPW denotes non-pension wealth. Summary statistics for NPW, liquid NPW and illiquid NPW are based on the SHARE data for Switzerland in 2003. NPW is the sum of liquid NPW and illiquid NPW.

Table 3: Optimal fraction of the pension wealth taken as a lump-sum

pension wealth	liquid non-pension wealth			
	0	100,000	200,000	400,000
100,000	0	0	0	80
200,000	0	0	0	100
300,000	0	0	70	100
400,000	0	60	80	100
500,000	35	70	85	100
600,000	70	80	85	100

Notes: The optimal fraction is determined for various levels of pension wealth and liquid non-pension wealth. The non-liquid non-pension wealth is assumed to be below 25,000 CHF.

Table 4: Tax rates for the lump-sum and the annuity income

Pension Wealth	100,000	200,000	300,000	400,000	500,000	600,000
Lump-sum	4.4	4.8	6.6	8.4	10.1	11.7
Annuity	6.8	8.1	9.3	10.5	11.7	12.8

Notes: On the lump sum, taxes are payed once. The tax rate on the annuity is for every payout of the annuity. When determining the tax rate we assume that the individual has a I pillar pension income of 24,000 CHF annually.

Figure 1: Fraction of retired and disabled individuals receiving means-tested benefits

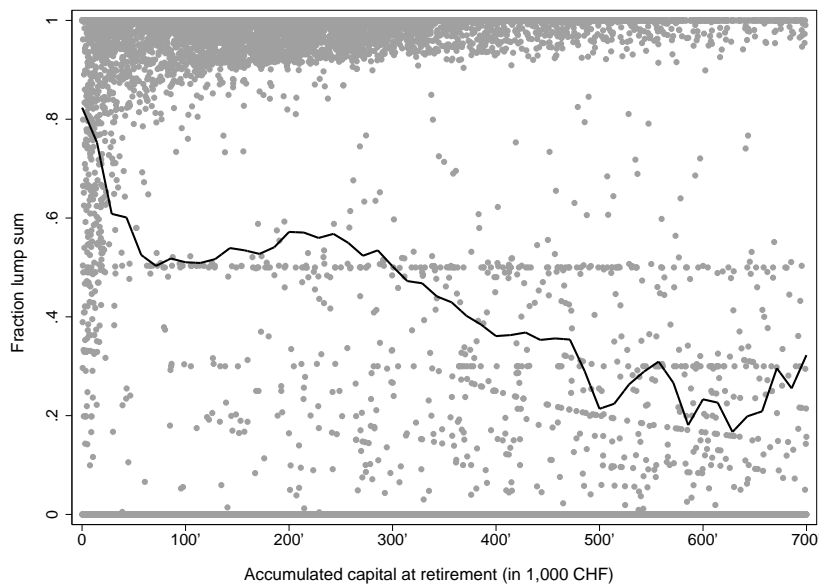
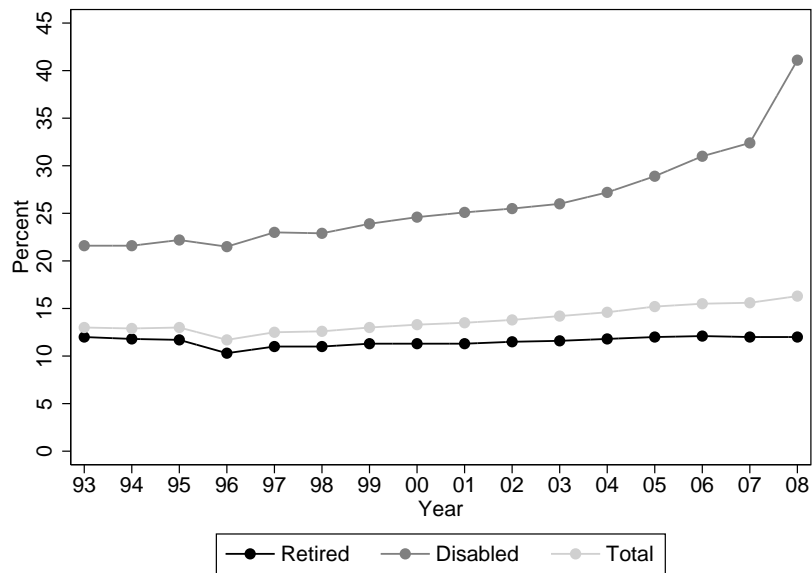
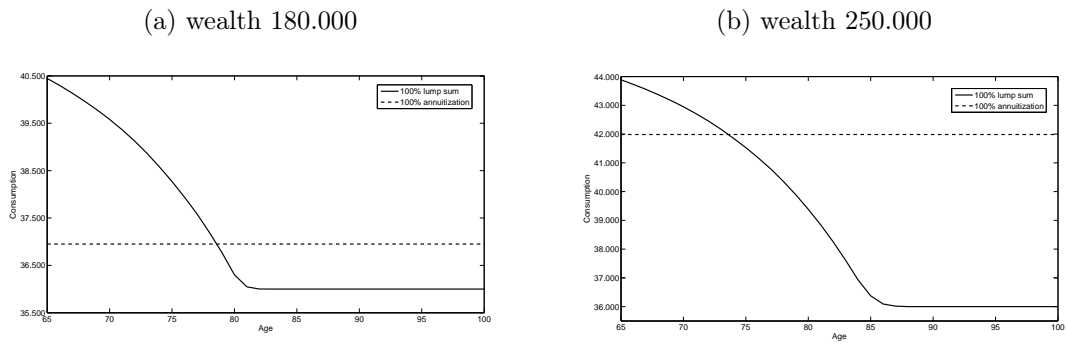


