Raising the Full Retirement Age: Defaults vs Incentives

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Abstract

We study a Swiss reform that increased the female full retirement age (fra) in stages, from 62 to 63 to 64, offering the option to claim early at the low price of a 3.4% cut in pension benefits. Exploiting sharp cutoffs generated by the reform, we find that individuals delay pension claiming by 7-8 months and labor market exit by 6-7 months, although maximization of pension wealth dictates early claiming. The price of early claiming was then raised from 3.4% to a more than actuarially fair level of 6.8%, providing strong financial incentives to delay but leaving the fra constant at 64. This change delays pension claiming by 4 months and has no effect on labor market exit. These findings suggest that the fra represents a default claiming age that many individuals passively comply with, regardless of the financial implications. We identify and estimate bounds on the fraction of passive decision makers in the population, exploiting the structure of the reform and the fact that a passive individual would always respond to stages of the reform that raise the fra, but would not respond to a change in financial incentives alone. The fraction of passive individuals is estimated to lie between [0.463, 0.691]. Finally, we show that if we assume active decision makers maximize discounted expected pension wealth, the fraction of passive decision makers can be point identified and estimated using a simple dynamic discrete choice model of benefits claiming. Our estimate of the fraction of passive individuals is 0.65, consistent with the bounds estimates, which has significant implications for the optimal design of social security.

Keywords: Full retirement age, social security reform, default, regression discontinuity design

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1 Introduction

Between 1960 and 2010 the average life expectancy at age 65 in the United States increased by 4.5 years for men and 4.2 years for women (OECD 2011b). Over the same period, the average effective retirement age declined by approximately three years (OECD 2011a). These trends have substantial fiscal implications for social security as individuals contribute for fewer years and receive benefits for longer than they ever have. A common policy response has been to increase the Full Retirement Age (FRA), the age at which individuals can draw a full pension. Policy makers raise the FRA by lowering the benefits individuals can claim at the old FRA, which becomes an Early Retirement Age (ERA). Typically, the benefit cut is actuarially fair, so that the discounted expected pension wealth associated with claiming at the ERA is equal to that associated with claiming at the FRA. This approach is popular because it is simple and performs the dual task of increasing contribution years and reducing the number of years that an individual receives full benefits for individuals who increase their claim age, and reduces benefit payments for those who do not.

While the effect of raising the FRA on benefits claiming and retirement has been documented in other settings (Behaghel and Blau (2012); Blau and Goodstein (2010); Mastrobuoni (2009); Song and Manchester (2007)), questions remain as to how and why the policy works. While raising the FRA does provide sufficient financial incentive to delay for many individuals evidence is mounting (Behaghel and Blau (2012), ?) that benefit claiming and retirement decisions move with changes in the FRA in a way that is difficult to rationalize with standard models of economic behavior. Rather, it is becoming apparent that a non-negligible fraction of the population passively complies with the FRA as the default claiming age, a type of behavior that should have serious implications for optimal social security design.

In this paper we study the response of pension claiming and labor market exit behavior to a unique 1997 reform to old age survivors’ insurance (OASI) in Switzerland. The reform first increased the FRA in two steps, from 62 to 63 years for all women born on the cut-off date January 1, 1939, and from 63 to 64 years for women born on January 1, 1942 or later. Initially, the penalty for early claiming was only 3.4%. Under this regime, early claiming is actuarially attractive for the average woman - the discounted

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In its recent annual report to Congress, The Board of Trustees of OASDI in the US note that the cost of social security has exceeded non-interest income on social security (from payroll tax) since 2010, and that the cost of social security will exceed total income by 2020, after which point paying out social security will require drawing down reserves. Under “intermediate assumptions” The Board of Trustees expects reserves to be fully depleted by 2035. See: [https://www.ssa.gov/OACT/TR/2019/tr2019.pdf](https://www.ssa.gov/OACT/TR/2019/tr2019.pdf).

Regardless of whether the individual adjusts her claim age in response, the total benefit paid out over the individual’s lifetime (and thus, the burden of the individual on social security) is smaller. If the individual chooses to claim at the old FRA, she will receive a fraction of her old benefits for the same number of (expected) years, and if she claims at the new FRA, she will receive the same benefit payment each year, but for one fewer year.
expected pension wealth associated with claiming early is actually larger than that of claiming at the FRA. In the final step of the reform, the penalty for early claiming was increased to 6.8% for women born after January 1, 1948, which is a more than actuarially fair increase - the discounted expected pension wealth associated with claiming early is smaller than that associated with claiming at or after the FRA.

