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# The Role of the Annuity's Value on the Decision (Not) to Annuitize: Evidence from a Large Policy Change<sup>1</sup>

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## **Abstract**

This paper presents new evidence on how the annuitization decision is affected by changes in the annuity's value. We take advantage of an unprecedented change in policy in a number of Swiss occupational pension plans: The 20 percent reduction in the rate at which retirement capital is translated into a life-long annuity implied a net present value loss of approximately 20'000 SFR (18'000 US\$) for the average affected retiree. To estimate the impact of the policy change we use administrative data from companies who did and one big company who did not change its price. Correcting for anticipation effects, we show that there was an approximately 14 percentage point decrease in the share of men choosing to annuitize their savings.

## **Keywords**

Annuity Puzzle, Occupational Pension, Policy Change

## **JEL Classification**

H31, J22, H53, D13

# 1 Introduction

Economic theory predicts that most people should annuitize their pension wealth. But 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 preexisting 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”<sup>1</sup>, but it has failed to present a convincing general explanation. Adverse selection, administrative loads, the existence of first-pillar annuities, intra-family risk-sharing, bequest motives,<sup>2</sup> and a desire to insure against expenditure spikes 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 not fully rational behavior.<sup>3</sup>

Given the very low level of voluntary annuitization observed in the real world, the puzzle’s solution is even more difficult due to the lack of suitable data. Empirical evidence that clearly identifies the determinants of the cash-out decision at

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<sup>1</sup>See Brown (2007), for an excellent review of this literature and Brown et al. (2005) for a formal analysis of the many obstacles that may prevent a full annuitization of pension wealth.

<sup>2</sup>In a recent working paper Lockwood (2009) presents microsimulations that demonstrate that the bequest motive might be able to explain low annuitization rates.

<sup>3</sup>See, 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.

retirement are thus scarce. Notable exceptions are Hurd et al. (1998) on pension cash-outs when changing jobs or retiring, Brown (2001) analyzing ex ante intentions to annuitize, and Bütler and Teppa (2007) on the annuitization decision in the context of the mandatory Swiss occupational pension scheme.

This paper analyzes the annuitization decision at retirement taking advantage of an unprecedented and sudden change in conversion rates recently implemented in a number of Swiss pension plans. In 2004, two of the four large insurance companies (covering approximately 10% of the work force) reduced their conversion rates by almost 20%. These conversion rates are used to calculate a life-long annuity based on the accumulated retirement capital in the super-mandatory part of the second pillar. Super-mandatory pensions represent a considerable part of retirement income in Switzerland, providing approximately 20 percent of total retirement income for an average retiree. Reducing the conversion rate as was done here, is equivalent to a loss of 20'000 SFR ( $\approx$  18'000 US\$) in present value for an average individual.

To the best of our knowledge, our paper is the first to analyze such a large and exogenous variation in the annuity price. The annuitization decision is analyzed using the administrative records of Swiss insurance companies. As a treatment group we use data provided by companies that reduced the conversion rate in one big step. A large insurance company that reduced the conversion rate later and more gradually serves as a control group. Although the latter is not perfect (in the sense that the underlying population differs with respect to pension wealth and annuitization behavior), it serves to demonstrate that the change in the rate of annuitization is not simply caused by a time trend.

The data includes approximately 15'000 individual annuitization decisions made between the years of 2001 and 2005, and provides reliable and complete information on pension plan details. Our setup evades the issue of individual self-selection into firms/plans based on unobserved characteristics, as well as the problem of omitted variables, which would impede the identification of the price

effect.

A fraction of the individuals who had planned to retire after the policy change obviously anticipated the change and retired earlier in order to profit from the higher annuity. Due to this anticipation effect, a simple comparison of the cash-out behavior before and after the policy change is likely to overestimate the effect of the policy change. In order to address this problem of potential anticipation we make use of the fact that it is more beneficial to retire earlier and benefit from the pre-reform conditions for individuals with a high capital stock who are close to the statutory retirement date at the time of the policy change. This allows us to construct a good proxy for the likelihood of an individual anticipating the change in policy by retiring early. Once anticipation is accounted for, we observe a constant annuitization rate before the policy change and an approximately 14 percentage point drop in annuitization in the year after the change. The annuitization rate also remains constant in the periods preceding the reform and following the change, respectively, when the anticipation component is filtered out.

The paper proceeds as follows. Section 2 describes the key features of the Swiss social security system and the change in policy. Section 3 describes the data set and discusses the macroeconomic environment. Section 4 outlines the theoretical and empirical strategy to analyze the effects of the policy change. Section 5 presents the results and the conclusion is presented in section 6.

## 2 The Swiss social security system and pension plan details

### 2.1 The importance of the second pillar

The core of Switzerland's pension system are the more or less equally important first and second pillars.<sup>4</sup> 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 to a limited degree on the average earned income. The statutory retirement age is 65 for men and 64 for women. At the earliest men may claim first pillar benefits at 63 and women at 62 (at actuarially fair reductions in pension benefits).<sup>5</sup> For the case in which total income is not enough to cover basic needs in old age, means-tested supplemental benefits may also be claimed as part of the first pillar. These additional benefits usually result in an income that is above the poverty threshold.

The second pillar is an employer-based, fully funded occupational pension scheme and is mandatory for all employees whose annual income exceeds a specified minimum. In 2004 89.4 percent of working men and 71.1 percent of working women were involved in an occupational pension plan, which corresponds to 81.2 percent of the total workforce. An employer can choose between different organizational structures for its occupational pension plan. These range from setting up a completely autonomous pension fund, which covers all risks to outsourcing the scheme entirely to an insurance company. The latter is relatively common particularly for small and medium sized companies.

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<sup>4</sup>A detailed description of all of the characteristics of the Swiss social security system can be found in Queisser and Vittas (2000) (especially concerning institutional details), and Bütler (2004) (for the second pillar).

<sup>5</sup>Retirement at 65/64 is not mandatory by law, but rather the age of 65 for men or 64 for women is the condition of eligibility for claiming public pension benefits. Most labor contracts specify a retirement age that coincides with the age of eligibility.



The main goal of the occupational pension system is to maintain pre-retirement income in addition to benefits from the first pillar. It insures income above that level that is covered by the first pillar.<sup>6</sup> Most pension funds aim at a total replacement rate of approximately 50-60 percent of insured income, including income from the first pillar. The net replacement rate after taxes often amounts to 70-80 percent for an uninterrupted career also for higher categories of income, and can reach 100 percent for beneficiaries with dependent children.

The insured income above the lower threshold and below the upper threshold<sup>7</sup> is called the *mandatory component*, and the income above the upper threshold is called the *super-mandatory* component of the second pillar. Pension insurers are required by law to insure the mandatory share. They are free to provide insurance for the super-mandatory share and they mostly do for two reasons. First, the second pillar is thought of as an important attribute in attracting a well-educated workforce to Switzerland's tight labor market. Second, both mandatory and super-mandatory pension components enjoy a favorable tax treatment.

The mandatory part of the second pillar is subject to stringent regulation with respect to minimum contribution rates, minimum interest rates and the rate at which the accumulated pension wealth is translated into an annuity. Although most pension plans are set up on a defined contribution base, the income guarantees (minimum accrual and interest rates, conversion factor) mandated by law for the mandatory part make the defined benefit and contribution schemes in practice very similar. The federal law puts very few restrictions on the contract conditions offered by the insurance companies in the super-mandatory part. The minimum interest rate in the super-mandatory part, which is set by the pension

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<sup>6</sup>In 2004 the threshold was approximately 20'000 SFR ( $\approx$  US\$ 18'000). The threshold explains the lower rate of coverage for women, who often work part-time and thus on average earn less.

<sup>7</sup>The upper threshold is equal to three times the yearly maximum single first pillar pension (i.e. 75'960 SFR or \$65'000 in 2004).

fund, is normally lower than the minimum interest rate in the mandatory part and can be adjusted according to fund performance.