Figure 2: Cash-out decision and accumulated pension wealth in the second pillar

Figure 3: Optimal consumption pattern for an individual with 180,000 CHF and 250,000 CHF of pension wealth



The figure displays the consumption pattern if an individual annuitized everything or took everything as a lump sum. Equity, inflation, and taxes are excluded from the model, only longevity risk is included in the model. If the wealth level is 180,000 CHF it is optimal to choose the consumption stream from taking all wealth as a lump-sum and if the wealth level is 250,000 CHF the consumption stream from full annuitization is preferred. The guaranteed income is equal to 36,000 CHF.

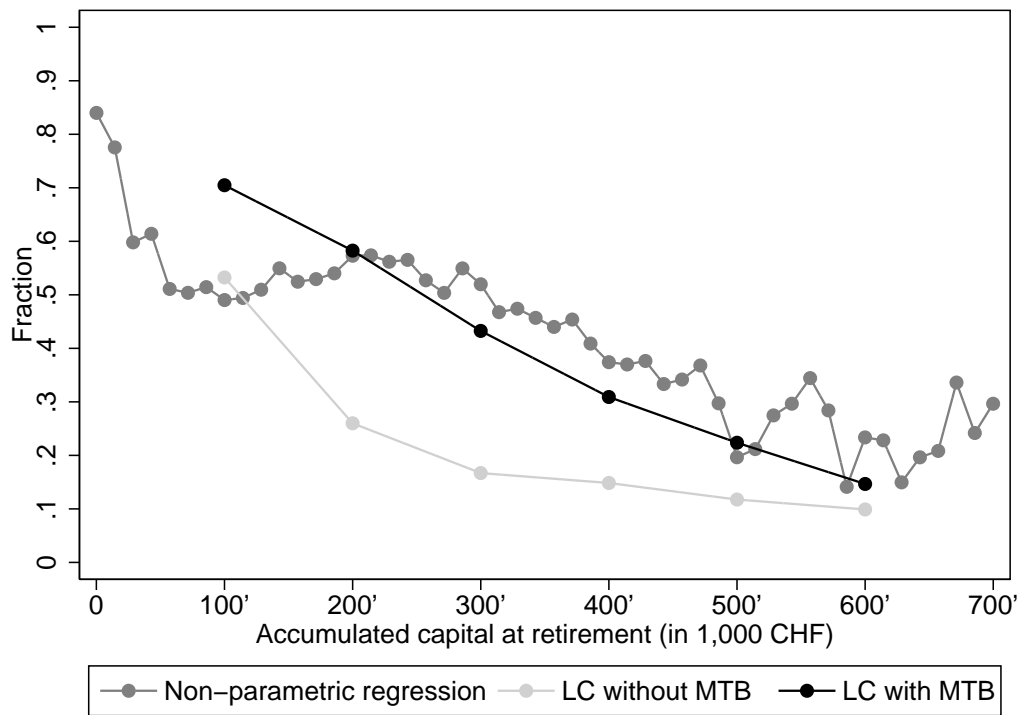


Figure 4: Comparison optimal fraction lump-sum and actual fraction taken as a lump-sum