Using rich administrative data from Switzerland, we first exploit the sharp cutoffs generated by the reform to study its effects on benefits claiming and labor market exit in a Regression Discontinuity (RD) Design. Using data that contains the complete labor market and earnings histories of all women, we find that increasing the FRA delays pension claiming by 7 to 8 months and labor market exit by 6-7 months. As these estimates may be driven in part by the additional tax levied on women who work and claim a pension, we verify that the effect on pension claiming is qualitatively and quantitatively the same when we restrict the sample to include only women who have left the labor market before reaching the age of early retirement.

On the other hand, increasing the penalty to early claiming from 3.4% to 6.8%, holding the FRA fixed, delays pension claiming by about 4 months, and has no effects on exit from work. So, increasing the FRA by one year, while actually financially dis-incentivizing early claiming[^3] delays pension claiming and labor market exit significantly, but increasing the financial incentive to delay while keeping the FRA constant delays pension claiming to a much smaller degree and has no consequences for labor market exit. These findings are difficult to rationalize using the standard model of behavior. In Switzerland, there is no mandatory retirement from work, and there is nothing tying labour market exit to the FRA. In particular, there is no earnings test, so that individuals are able to claim and continue working or retire early and not claim benefits. Changes to retirement benefits affect wealth but do not change the incentive to work over and above the disincentive effects through the tax system. Then standard assumptions on economic behavior - fully rational forward looking expected utility maximizers - would dictate that individuals simply claim benefits at a point that maximizes discounted expected pension wealth. The evidence strongly suggests that a substantial fraction of the population does not behave the way we would expect a fully rational agent to behave.

In Switzerland, the FRA is the default pension claiming age. Individuals must contact local authorities to inform them when they want to start claiming a pension. Those who do not claim a pension automatically at the FRA. Following Chetty et al. (2014), we label individuals who simply follow the default, as “passive” decision makers and those who respond to incentives as “active” decision makers, and exploit the different

[^3]: A pension reduction of 3.4% per year early is less than actuarially fair for a women with average life-expectancy and discount rate of 2.5%, while 6.8% is more than actuarially fair.
stages of the reform to identify and estimate tight bounds on the fraction of the population that is passive. Our strategy is simple. Compliance with a stage of the reform is informative about the individual’s type. For example, an individual that does not delay claiming in response to (does not comply with) the first stage of the reform - an increase in the FRA with a small penalty for early claiming - cannot be “passive,” because by definition being passive here means following the default regardless of the financial implications. For similar reasons, an individual who delays in response to (is compliant with) the final stage of the reform - an increase in the financial penalty associated with early claiming but no change in the FRA - also cannot be passive. As compliance rates are observed in the data under mild assumptions, we identify and estimate bounds around the fraction of passive individuals in the population. The bounds are estimated with high precision to be $[0.463, 0.691]$, a substantial proportion of the population who’s presence should have significant implications for the optimal design of social security.

While we have a precise idea of what it means to be a passive decision maker in this setting, we are less precise about what it means to be an active decision maker except that for these individuals, their claim age might respond to a change in financial incentives. As benefit claiming and retirement are untied in Switzerland, the benchmark active decision maker would seem to be one who chooses the age of claiming to maximize discounted and expected pension wealth. We specify a simple dynamic discrete choice model of benefits claiming with two unobserved types: passive decision makers, who claim at the default age (FRA) and active decision makers, who maximize discounted expected pension wealth. As we are able to observe all the determinants of benefits and pension wealth that would accrue to each possible claiming age for each individual in the data, the likelihood that an individual claims at any given age conditional on their type is known to the researcher. The model thus implies a simple finite mixture likelihood where the mixture weight is the fraction of passive decision makers and is point identified. We are able to test whether this simple model could be generating the behavior we observe in the data, by examining whether the fraction of passive decision makers implied by the model falls in the interval $[0.463, 0.691]$. We precisely estimate the fraction of passive decision makers to be 0.65. We cannot reject the possibility that the data was generated by a model with two types of individuals, passive types who always claim at the FRA, and active types who fit the standard model of economic behavior.