The accrued capital is fully transferable when the individual changes employers. By law, when an employee goes from one company to another 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 lifetime and is a good proxy for lifetime income. It is important to note that it is not possible for individuals to take their funds and buy an annuity at another insurance company within the regulated second pillar. It is legally possible, however, to withdraw the funds and buy an annuity in the unregulated market. As conversion rates in unregulated markets have been well below the adjusted conversion rates in the second pillar for many years, such a strategy would not have been optimal.

## 2.2 Options to withdrawal of the Swiss second pillar

The accumulated 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 there is a cash-out limit equal to 50 or 25 percent (the legal minimum) of accumulated capital. Depending on insurer regulations, between three months and three years prior to the effective withdrawal date, the individual must declare his choice. Many pension insurers define a default option for those beneficiaries not making 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*  $\gamma$ :  $B = \gamma K$ . 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 7.1 percent but was equal to

7.2 percent until 2004 and 7.15 percent in 2005.<sup>8</sup> In the super-mandatory part, pension insurers are free to set the conversion factor. Pension funds are requested to index pension benefits to inflation if the financial situation of the fund allows for this. At present, very few funds can index pensions to inflation. This is mainly due to the great liabilities created by the very high conversion factor in the mandatory part.

A majority of retirees covered by Swiss occupational pension plans choose the annuity, despite the first pillar already providing an annuity stream covering subsistence needs in old age and lump sums profiting from preferential tax treatment in many cantons (the Swiss states). Bütler and Teppa (2007) analyze the annuitization decision at retirement, making use of variations in the annuity's value caused by differences in company pension plans. They show that the annuity's value is the most important determinant in the cash-out decision, but that there are also great differences between companies. Individuals often choose the standard option offered by the company or seem to follow their peers. Small stocks of old age capital are much more likely to be withdrawn as lump sums. This is probably a consequence of the fact that for small amounts of capital, it may be optimal to spend all resources in order to qualify for means-tested social assistance. As in other studies, Bütler and Teppa (2007) find mixed evidence for the existence of a bequest motive. This is largely due to the limited amount of information they had on individual backgrounds in their data.<sup>9</sup>

In light of some recent behavioral explanations for the low demand for annuities (such as Brown et al. (2008)), the unusually high degree of annuitization in Switzerland may be attributed to the prevailing framing in the scheme: By law,

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<sup>8</sup>The conversion rate will be lowered continuously to 6.8 percent in 2015.

<sup>9</sup>Bütler and Teppa (2007) report that divorced and widowed men (who are much more likely to have children) have higher propensity to cash-out than singles at the margin, although the former have a higher remarriage rate and should therefore choose the annuity more often. This finding may be interpreted as an indicator for the existence of a bequest motive.

pension insurers must provide each year all of their insurees with a statement in which not only the accumulated capital to date is reported, but also the expected anticipated annuity stream (based on an extrapolation of current earnings and interest rates). Although the accumulated capital is reported on the statement, the space dedicated to annuity streams (including survivor benefits and disability benefits) is much bigger. The statement thus comes close to what Brown et al. (2008) call a consumption frame.

## 3 The Policy Change and Data

### 3.1 The macroeconomic environment of the policy change

Until the end of 2003 conversion rates of the mandatory and super-mandatory parts coincided with the statutory proposed conversion rates for most pension providers. Due to longer life expectancy, low interest rates and plummeting yields in stock markets since 2000, more and more pension funds, in particular life insurers, were having trouble fulfilling minimum legal requirements as defined by the Law on Occupational Pension Schemes.

Despite these looming financial problems, there was virtually no media coverage of potential measures (such as a drastic reduction in the conversion rate). In an extensive media analysis, we only found three newspaper articles that mentioned the possibility of such a policy change. In all three contributions the reference to a lower conversion rate was not at the center of the article, but was mentioned as a side issue within the context of a report on a particular insurance company or pension sponsor.

Mid-2003 four large insurance companies announced a reduction in the conversion rate applied to the super-mandatory component of the occupational pension scheme. The price change had been on the insurance companies' agenda for some time before it became public. The increase in longevity and the fall in interest

rates had made the previous conversion rates unsustainable. Reserves accumulated in times of much higher interest rates had been run down and looming deficits called for quick action. For a man retiring at the age of 65 the conversion rate was reduced from 7.2 percent to 5.835 percent and for a woman retiring at age 62 from 7.2 percent to 5.454 percent.<sup>10</sup>

After the announcement end of June 2003, the policy change was extensively discussed in the media. The so-called "Winterthur Modell" (the name of the insurance company announcing the changes first) was heavily and publically criticized (keyword "Rentenklau" = benefit theft). Many were bewildered by the fact that all four insurance companies asked the Federal Office of Private Insurance for permission to use exactly the same conversion rates. The accusation of an illegal agreement and the demand for authorities to investigate and intervene followed. The insurance companies justified the almost identical size and pattern of the price changes by the fact that they used the same mortality table for their calculations.

The Swiss Competition Commission came to the conclusion that applying the same conversion rate represents an illegal agreement as defined by Swiss anti-trust law. However, in their view the resulting analysis of the actual situation between competitors did not produce any evidence of a substantial constraint on competition between life insurers. The Swiss Competition Commission considered the presence of different insurance models and the fact that 50-60% of the insured reaching the statutory age of retirement chose the capital option and not the annuity an indication that the agreement could not substantially affect competition.

One potential way for the employers to escape the price change was to change the insurance company, providing the outsourced pension plan. However, there

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<sup>10</sup>The insurance companies justified the difference in conversion rates between men and women by a lower age of female retirement in 2004. By law pension providers are not allowed to differentiate payout rates according to gender or marital status.

are several factors, which to various degrees make a change in pension provider difficult for employers. First of all, cancelling a contract within the first five years entails paying buy-back costs for interest risks. Secondly, there are often substantial costs involved in changing pension providers. Most importantly, the new coverage may presuppose an expensive increase in the amount of coverage capital required for those already pensioned.

### **3.2 The individual perspective of the policy change**

From the individual point of view, the price change came as a surprise and can thus be viewed as exogenous for a number of reasons. First, prior to the announcement a public discussion of a potential adjustment of the conversion rate was virtually nonexistent. Most likely this was due to the fact that a reduction of the conversion rate, albeit very small and implemented over a period of more than 10 years, was part of the first revision of the Law on Occupational Pension Schemes. Before the policy change the media focused exclusively on the reduction of the minimum interest rate. The public seemingly took this measure as being sufficient, a conclusion that is supported by most of the pension fund managers we contacted.

Second, apart from anticipating retirement individuals could do nothing to avoid the price change. The decision which insurance company to buy the pension plan from, lies exclusively in the hands of the employer. Moreover, the reduction was announced at very short notice. Only individuals who were close enough to the statutory age of retirement had the option to anticipate the benefit of early retirement, thereby profiting from higher conversion rates.

Third and in contrast to most other countries, the accumulation and payout phase are in the hands of a single pension provider. While it is theoretically possible for an individual to cash out retirement balances and buy an annuity contract with another insurance company, the latter would be outside the regu-

lated second pillar pension system and would lead to significant money losses for the individual in almost all circumstances. At the time of the policy change, the annuity contracts sold in the unregulated market involved conversion rates that were even below the new low conversion factors.

### 3.3 Taking the policy change to the data

Based on the reasons outlined above, the policy change can be seen as exogenous to the individual. Nonetheless it is difficult to quantify the impact of the price change with time series data alone. Our main strategy to isolate the price impact is to use data from companies that did not change their prices over this period. This allows us to examine whether annuitization rates had the tendency to be similar at the two types of companies prior to the price change. Ideally the control group would consist of insurance companies that offer similar conditions to similar employers. Unfortunately, the four companies that would satisfy these criteria came up with almost identical adjustments as explained before.

We do have data from an insurance company that followed another policy and reduced the conversion rate for its existing firms covered, much more slowly and only starting in 2005 (instead of 2004). The main caveat is that the company's clientele differs in terms of average capital and annuitization behavior as will be explained below. But although the control group is not perfect, it helps to support the validity of the exogeneity claim.