This paper is related to several strands of the literature. First, a series of studies examine how the Social Security Amendments of 1983 in the US, which increased the FRA from 65 to 67, affected labor force participation of older workers. Blau and Goodstein (2010); Mastrobuoni (2009); and Song and Manchester (2010). Benefit payments are a function of claiming age, Average Indexed Monthly Earnings (AIME) and the individual’s birthdate, all of which are observable.
find that a one year increase in the FRA delays in labor force exit and benefit claiming among affected birth cohorts of about half a year. Duggan et al. (2007) find that the Amendments significantly increased Social Security Disability Insurance (SSDI) enrollment. Behaghel and Blau (2012) find that the benefit claiming hazard at 65 moved in lock-step along with the FRA increase implemented with the 1983 Amendments. Second, our analysis is related to studies that focus on the effects of changes in pension rules on labor supply of women near retirement age. Staubli and Zweimüller (2013) study the effects of raising the early retirement age (ERA) by 2 years for men and 3.25 years for women in Austria and find that both men and women are about 10 percentage points more likely to work. Using labor force data, Cribb et al. (2013) measure the effects of increasing the women’s state pension age from 60 to 61 years in the U.K. and find that this reform induced women (7.3 percentage points) and their spouses (4.2 percentage points) to work more. Hanel and Riphahn (2012) study the first two steps of the Swiss 1997 reform using labor force data and find that an increase in the FRA by one year delayed labor force exit by half as much. Third, our paper is also related to the literature on the impact of retirement on health (Kuhn et al., 2010; Coe and Zamarro, 2011; Hernaes et al., 2013) and the literature on the role of financial incentives for retirement on labor supply (Krueger and Pischke, 1992; Gruber and Wise, 1999; Coile and Gruber, 2007; Manoli and Weber, 2014; and Gelber et al., 2016) and in particular to Chetty et al. (2014) who quantify passive decision makers in the context of retirement savings decisions in Denmark.

We complement the literature in several ways. Disentangling the effect of changes in the FRA on benefits claiming from the effect on labor market exit can be difficult, because the two decisions are institutionally tied together in many cases. In Switzerland, pension claiming and retirement are completely untied, allowing us to identify the direct effect of increasing the FRA on these decisions separately. Our empirical design is rich, embedding both wealth effects, and changes in the price of early claiming. This design allows us to learn about features of the joint distribution of costs that prohibit people from adjusting claim and labor force exit decisions. The sharp implementation of the reform in our setting (rather than more gradual increases of the FRA of a few months per age cohort, as in the UK case, for example) yields a causal interpretation for our parameter estimates. We are able to take a regression discontinuity approach, a transparent and powerful empirical design, whereas previous studies adopt a difference-in-differences or a interrupted time series design, both vulnerable to violations of identifying assumptions. Finally, our approach to quantifying the subpopulation of passive decision makers complements the approach in Chetty et al. (2014) who exploit the fact that savings is a continuous decision variable, so that, assuming an interior optimum, an individual’s non response to a change in incentives is sufficient to count the individual as
passive. The choice variable in our setting (to delay claiming or not) is discrete, and as such we must develop a new approach which delivers bounds around the proportion of the population that is passive instead of a point estimate. Only with some mild structural and behavioural assumptions are we able to finally point identify the fraction of passive decision makers.

The outline of the paper is as follows. We next discuss the institutional background. Section 2 presents the data and descriptive statistics. Section 3 presents a descriptive preview of our main RD results. Section 4 discusses the RD strategy and presents the main results. Section 5 describes our strategy for identifying bounds around the proportion of the population that is passive, presents estimates of the bounds, and then develops and estimates a simple dynamic discrete choice model of benefits claiming to point identify and estimate the fraction of passives. Section 6 concludes with a summary of our findings and their policy implications.

2 Background

This section presents the Swiss old age pension system, discusses the reform we use to assess the effects of raising the full retirement age on labor supply, income, and mortality, and presents our main hypotheses.

2.1 Pension Wealth and Work

The Swiss OASI pays a full pension to anyone claiming at the full retirement age (FRA), 62 years for women (before 2001) and 65 years for men. Men and women need to contribute to the pension system by paying social security taxes of 8.4% on their wage or unemployment benefits. Full contribution to social security means paying into the system for each year between age 20 until the FRA. Pensions are reduced by 2.3% per missing contribution year. Students, individuals living on disability benefits, and other non-employed individuals pay means-tested non-employment contributions to maintain a continuous contribution history.