With an imperfect control group to account for potential time variations in the demand for annuities, the concern remains that other institutional and macroeconomic factors relevant for the annuitization decision might have changed about the same time as the change in policy did. However, we could not identify any other (unobserved) change that might have influenced annuitization demand: There were changes neither in mortality, nor changes in the macroeconomic environment. There were no other policy changes, such as tax treatment of payout

options that might have impacted the desirability of payout options differentially. Moreover, the insurance companies in our sample did not report any other changes to retirement plans for men during this period.

We control for macroeconomic factors that might have affected the annuitization decision. In the final analysis interest rates are the only macroeconomic variables we kept. Other indicators such as the unemployment rate varied very little over the period of analysis or were not available at monthly frequencies. If people expect future interest rates to rise, investment opportunities yield a higher payoff and hence the lump sum option becomes more attractive.<sup>11</sup> We construct an actuarial factor to capture changes in the yield curve: The variable  $PV(\text{income})$ , computed for each month in our dataset, corresponds to the mortality adjusted present value of an annual income stream for a 65 year old single man until the end of his life. This allows us to capture the trade-off between a fixed annuity income stream and a changing interest income stream from alternative assets.<sup>12</sup>

The two panels in Figure 1 present the monthly share of individual taking a lump sum (left scale) together with the companies' conversion rate at the statutory age of retirement, 65, in the super-mandatory part (right scale). The first panel presents the statutory conversion factor, the second panel shows a hypothetical market conversion rate at age 65 based on the actuarial factor  $PV(\text{income})$ . The latter therefore is proportional to the money's worth of the annuity taking

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<sup>11</sup>Milevsky (1998) argues that one of the reasons for the weak demand for voluntary annuities is the individual draw towards investing in risky assets in order to receive higher expected returns.

<sup>12</sup>We use nominal yields on Treasury bonds with maturities of 1, 2, 3, 4, 5, 7, 8, 10, 20 and 30 years reported by the Swiss National Bank (SNB (2007)) are used to calculate the expected nominal short rate in each future period. Data on mortality rates are based on the mortality tables created by the Swiss Federal Statistical Office (Kohli (2005)) over the period 1998-2003. We have also experimented with other summary measures for potential investment yields. However, the estimation results were not sensitive to the yield measure employed.



into account movements in interest rates. The conversion rate in the super-mandatory part fell from 7.2 percent in December 2003 to 5.845 percent in January 2004 for the treatment group. For the control group, the conversion rate was reduced much less in January 2005. Over the same period the fraction of individuals taking the full or partial lump sum increased from 46.2 percent to 84.7 percent. From mid-2004 to mid-2005 interest rates fell by almost one percent on average, leading to an increase in the hypothetical market conversion rate relative to the companies' conversion rate.

### 3.4 Data

Our data set consists of administrative records of individuals covered by occupational pension plans provided by large Swiss insurance companies. The private firms which outsource their second pillars to these insurance companies are typically small to medium sized enterprises. They are drawn from all sectors of the economy. The sample is restricted to defined contribution (DC) plans. The data is a repeated cross-section, each individual is observed only once at retirement. For the companies in our sample, we were given information about all employees who retired between 2001 to 2005. We use the records for the years 2001 to 2003 as the “before” period and those for 2004 and 2005 as the “after” period.

The treatment group comprises insurance companies that reduced the conversion factor in one big step at the beginning of 2004. The control group is one large insurance company that adopted a more continuous strategy. More precisely, at the beginning of 2005 the conversion rate for men retiring at age 65 was decreased from 7.2 to 6.8 percent, followed by further reductions to 6.4 percent in 2006.

In the analysis we focus on men for two reasons. First, the retirement age for women was raised twice over the period of interest (in 2001 from 62 to 63 and in 2005 from 63 to 64). Second, women generally have a much lower amount of

capital stock in the super-mandatory part and are thus affected much less by the decrease in the annuity's value. We also exclude from our sample 39 individuals with a total capital stock of more than 1'500'000 SFR. Men with a higher capital stock are likely to be covered by supplementary insurance for managers. The chosen threshold corresponds to approximately four times the average second pillar capital stock at retirement as calculated in Bütler and Teppa (2007). We also drop 285 individuals who retired before reaching the age of 60. Retirement before age 60 is very unusual for the companies in our sample and is often an indication of poor health or a difficult employment situation. The final sample thus consists of 15,312 men, of which 5'855 men are in the treatment group and 9,457 in the control group.

For each individual we have information on their date of birth, retirement date, annuitization decision, amount of accumulated capital stock, name of employer, earnings in the last year before retirement, as well as the individual specific conversion factor of the mandatory and super-mandatory amounts. For individuals in the control group and individuals in the treatment group retiring before 2004, we only know their total capital stock, but not how it is split up between the mandatory and super-mandatory parts. The insurance companies do not collect any information on non-pension wealth, marital status, education, health, occupation, or other indicators of socioeconomic status, even though such factors are likely to be related to the risk of mortality. Nonetheless, we have no reason to believe that these factors differ in a significant way from one year to the next.

It should be noted that the data is not representative for Swiss second pillar beneficiaries. The individuals in the sample are on average poorer as measured by their accumulated pension wealth, retire approximately 2 years later and choose to cash-out much more often. These statistics mirror the fact that insurance companies in general provide second pillar plans for smaller firms with a less educated and lower paid workforce.<sup>13</sup>

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<sup>13</sup>Unlike many other countries, well educated and high income workers in Switzerland tend

Table 1 provides summary statistics for the most important variables in our data set. Early retirement, starting at age 55 in the treatment and 57 in the control group, as well as working beyond planned retirement is possible. However, the average retirement age is close to the statutory retirement age of 65 and the majority retires at that age, as shown in the last two rows of Table 1. With regard to early retirement, for both companies 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 age of retirement.

At retirement the individual can choose between an annuity, a full lump sum or a mixture of the two. The insurance companies in the treatment group require three months advance notice in making a decision, compared to one year in the control group. In the control group mixed options are not separately recorded in the data but are subsumed under the annuity. According to the pension funds manager, a mixed option is rarely chosen, which is consistent with the findings for the treatment group. A large fraction of the beneficiaries chose a polar option (full lump sum or full annuity) and did not distinguish between the mandatory and super-mandatory part of the insurance, although the implicit annuity prices are dramatically different after 2003. Compared to the control group, the percentage of annuitants in the treatment group fell considerably after 2003, thereby providing the first evidence that the policy change had an effect on cash-out behavior.

#### Table 1

The individuals in the control group are on average wealthier, tend to retire earlier and are more likely to annuitize their pension wealth than individuals in the treatment group. The higher annuitization rate in the control group may be 

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to retire at an earlier age than their less educated and lower paid colleagues. This most likely is a consequence of very high replacement rates in the second pillar for high income workers (Bütler et al. (2004)).

the result of different default options. While the annuity is the default option in the control group, insurance companies in the treatment group force individuals to make a timely decision (no defaulting). Bütler and Teppa (2007) show that the sponsor’s default option is an important determinant of annuitization decision.

The evolution of the cash-out rates and the conversion factors at retirement age 65 in the super-mandatory part for the treatment (T) and the control group (C) are presented in Figure 1. In 2001 and 2002 cash-out rates have a similar trend in the treatment and control groups, providing evidence of the validity of the control group. In 2003 the fraction of people taking a lump sum decreases in the control group, while the cash-out rate slightly increases in the treatment group, followed by a sharp decline at the end of 2003. After the policy change became effective, cash-out rates are significantly higher in the treatment group compared to the control group, but the difference becomes smaller in 2005.

It is a priori unclear to what extent this is due to a smaller difference between the conversion rates induced by the small reduction in the conversion rate in the control group. Figure 1 and Table 1 also show a partial recovery in the annuitization rates for the treatment group and — albeit to a lesser degree — for the control group in 2005. This might be interpreted as an indication for the relevance of interest rates in the annuitization decision. An alternative explanation would be that the recovery represents an exaggerated reaction to the price change.