Individuals with a full contribution history receive a pension whose level depends on average indexed (annual) earnings (AIE). Individuals with AIE of 14,100 CHF, or lower, receive the minimum pension of 14,100 CHF, so the replacement rate is 100% or higher. Individuals with AIME of about 84,600 CHF, or higher, receive an annual pension of 28,200 CHF, so the replacement rate is 34% at the maximum pension.

\footnote{Voluntary contributions are means-tested and range from less than 500 Swiss Francs or CHF (CHF 1 = USD 1.07 = 0.83 EUR) for individuals with wealth below 300,000 CHF to 24,000 CHF for individuals with wealth at 8.4 Million CHF or higher.}

\footnote{Average earnings are supplemented for parents who have taken care of children below age 16, or individuals who provide for relatives in need of care. Supplements are equivalent to three times the minimal pension.}
OASI benefits replace about 30% of pre-retirement earnings, and redistribute from high earners to low earners. Benefits are indexed to the average of price and wage inflation, adjustments taking place every other year. The precise annual benefits \( b \) for an individual with an AIME of \( a \) that receives full benefits (claims at the FRA) is given by the formula in equation 1:

\[
b = 14100 \times I(a \leq 14100) + \\
(14100 + 0.26 \times (a - 14100)) \times I(14100 < a \leq 42300) + \\
(21432 + 0.16 \times (a - 42300)) \times I(42300 < a \leq 84600) + \\
28200 \times I(a > 84600)
\]

Individuals who claim their old age pension later than the FRA earn an actuarially fair increase in their pension, \( r \times b \) with \( r > 1/ \) For instance, a women who delays claiming benefits by one year receives a 5.2% higher pension than at the FRA, not capped at the maximum regular pension (i.e., \( r = 1.052 \)). Delaying and claiming late is an active decision. Individuals who wish to delay claiming benefits until after the FRA must have inform their local OASI agency about this intention in the year after they attain the FRA. Individuals who do not inform the agency receive the same benefits as they would have if they had claimed at the FRA. Individuals who work beyond the FRA continue to pay social security taxes on any job with income that exceeds 1,400 CHF per month (the earnings disregard) even though the additional contribution years do not increase their pension level. Prior to the reform there was no Early Retirement Age, so claiming before the FRA was not an option. We discuss this further below.

Married spouses are assessed as individuals until both spouses claim benefits. Couples are eligible for a joint pension that is equal to 150% of the husband’s pension. A claiming husband whose wife is 55 years or older but has not started claiming yet, receives a supplement of 30% of his individual pension.

Individuals have access to two additional sources of pension wealth. The first is an employer provided occupational benefit plan to guarantee the accustomed (pre-retirement) standards of living. Occupational benefits can differ enormously, as the government only regulates contributions and pay-outs. Contributions are mandatory for annual earnings that exceed about CHF 20,000. Occupational pensions specify a “second pillar” full retirement age that need not be the same as the “first pillar” FRA (the FRA associated with social security). Individuals who reach the second pillar FRA can either receive an annuity, withdraw a lump-sum amount, or receive a mix of these two. The majority of retired individuals choose the annuity.
even though the first pillar already provides an annuity stream in old age (Büttler and Teppa, 2007). Second pillar pensions can be withdrawn as early as age 58 years, with actuarially fair adjustment. Late claiming is also possible if the pension plan allows it. The net replacement rate of the second pillar is on the order of 40% for the average earner. The second pillar system is very fragmented: 2,543 pension funds operated in 2007 offering plans that are very heterogeneous regarding claiming and payout options.

The second additional source of pension wealth consists of tax deferred savings accounts, or life insurance policies, to supplement the state pension with sufficient means to ensure an ultimately comfortable retirement. The contribution rate is decided individually. Contributions to the third pillar are deducted from taxable income. Wealth in tax deferred savings account is taxed, albeit at a reduced rate.

Many OASI embed strong disincentives from working an extra year, through small or no adjustments of benefits for delays in claiming. In some systems, retiring from work and claiming are one and the same decisions. IN Switzerland claiming and retiring from work are separate decisions, and the Swiss OASI offers actuarial adjustment for delays in claiming. Switzerland also has no mandatory retirement at the FRA (Senti, 2011). Workers who wish to leave the labor force upon reaching the FRA have to quit their job by formally informing their employer of their decision. Workers covered by collective agreements or public sector employees may have contracts that terminate automatically upon reaching the FRA. These contracts can, however, be renewed. Continuing work beyond the FRA is often financially attractive as contributions to company pensions are no longer mandatory. But many employment relationships are implicitly understood to end at the FRA. Moreover, employment protection legislation weakens at the FRA. Considering that workers have access to a pension after the FRA, the Swiss Supreme Court has ruled that dismissal was just in situations that would have been unjust for a worker younger than the FRA. Effective employment protection is likely to be weaker beyond the FRA.

Unemployment insurance (UI) and disability insurance (DI) are income support programs that can serve to finance hidden forms of early retirement. Though UI is more generous to individuals who are two years from the FRA, it is no easier to qualify for older workers than it is for younger ones. By comparison, DI pays higher benefits than UI, though the requirements for receiving DI benefits are more stringent. Time on both UI and DI counts towards the contribution requirement for receiving full social security benefits.

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7Part-time retirement is not possible in the first pillar. Workers who move to part-time employment in the years before retiring incur an adjustment as their average pension contributions decrease. The second pillar allows for part-time retirement with penalties for late or early claiming on the part taken out before or after the FRA.
2.2 The 1997 FRA Reform

The Swiss government enacted a major reform of OASI to take effect as of January 1, 1997. The most important element of this reform was an increase in the FRA for women from age 62 to age 64, affecting all women born January 1, 1939 or after. The increase occurred in two main stages. First, the FRA was increased to age 63 for women born between 1939 and 1941 and to age 64 for women born in 1942 or later.

The second major element of this reform was the introduction of early claiming. Women born January 1, 1939 or after could still claim benefits as early as age 62 subject to an adjustment of 3.4% of full benefits for each year of claiming prior to the FRA. The price for early retirement doubled, from 3.4% to 6.8%, for women born on January 1, 1948 or after. Women who wanted to claim pensions early had to inform a pension agency in advance, at least one day ahead of their early retirement birthday. Early claimers continue to contribute to the system until the FRA, either through the social security tax, if working, or through a tax on their pension income, if not working. Importantly, there is no direct tax levied on incomes of early claimers, except for the fact that earning an income and a pension may place them in a higher tax bracket.

Figure 1 shows how the Swiss systems adjusts pensions for early or late claiming. The blue line gives the pension adjustment factor (PAF) for women born in 1938, the last cohort unaffected by the reform, who we label as the fra62 cohort. Women in this cohort could not claim old age pensions before age 62. Women who started claiming old age pensions at age 62 received the full pension amount, i.e. their PAF was at 100%. Women who delay claiming an old age pension by one year to age 63 were entitled to a pension that was 5.2% higher than the full pension, and it increases further (in an actuarially fair way) for every year of delay.

The figure illustrates how the reform affected the PAF in three stages. The yellow line provides the adjustment factor for women born 1939 to 1941. For this cohort, 62 became an Early Retirement Age (ERA). Individuals could claim benefits at the ERA, but doing so would mean a 3.4% cut to benefits. Delaying to the new FRA of 63 would mean eligibility for a full pension, with actuarially fair adjustments to pensions for those claiming later than the FRA at 63 years. We label this cohort the fra63 cohort.

The green line gives the adjustment factor for women born between 1942 and 1947, who we label as the fra64 cohort. As in the case of the fra63 cohort, these individuals can claim a year early (at age 63) at the price of a 3.4% cut to benefits. Additionally, individuals in the fra64 cohort may claim benefits as
early as age 62 (2 years before their FRA), at the price of a 6.8% cut to their pension. Women in FRA64 who wait until the FRA (age 64) receive their full pension. Pensions for those delaying to claim beyond the FRA receive benefits adjusted at an actuarially fair rate.

Notice that the Pension Adjustment Factors for both FRA63 and FRA64 are kinked at their respective FRAs, while the same is not true for the FRA62 cohort. This is due to the fact that the penalties for claiming early as a member of either FRA63 or FRA64 are not actuarially fair - the lifetime discounted expected pension wealth for the average woman that claims early as a member of either of these cohorts is actually larger than what it would be if she claimed at her FRA.

Finally, the red line applies to women born in 1948 or later, who also have an FRA of 64. The adjustment for these women is such that they could claim at age 63 years and face a 6.8% cut to their pension, or at age 62 years at a cut of 13.6%. The early claiming adjustment for this cohort of women is double the adjustment of the FRA63 and FRA64 cohorts, and in fact raises the PAF to a level that is more than actuarially fair. As such, we label this cohort the MAF cohort.