#### Figure 1

The pronounced drop in the cash-out rate at the end of 2003 suggests that the policy change may have triggered not only a higher cash-out rate, but also a shift in retirement to take advantage of the favorable conditions prior to the change for those most affected by the reform. Consistent with this conjecture, the number of retirees in the treatment group spikes in December 2003, as reported in Figure 2. Similarly, Table 1 reports a higher average capital stock and a large increase

in the number of early retirees in the treatment group in 2003. Not taking this *anticipation effect* into account would cause an upward bias of the impact of the policy change on cash-out behavior.

Given that individuals in the control group had to notify the insurance company one year prior to retirement about their annuitization decision, the reduction in the conversion factor in the control group from 7.2 to 6.8 percent in 2005 is unlikely to have caused large changes in the timing of retirements. However, to the extent that this cut reduces the difference between the conversion factors in the control and treatment groups we would underestimate the effect of policy change in 2005 if we did not account for it in an appropriate way.

*Figure 2*

## 4 Empirical strategy

The (money) value of an annuity is determined essentially by the conversion rate and the relevant interest rates at the time of retirement. The 19 percent reduction in the conversion rate of the super-mandatory part is thus accompanied by an equal net present value loss of the annuity relative to the lump sum. For the average male retiree at age 65, the decrease in the net present value of the benefit stream amounted to approximately 20'000 SFR ( $\approx$  \$ 17'000). Before the policy change a conversion rate of 7.2 percent would have generated a yearly annuity payment of 7'920 SFR in the super-mandatory part; afterwards the applicable conversion rate of 5.835 percent only yielded a yearly pension of 6'420 SFR. Therefore, we expect to observe a decline in the annuitization rate once the policy change became effective.

Based on the results of previous studies, we also expect a higher probability to cash-out retirement wealth for those with low capital stocks (see, for example, Bütler and Teppa (2007)). The main reason for that behavior lies in the

availability of social assistance in the form of supplemental benefits. This is true because an annuity, even a small one, is detrimental to the eligibility for income support.

Prior to its adoption, the policy change had been subject to extensive discussions in the media. As a consequence, the policy change and its consequences became public knowledge and we can expect that some people may have chosen to retire earlier to benefit from the higher conversion rate. This is particularly true for individuals that had planned to retire not too long after the policy change and wanted to annuitize their accumulated assets at the pre-reform conversion rate. Ignoring the anticipation effect will lead to biased estimates of the effects of the policy change; strategies to deal with anticipation effects are outlined below.

## 4.1 Difference-in-Difference Estimation

A straightforward way to analyze the effects of the policy change is to compare annuitization rates of individuals who were affected by the reduction in the conversion rate with corresponding observably similar individuals who were covered by an insurance company that did not reduce the conversion rate. This comparison can be implemented by estimating a regression of the form:

$$\begin{aligned}
LU_{it} = & \alpha + \beta T_{it} + \sum_{j=2001}^{2005} \gamma_j Y_j + \delta_{2001}(T_{i2001} * Y_{2001}) + \delta_{2002}(T_{i2002} * Y_{2002}) \\
& + \delta_{2004}(T_{i2004} * Y_{2004}) + \delta_{2005}(0.7 * (T_{i2005} * Y_{2005})) + \theta \mathbf{x}_{it} + \varepsilon_{it}, \quad (1)
\end{aligned}$$

where  $i$  and  $t$  denote individuals and years, respectively. The variable  $LU_i$  is one if individual  $i$  chooses a lump sum or a mixed option and zero in the case of an annuity.<sup>14</sup> The variable  $T$  is an indicator for whether individual  $i$  is in

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<sup>14</sup>The reasoning behind this strategy is that in the case of a mixed option the insurance companies pay out the annuity from the mandatory capital and the lump sum on the remaining capital. Therefore, choosing a mixed option is equivalent to choosing a lump sum in the super-mandatory part.

the treatment group. The variable  $Y_j$  is equal to one in year  $j$  and otherwise equal to zero. The vector  $x_i$  contains background characteristics for individual  $i$  including the accumulated total capital stock in 100'000 SFR, the square of the accumulated capital stock, a series of age dummies, and the actuarial factor  $PV(income)$ .

The coefficients of interest in this equation are the deltas. These measure the differential change in annutization rates between treatment and control group in a given year. The pre-2003 interaction terms provide “pre-treatment” specification tests. Due to the reduction of the conversion rate from 7.2 to 6.8 percent in the control group in 2005, the difference in conversion rates between the treatment and control group is roughly 30 percent lower compared to 2004. Therefore, we set the  $T_{ij} * Y_j$  interaction term to 0.7 in 2005. The identifying assumption of this model is that, absent the policy change, the cash-out rates would have followed a comparable trend for individuals in the treatment and control group after controlling for background characteristics. Under these assumptions,  $\delta_{2004}$  and  $\delta_{2005}$  measure the causal effect of the reduction in the conversion rates on the decision to annuitize pension wealth.

## 4.2 Anticipation effects

Anticipating retirement comes at the cost of losing additional contribution months and years that would have led to both a higher amount of capital stock and a higher annuity. Taken together and neglecting the disutility of labor, both the utility value of the lump sum and annuity are increasing with the age of retirement, as depicted schematically in Figure 3. The decrease in the conversion rate leads to a discontinuous fall in the utility value of the annuity at the time of the policy change, but leads the lump sum unaffected.

The individual foresees an earlier retirement if the utility value of the annuity just before the policy change exceeds the utility value of the chosen payout option

at the statutory retirement age. A differentiation can be made between three cases, of which two are presented in Figure 3. First, individuals whose valuation of the annuity before the policy change does not significantly exceed that of the lump and who would cash out after the policy change (see upper panel in Figure 3). These individuals can be expected to retire earlier provided they are close to the statutory retirement age: The higher the pre-reform ratio between the value of the annuity and the lump sum, the more likely an earlier retirement is. The second case is similar to the first, but deals with individuals who would have annuitized even after the loss in the annuity's value (see lower panel in Figure 3). Again these individuals are more likely to retire earlier. The third case concerns individuals who would have chosen the lump sum even before the change and are thus clearly not susceptible to an anticipation effect.

*Figure 3*

#### 4.2.1 Ad hoc correction of anticipation effects

The first strategy to deal with potential anticipation effects is to use an ad-hoc correction of the potential anticipators' behavior. Potential anticipators are individuals in the treatment group who are younger than 65, take an annuity, have some of their pension wealth in the super-mandatory part, and retire one or two months before the policy change comes into effect. Instead of taking their chosen retirement date for the year-by-year comparisons, we make potential anticipators retire at the statutory retirement age of 65. This procedure should provide us with bounds as to the effect of the policy change. A drawback of the procedure is that although potential anticipators can be identified, some of those who retired early in late 2003 might have done so even in the absence of the conversion rate change.

To illustrate the implications of the proposed strategy, we denote by  $LU_0^j$  and  $LU_1^j$  the fraction of individuals in the treatment ( $j = T$ ) and control group



( $j = C$ ) taking the lump sum before and after the policy change. Without any loss of generality we assume that the number of retirees in the absence of anticipation is equal in the two periods and normalized to 1. Had the reform come as a surprise, we could simply compute  $\Delta_{\text{true}} = (LU_1^T - LU_0^T) - (LU_1^C - LU_0^C)$  to quantify the impact of the reform on the annuitization decision. As outlined above, however, there are two groups of people likely to retire earlier to benefit from a higher annuity value before the policy change (see also Figure 3): Let  $AA^T$  and  $AL^T$  denote the anticipators (measured as a fraction of all retirees in the treatment group after the policy change) who would have chosen the annuity and the lump sum, respectively, after the policy change. If anticipation occurs, we therefore observe

$$\Delta_{\text{bias}} = \left( \frac{LU_1^T - AL^T}{1 - AL^T - AA^T} - \frac{LU_0^T}{1 + AL^T + AA^T} \right) - (LU_1^C - LU_0^C),$$

which clearly shows that this measure is biased.

If we were able to correctly identify anticipators ( $AA^T + AL^T$ ), but unable to distinguish between the two groups, we could compute upper and lower bounds for the policy effect as follows: An upper bound for the impact can be found by letting all anticipators choose the lump sum instead of a reduced annuity after the policy change,  $\overline{\Delta} = (LU_1^T + AA^T - LU_0^T) - (LU_1^C - LU_0^C) > \Delta_{\text{true}}$ . Letting the anticipators choose the annuity even after the policy change defines a lower bound,  $\underline{\Delta} = (LU_1^T - AL^T - LU_0^T) - (LU_1^C - LU_0^C) < \Delta_{\text{true}}$ . In that latter case the policy change merely leads to a change in the timing of retirement, but not to a change in the pay-out option. The greater the fraction of anticipators, the wider the bounds will be. The same strategy also delivers bounds for other year-by-year comparisons of annuitization rates.

Unfortunately, this ad-hoc strategy is susceptible to individuals who are falsely identified as anticipators. If there are not too many false anticipators, the bounds still contain the true effect, but the gap between the bounds widens and the

strategy delivers worse bounds for other year-by-year comparisons.<sup>15</sup>

#### 4.2.2 Proxy for the likelihood to anticipate

If we knew who retired earlier as a reaction to the future decrease in the annuity's value, we could simply add an additional regressor  $a$  in the estimation. But, unfortunately, this information is unavailable because not all of those individuals retiring earlier just before the change do so because of the policy change. The second strategy is to construct a suitable proxy  $z$  for the *unobserved* anticipation and earlier retirement decision  $a$ . Such a proxy has to satisfy two conditions:<sup>16</sup>

1.  $z$  must be *redundant*, i.e., in a conditional sense  $z$  is irrelevant in explaining the choice of the pay-out option, once anticipation  $a$  and other covariates  $x$  have been controlled for.
2.  $z$ 's relation to the anticipation and earlier retirement decision  $a$  should be close enough so that once  $z$  is included in the estimation equation, the covariates  $x$  are not partially correlated with  $a$ .

It immediately follows from the graphical analysis drawn in Figure 3 that the cost of not anticipating and retiring earlier increases with the age of potential anticipators at the time of the policy change. The cost is 0 for people turning 65 before the policy change, jumps to a maximum for people who turn 65 just after the change and then decreases with the increasing time span between the policy change and the date of the statutory retirement age of a potential anticipator. Neglecting the disutility of labor, the individual has to balance the advantages of anticipating the policy change and retiring earlier (thus benefiting from a higher

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<sup>15</sup>Taking into account false anticipators  $F^T$  reduces the upper bound to  $\overline{\Delta}_F = \left( \frac{(LU_1^T + AA^T + F^T)}{1 + F^T} - \frac{LS_0^T}{1 - F^T} \right) - (LU_1^C - LU_0^C)$ , and the lower bound to  $\underline{\Delta}_F = \left( \frac{(LS_1^T - AL^T)}{1 + F^T} - \frac{LS_0^T}{1 - F^T} \right) - (LU_1^C - LU_0^C)$ .

<sup>16</sup>See Wooldridge (2002) (Section 4.3.) for details concerning the properties of the estimators when using proxies for omitted variables.

pre-change conversion rate) against the cost of extra contribution years that are forgone when retiring early. Following the visual presentation in Figure 4, we take as a base proxy a maximal cost minus the number of years between the policy change and the date of retirement at the statutory age of 65. The cost thus corresponds to the maximal period for which anticipation is beneficial in money terms minus the number of years for which additional contributions are forfeited for those who are affected by the reform. Neglecting the disutility of labour, the maximal period for which anticipation pays off in money terms is between 2.5 and 4 years (it depends on how interest is accrued during this period). We took the maximum cost to be 4, but the results are in no way sensitive to the choice of this number. The proxy is set equal to 0 for individuals in the control group and individuals in the treatment group turning 65 before the policy change.

The chosen proxy satisfies the first requirement. Given the value of the annuity relative to the lump sum and the age of the individual, the time span between the date of the policy change and the individual's 65th birthday is redundant for the choice of the option. For the second requirement — the correlation between the omitted anticipated earlier retirement decision  $a$  and each of the covariates  $x$  proxy is zero once we derive for  $z$  — it can be argued that all true anticipators ( $a = 1$ ) are picked up by the proxy variable.

Anticipated early retirement is not only driven by the length of the anticipated early retirement period, but also by the magnitude of the anticipated benefit per period. The latter is directly related to the amount of capital in the super-mandatory part. Therefore, to capture the impact of the super-mandatory capital stock on the anticipated earlier retirement decision, we would ideally interact the proxy with the amount of capital in the super-mandatory part. However, since we do not observe the super-mandatory capital stock in the years prior to the reform, we use the total capital stock instead.

Note that if the base proxy does not have a zero mean in the population (which is obviously not the case here), OLS does not consistently estimate the

size of the policy impact. As we do not know its population mean, we demean the proxy variable before interacting it with the super-mandatory capital stock. Once interaction effects with the capital stock are included, we would expect the base proxy to no longer have an impact on the choice between the lump sum and the annuity.

*Figure 4*

## 5 Results

As outlined in the previous section we adopt two strategies in dealing with anticipated earlier retirement effects. The first is an ad-hoc correction in which we treat potential anticipators as if they retired at their statutory retirement age. The results are shown in Table 2, columns (A1) to (A4). The outcomes of the proxy variable OLS estimations are shown in Table 3.

### 5.1 Before-after comparisons, ad-hoc correction for anticipation

Table 2 shows the uncorrected difference-in-difference estimate (without controls) of the policy effect (column (AO)) together with two bands for the true effect derived from two different choices of the retirement period of potential anticipators. Although *prima facie* there is little reason to retire in November 2003 (instead of December 2003), the uncertainty accompanying the policy change might have induced some individuals to choose the earlier exit out of the labor market despite the loss of annuity income. Including November early retirees however renders the strategy more susceptible to falsely identified anticipators.

If we assume that in the absence of the policy change anticipators would have taken the annuity and retired at age 65, the effect of the policy change on the annuitization decision is eased (this gives us a lower bound of the effect of the

policy change). On the other hand, if anticipators instead would have cashed-out their retirement balances upon reaching the statutory retirement age, the effects of the policy change on cash-out behavior is amplified (this is the upper bound). An alternative strategy to obtain bounds is to assume that in the absence of the change in law anticipators would have retired in the year after the policy change instead. However, once an individual has decided against advancing retirement to benefit from the higher conversion rate, it is unlikely she/he chooses to retire early and take the annuity before the statutory retirement age.

As shown in column (A0), the uncorrected effect varies between 16 to 19 percentage points. It is always statistically significant. The lower bound for the policy change (columns (A2) and (A4)) is considerably smaller or even insignificant. If we assume that individuals switch to a lump sum, the effect of the policy change remains significant and relatively big. This is also confirmed by the bounds for the impact of the policy change comparing the years 2002 and 2004 as well as comparing the years 2002 and 2005.

In some cases the bounds are very wide. This is a consequence of both the large number of anticipators relative to the total number of retirees, as well as the possibility of falsely identified anticipators. Not all retirees in December (and even more so, in November) 2003 who take an annuity and retire before the statutory retirement age have retired earlier as a consequence of the policy change. Most early retirees leave the workforce one or two years prior to the statutory retirement age, few do so three or four years. These numbers are consistent with the maximum period for which anticipation is beneficial in pecuniary terms, which is used for the construction of the proxy for anticipation.

## 5.2 Proxy for anticipation decision

Table 3 presents the estimates of the difference-in-difference model specified in equation (1). Columns (P0-P2) present the results of estimating equation (1)

without controlling for anticipation and with and without controlling for other covariates. These estimates show a common time trend between treatment and control group before the policy change (captured by the treatment effect in 2001 and 2002). They also show a highly significant 17 percentage point increase in the probability of the treatment group to take the lump sum after the policy change. As outlined before, these estimates are likely to overstate the true effect of the policy change.