Three other elements of the reform are important in our context. First, the 1997 reform changed pensions for couples. Prior to the reform, retired couples earned 150% of the husband's pension. The 1997 reform introduced splitting. Once both husband and wife claimed benefits, the earnings accumulated by husband and wife during the marriage were split equally between the two. These split earnings trajectories were used to determine the pension benefit separately for husband and wife. All new pensions were calculated according to the new rules immediately, and on-going pensions were re-calculated from January 1, 2001 onwards. Splitting came into effect in 1997, whereas the FRA increase affected new pensions from 2001 onwards, so that splitting does not affect our analysis of the effects of the FRA on women's decisions.

Second, the 1997 reform abolished the supplementary pensions for retired husbands whose wives were born in 1942 or after. This change could in principle affect our analysis of the FRA64 reform, because it the change also occurs sharply around the January 1, 1942 cutoff. We assess this by studying single women, or women with a young husband.

Third, the reform introduced early retirement for men. From January 1, 1997 onwards, men could claim old age pensions at age 64, one year prior to men's FRA at 65. The first cohort affected is the cohort born in 1933. Pension benefits were reduced by 6.8% for those men who decided to retire early, i.e. the early claiming adjustment was twice as large for men than for women. Starting January 1, 2001, men could claim old age pensions at age 63, up to two years prior to the FRA, at a discount of 6.8% per year of early claiming. The first cohort affected is born in 1938. There were no changes in supplements for late
retirement. We document whether men take advantage of early retirement, at the price of 6.8%, or not.

2.3 Wealth Effects

The Swiss reform provides a unique opportunity to study how behavior responds to shocks to pension wealth. First, in Switzerland retiring from work and claiming benefits are two separate decisions, because the pension system allows individuals to claim a pension and work at the same time. A second key advantage of our design is that we observe individual decisions both at a low price, of $\alpha = 3.4\%$, and a high price, $\alpha = 6.8\%$. Finally, in the first stages of the reform there is an increase in the FRA with a small change to the price of early claiming, while in the final stage there is no change in the FRA but a sharp increase in the price of early claiming.

Figure 20 presents social security wealth (SSW) as a function of claim age for each of the four different cohorts. The figure shows that all reform steps had sizeable effects on OASI wealth. For FRA62 (in blue), discounted expected pension wealth is roughly constant, reflecting the actuarial fairness of the Pension Adjustments associated with each claiming age. Beginning with the cohort FRA63 (yellow), women are not forced to claim benefits at the FRA. Cohort FRA63 experiences a negative wealth shock relative to FRA62, and it is actuarially advantageous for women in cohort FRA63 to claim early, as expected discounted pension wealth is higher for those who do so. Cohort FRA64 is similar - women in this cohort should claim before age 64 if maximizing pension wealth is the objective. Given the low price of early claiming, women in these cohorts can partially mitigate the implied wealth shocks by claiming early. Finally the MAF cohort is strongly disincentivized from claiming early.

Figure 20

We first illustrate the simple trade off faced by an individual that is deciding when to claim benefits. Suppose for simplicity that the individual expects to live for $T$ periods. If the individual discounts the future at rate $\beta$, the lifetime discounted value of receiving benefits $b$ each period at age $t$ is given by:

$$V_t(b) = \sum_{\tau=t}^{T} \beta^{\tau-t}b$$

8But there are links between the two decisions. Women who claim a pension early, and continue to work until the FRA, will potentially enter a higher income tax bracket. This tax increase needs to be added to the price of early retirement, increasing it from 3.4% to about 4%, depending on progressivity of state and local tax. Recall that the contribution requirement extends until the FRA, not distorting the early claiming decision. Women who claim benefits early but work until the FRA contribute by continuing to pay social security taxes on the wage they earn. Women who claim early but do not work pay non-employment contributions, levied on their retirement income.

9We calculate SSW as in Table 2 for a women with average life-expectancy and a discount rate of 2% per year.