The results of a simple proxy-variable OLS estimation (Table 3, estimation P3-P5) do not differ significantly from the more sophisticated proxy estimation in which the time cost is interacted with the amount of capital in the second pillar (Table 3, estimation P6-P8).<sup>17</sup> In the latter, the impact of the simple proxy vanishes as expected, as the total cost of non-anticipation is approximately proportional to the length of the anticipation period multiplied by the magnitude of the benefit.

The proxy variable OLS estimations show a robust increase in the cash-out rate by 13 to 14 percentage points as a consequence of the policy change, regardless of whether the simple or the interacted proxy is employed. The results are very robust to the inclusion of strategies to deal with anticipation, other covariates on the individual as well as time series effects. They also do not differ very much from estimates that ignore anticipation. Although the ability to retire early to escape the impact of the policy change accounts for a significant fraction of the decline in annuitization rates between 2003 and 2004, it is still dominated by the lasting effect of the change. The difference in cash out behavior between control and treatment group declines slightly (by about 1%) from 2004 to 2005. Unfortunately we do not have the data to explore, whether the difference decreases even more thereafter.

The implied responsiveness of the annuitization decision with respect to the

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<sup>17</sup>Assuming a maximal cost of 4 for the proxy. Alternative specifications based on a lower (2.5) or much higher (10) maximal costs yield very similar estimates.

change in the annuity value corresponds well to estimates of previous studies. The observed 19 percentage point decrease in the annuity reduces the probability to annuitize by around 13 percentage points for the treatment group, which translates into a responsiveness of approximately 0.7. This number is slightly lower than the estimate of a one by one correspondence by Brown (2001) (for men and women) and somewhat higher than the estimate of 0.5 for men only in Bütler and Teppa (2007). Given that the variation in the annuity's value differs so much between these studies, the effect of the annuity's value on the decision (not) to annuitize thus seems remarkably robust across different countries, pension plan details and the manner in which the choice is elicited.

Our results also show a robust difference in annuitization rates between the treatment and control groups even after controlling for individual characteristics. The probability to take the lump sum is 12 to 13 percentage points higher in the treatment group compared to the control group. One possible interpretation for the higher annuitization rate in the latter is the unobserved effect of the default option in the control group. In the absence of an active decision, individuals are defaulted into the annuity in the control group. Individuals in the treatment group, on the other hand, do not face a default option, but are forced to make a decision three months prior to planned retirement. This interpretation is consistent with previous findings. According to Bütler and Teppa (2007) the sponsor's default option is found to be highly influential in the decision to annuitize.

Other covariates in our estimations show the expected sign and magnitude: The probability to annuitize is always lowest for individuals with a low capital stock (presumably as a consequence of the availability of means-tested income support), then increases and reaches a maximum at around 1,300,000 Swiss francs and declines with even higher capital stocks.

Annuitization at least partially depends on alternative investment possibilities as captured by the actuarial factor  $PV(\text{income})$ . The actuarial factor as a summary measure for interest rates has the expected negative sign, once the

possibility to retire early is taken into account. An increase in the mortality adjusted present value of an income stream of 1 for a 65 year old single man increases the annuitization probability by three percentage points. Once interest rates are included in the regressions the year effects almost disappear and the treatment year effect in 2004 and 2005 picks up the entire variation over time. For the control group, annuitization rates thus do not exhibit any time trend apart from the ones included by alternative investment opportunities.

The likelihood to cash-out retirement balances is higher for individuals under the age of 65. There are two possible interpretations for this finding. *First*, unobserved differences in mortality rates not captured by the capital stock may explain higher cash-out rates of early retirees. Those who retire early have a lower life expectancy making the annuity worth less. *Second*, due to higher cuts in first-pillar benefits (which are available from age 63 at a sizeable reduction of the benefit) it is better in money terms not to anticipate benefit payment in the first pillar and pay a notional contribution during the inactive period until the statutory age of retirement. Those with insufficient private wealth have an incentive to cash out second pillar capital to bridge the time until age 65.

## 6 Conclusions

To the best of our knowledge, our paper is the first to analyze the effects of a truly exogenous variation in the annuity price on the cash-out behavior at retirement. The annuitization decision is analyzed by exploiting a recent policy change. Several Swiss insurance companies reduced the conversion rate at which the retirement capital in the super-mandatory part of the second pillar is translated into a life-long annuity of nearly 20 percent less.

Despite the fact that the administrative data made available by Swiss insurance companies contain no information on non-pension wealth and limited individual information, they offer many advantages over existing empirical stud-



ies. The data set is made up of real rather than planned annuitization decisions. Individual decisions involve very large amounts of money (approximately 220'000 US\$ on average) and some individuals had to make retirement choices subject to great differences in prices. We therefore believe that individuals spend more time in the decision-making process than they do when answering a questionnaire on hypothetical choices.

The empirical results highlight the importance of the annuity price for the annuitization decision. As a consequence of the policy change the fraction of individuals choosing a lump sum increases by approximately 14 percentage points. This estimate already takes into account that some individuals do not only change their cash-out behavior as a reaction to the change in policy, but also anticipate retirement to benefit from the more favorable pre-reform conditions. Once anticipation is properly taken into account, we find constant cash-out rates in the periods before and after the reform.

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Variable (Means)	<i>period not affected</i>				<i>reform announced</i>		<i>reform implemented</i>			
	<b>2001</b>		<b>2002</b>		<b>2003</b>		<b>2004</b>		<b>2005</b>	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
<b>Age at retirement</b>	64.7 (1.1)	64.4 (1.3)	64.5 (1.2)	64.1 (1.6)	64.3 (1.3)	64.5 (1.2)	64.5 (1.3)	64.4 (1.3)	64.5 (1.2)	64.4 (1.3)
<b>Conversion rate</b>										
Mandatory Part	7.136	6.966	7.104	6.906	7.059	7.023	7.071	6.988	7.029	6.953
Supermandatory Part	7.136	6.966	7.104	6.906	7.059	7.023	5.774	6.988	5.780	6.727
<b>Capital at retirement</b>	238,850 (200,431)	260,158 (223,245)	235,799 (189,342)	219,328 (189,136)	282,198 (225,018)	272,087 (235,307)	228,548 (178,182)	269,093 (218,238)	238,914 (181,249)	260,696 (203,305)
Mandatory Capital							132,047		134,952	
Super-mandatory Capital							96,380		103,962	
<b>Annuity</b>	0.353	0.456	0.330	0.413	0.407	0.511	0.251	0.522	0.334	0.552
<b>Lump Sum</b>	0.616	0.544	0.632	0.587	0.548	0.489	0.730	0.478	0.632	0.448
<b>Mixed</b>	0.031	0.000	0.038	0.000	0.045	0.000	0.019	0.000	0.033	0.000
<b>Early Retirement</b>	168	709	241	726	619	488	252	519	215	450
<b>Retirement at Age 65</b>	783	1,406	850	1,283	1,027	1,330	805	1,288	790	1,258
<b>Observations</b>	976	2,115	1,104	2,009	1,678	1,818	1,080	1,807	1,017	1,708

Table 1: Summary statistics for men. Standard deviation in parenthesis for age and capital at retirement.

<i>potential anticipators</i> strategy: retirement date strategy: imputed choice Variable	<i>none</i> as observed No correction (A0)	<i>retire in dec 2003</i> shifted to age 65 lump-sum annuity (A1) (A2)	<i>retire in nov/dec 2003</i> shifted to age 65 lump-sum annuity (A3) (A4)
No. pot. anticipators		229	290
No. shifted 2003 → 2004		92	116
No. shifted 2003 → 2005		55	68
$\bar{L}\bar{U}_{2004} - \bar{L}\bar{U}_{2003}$	0.166*** (0.025)	0.108*** (0.025)	0.090*** (0.025)
$\bar{L}\bar{U}_{2004} - \bar{L}\bar{U}_{2002}$	0.186*** (0.026)	0.206*** (0.026)	0.210*** (0.026)
$\bar{L}\bar{U}_{2005} - \bar{L}\bar{U}_{2003}$	0.162*** (0.037)	0.100*** (0.038)	0.079*** (0.037)
$\bar{L}\bar{U}_{2005} - \bar{L}\bar{U}_{2002}$	0.191*** (0.038)	0.235*** (0.038)	0.243*** (0.038)

Table 2: Correction of anticipation effects: Potential anticipators (annuitants with positive retirement capital in the super-mandatory part retiring early in December (and November) 2003) are shifted to the statutory retirement age. The lower bound for the effect is found by letting the shifted individuals annuitize even after the policy change, the upper bound by assuming that the anticipators would have taken the lump sum after the change. Significance levels: \*\*\* = 1%, \*\* = 5%, \* = 10%.

	(P0)	(P1)	(P2)	(P3)	(P4)	(P5)	(P6)	(P7)	(P8)
T*Y <sub>2001</sub>	-0.001 (0.026)	0.017 (0.026)	0.018 (0.026)	-0.017 (0.026)	-0.004 (0.026)	-0.003 (0.026)	-0.026 (0.026)	-0.012 (0.026)	-0.011 (0.026)
T*Y <sub>2002</sub>	-0.021 (0.025)	0.008 (0.025)	0.010 (0.025)	-0.036 (0.026)	-0.017 (0.025)	-0.013 (0.025)	-0.046* (0.025)	-0.026 (0.025)	-0.023 (0.025)
T*Y <sub>2004</sub>	0.168*** (0.025)	0.169*** (0.026)	0.171*** (0.026)	0.152*** (0.025)	0.145*** (0.026)	0.147*** (0.026)	0.143*** (0.025)	0.138*** (0.025)	0.140*** (0.025)
0.7*T*Y <sub>2005</sub>	0.162*** (0.040)	0.175*** (0.040)	0.176*** (0.040)	0.140*** (0.040)	0.139*** (0.040)	0.140*** (0.040)	0.127*** (0.039)	0.127*** (0.039)	0.129*** (0.039)
T	0.104*** (0.021)	0.096*** (0.021)	0.095*** (0.021)	0.119*** (0.021)	0.122*** (0.021)	0.121*** (0.021)	0.129*** (0.021)	0.131*** (0.020)	0.130*** (0.020)
Y <sub>2001</sub>	0.055*** (0.017)	0.045*** (0.017)	0.027 (0.022)	0.044** (0.017)	0.022 (0.017)	-0.006 (0.022)	0.047*** (0.017)	0.025 (0.017)	-0.003 (0.022)
Y <sub>2002</sub>	0.098*** (0.017)	0.074*** (0.017)	0.061*** (0.019)	0.087*** (0.017)	0.053*** (0.017)	0.033* (0.020)	0.091*** (0.017)	0.058*** (0.017)	0.037* (0.020)
Y <sub>2004</sub>	-0.011 (0.017)	-0.014 (0.017)	-0.014 (0.017)	-0.023 (0.017)	-0.034** (0.017)	-0.035** (0.017)	-0.019 (0.017)	-0.031* (0.017)	-0.032* (0.017)
Y <sub>2005</sub>	-0.041** (0.019)	-0.044** (0.019)	-0.027 (0.023)	-0.052*** (0.019)	-0.063*** (0.019)	-0.038* (0.023)	-0.048** (0.019)	-0.060*** (0.019)	-0.034 (0.023)
Capital (100k)		-0.0361*** (0.007)	-0.0361*** (0.007)		-0.0354*** (0.007)	-0.0353*** (0.0073)		-0.0362*** (0.007)	-0.036*** (0.007)
Capital sq		0.0013* (0.001)	0.0013* (0.001)		0.0012* (0.001)	0.0012* (0.001)		0.0015** (0.001)	0.0014** (0.001)
R.A. 60		0.079* (0.041)	0.078* (0.041)		0.079* (0.041)	0.079* (0.041)		0.074* (0.041)	0.073* (0.041)
R.A. 61		0.150*** (0.022)	0.149*** (0.022)		0.155*** (0.022)	0.155*** (0.022)		0.153*** (0.022)	0.153*** (0.022)
R.A. 62		0.121*** (0.019)	0.121*** (0.019)		0.137*** (0.019)	0.138*** (0.019)		0.137*** (0.019)	0.137*** (0.019)
R.A. 63		0.117*** (0.016)	0.117*** (0.016)		0.152*** (0.017)	0.153*** (0.017)		0.147*** (0.017)	0.147*** (0.017)
R.A. 64		0.089*** (0.018)	0.089*** (0.017)		0.140*** (0.019)	0.141*** (0.019)		0.139*** (0.019)	0.140*** (0.019)
PV(Income)			-0.021 (0.016)			-0.033** (0.016)			-0.033** (0.016)
Proxy				-0.037*** (0.009)	-0.071*** (0.009)	-0.072*** (0.009)	0.044*** (0.014)	0.000 (0.015)	-0.001 (0.015)
Proxy x Cap							-0.024*** (0.003)	-0.021*** (0.004)	-0.021*** (0.004)
n	15,312	15,312	15,312	15,312	15,312	15,312	15,312	15,312	15,312
R <sup>2</sup>	0.0309	0.0481	0.0482	0.0324	0.0524	0.0527	0.0366	0.0556	0.0558

Table 3: The table reports coefficient estimates from linear probability models of equation (1). The dependent variable for each specification is an indicator for whether individual  $i$  takes a lump sum. Standard errors in parentheses account for clustering at the firm level. The time period is 2001-2005, with 2003 being the baseline year. Significance levels: \*\*\* = 1%, \*\* = 5%, \* = 10%.

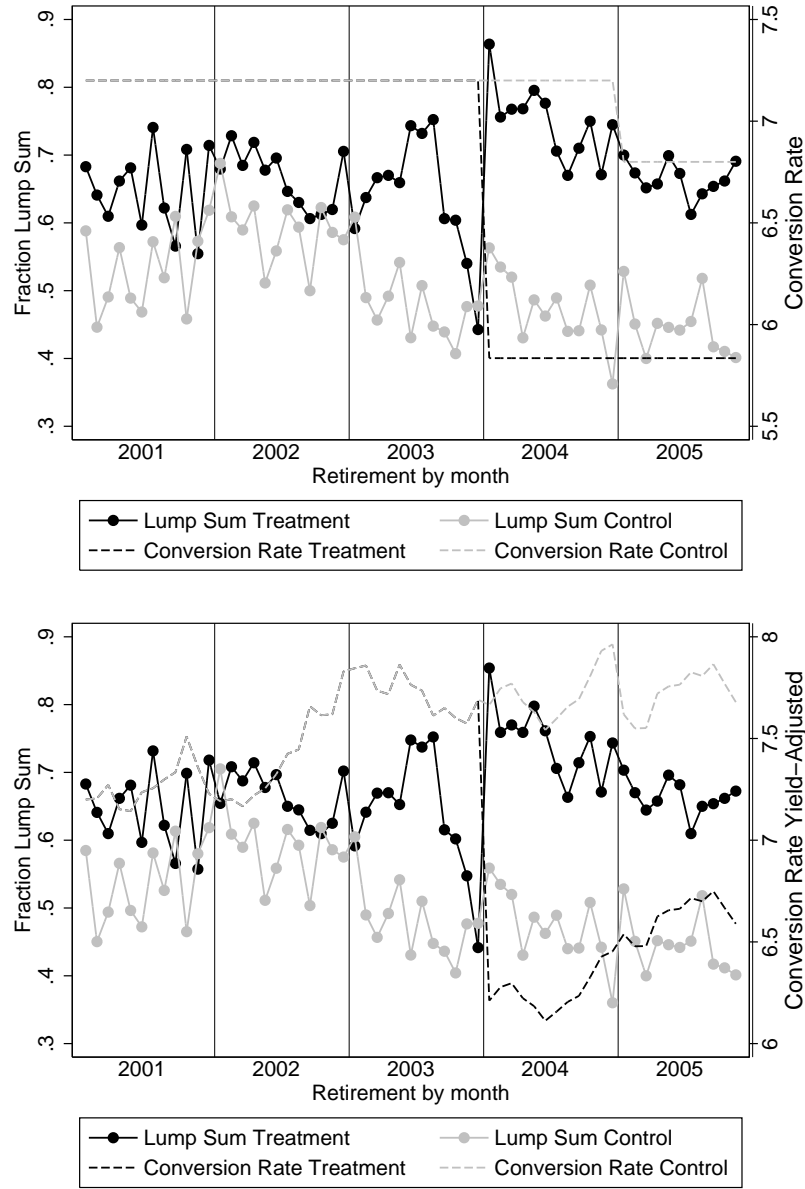


Figure 1: In both panels the solid line (left scale) represents the percentage of individuals taking the lump sum for the treatment group (black) and the control group (grey) over time. In the upper panel the dashed line (right scale) corresponds to the observed average conversion rate in the super-mandatory part. In the lower panel the dashed line (right scale) represents the hypothetical market conversion rate. The latter is normalized so that it is equal to the conversion rate in Jan 2001.

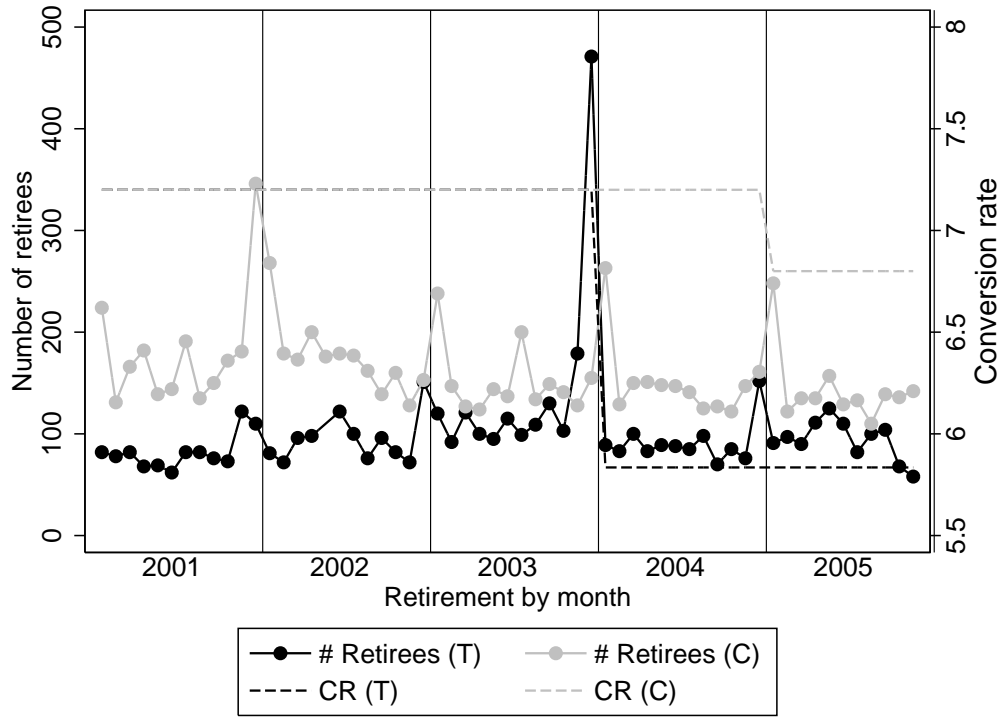


Figure 2: The solid line (left scale) represents the number of retirees in the treatment group (black) and the control group (grey) over time. The dashed line (right scale) corresponds to the observed average conversion rate in the super-mandatory part.



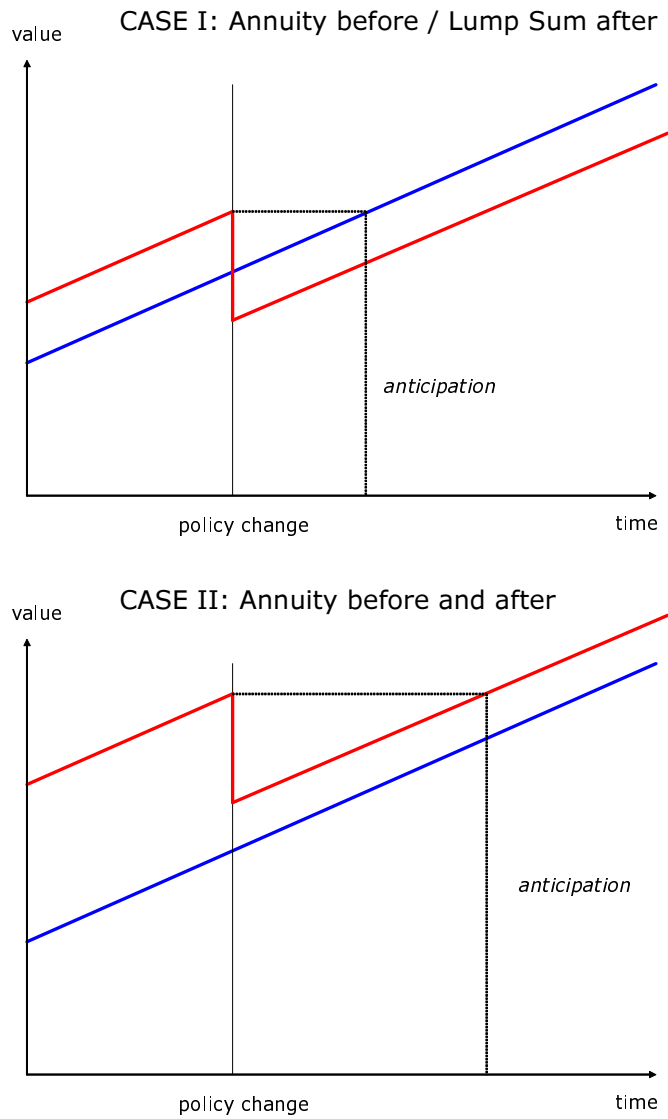


Figure 3: Potential anticipators foreseeing a decrease in the annuity's value. The blue line represents the individual's utility valuation of the lump sum, assumed to increase with age due to additional contributions. The red line represents the annuity's value. Early retirement is anticipated if the annuity's value just before the policy change exceeds the annuity's value or the lump sum, respectively, at the statutory retirement age.

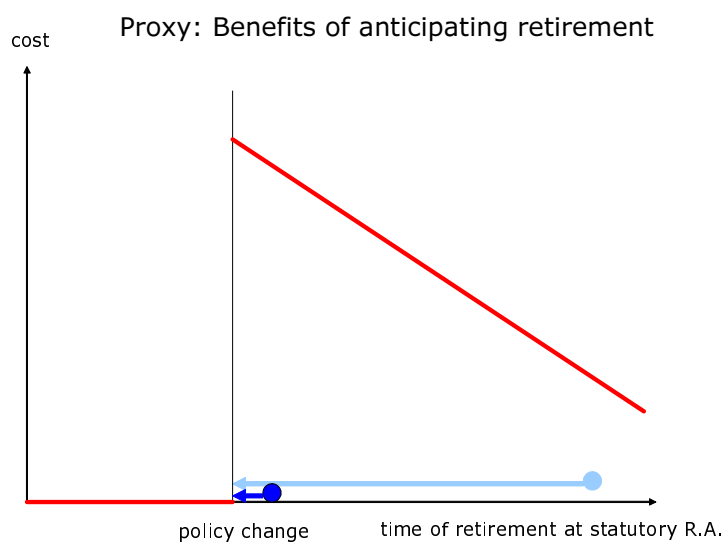


Figure 4: Construction of a proxy  $c$  for the likelihood of anticipating early retirement in light of the decrease in the annuity's value. The base proxy  $c$  is zero for individuals who reach the statutory retirement age before the reform and is maximal for those who turn 65 just after the policy change.