10Pension adjustments are actuarially fair for the general population. Women have a higher life expectancy than the general population.
If we take $t$ to be the FRA, this is the value of receiving full benefits. An increase in the FRA by a year accompanied by a penalty for claiming early introduces a trade off. Let the penalty, or adjustment factor, be given by $\alpha < 1$, so that an individual who claims early receives $\alpha b < b$ each period for the rest of their life. At period $t$, the value of claiming is:

$$V_t^\alpha(b) = \sum_{\tau=t}^{T} \beta^{\tau-t} \alpha b$$

(3)

If the individual delays a period, she receives

$$V_{t+1}(b) = \sum_{\tau=t+1}^{T} \beta^{\tau-(t+1)} b$$

(4)

Maximizing pension wealth at period $t$ means comparing $V_t^\alpha(b)$ with the discounted value of claiming next period, $\beta V_{t+1}(b)$. Comparing these we get that an individual delays if and only if:

$$\frac{\alpha}{1-\alpha} < \sum_{\tau=t+1}^{T} \beta^{\tau-t}$$

(5)

or:

$$\alpha < \frac{1}{1 + \sum_{\tau=t+1}^{T} \beta^{\tau-t}}$$

(6)

As $T$ gets large the RHS gets smaller and this condition is less likely to be satisfied for a given $\alpha$. This is intuitive. The longer a person expects to live, the more costly is a penalty on benefits for every period into the future. In the limit as $T \to \infty$ the RHS approaches $\beta$. So an individual that expects to live forever will delay claiming if $\alpha < \beta$ and claim early if $\alpha > \beta$. $\beta$ is the cutoff point where an individual is indifferent between claiming early and delaying - it is the actuarially fair adjustment for an infinitely lived individual. This is because reducing benefits associated with claiming early by a factor of $\beta$ would result in a lifetime payoff exactly equal to receiving full benefits starting from next period.
Returning to the case of finitely lived individuals, the equation:

$$\alpha = \frac{1}{1 + \sum_{\tau=t+1}^{T} \beta^{\tau-t}}$$  \hspace{1cm} (7)$$

allows us to characterize, for candidate values of $\alpha, \beta$, the life expectancy one should have to rationalize claiming early or not. In Table I we compare rates of early claiming in the data (first column) with simulated rates assuming pension wealth maximizing individuals, for a given discount factor and using the value of $\alpha$ implied by the policy (say, $T(\alpha, \beta)$) and life expectancies in the data. In the first row we consider the FRA63 cohort. For this cohort, early claiming means claiming at age 62, and delaying means not claiming until 63. In the data, 22.3% claim at age 62, while pension wealth maximization would dictate that 70.9% claim early if $\beta = 0.98$, 47.8% claim early if $\beta = 0.99$ and 35.6% claim early if $\beta = 1$. In other words, there is no discount factor that can rationalize the rates of early claiming we observe in the data for this cohort. The story is similar for the other stages of the reform. This is highly suggestive that a substantial fraction of individuals do not maximize pension wealth.

Table I

3 Data and Descriptive Statistics

3.1 Data

Our empirical analysis uses Swiss Social Security data (SSSD) from three sources. The first data source covers all women born between 1935 and 1948. We observe their labor market histories, beginning in 1982 and currently observed until the end of 2013. Individual accounts contain detailed information on labor supply. Employed or self-employed individuals generate one record per employment spell per year that details the starting and ending month of an employment relationship along with the total earnings over that time period, without information on full- or part-time status. Unemployed benefit recipients also generate one record per year that contains information on unemployment benefits and the starting and ending months of an unemployment spell. Individual accounts also contain information on week of birth, and nationality.

The second data source contains information on all disability and old age pension claims. For old age pensions, we observe the start date of the old age pension, its benefit level along with the contribution

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\(^{11}\)We calculate average mortality probabilities and use these together with $T(\alpha, \beta)$ to calculate the fraction of individuals who live longer than $T(\alpha, \beta)$, and should therefore delay. The complement of this fraction is the fraction that should claim early.
years and average indexed monthly earnings (AIME) used to calculate the pension level. For disability pensions, we observe the start date of the disability pension, its level, and the reasons for granting it. The pension claims data also contains information on mortality as both disability and old age pension claims terminate when its claimant dies. We match spouses to married women and observe information on their labor supply and pension claiming.

The third data source contains income tax records of individuals who live in a large region of Switzerland. These records cover the period between 2001 and 2015 and contain detailed information on income, asset holdings, and asset returns.

### 3.2 Descriptive Statistics

We extract a series of samples of women with labor force attachment who were just affected or not affected by the changes implemented with the reform. Specifically, we focus on women born between 1938 and 1939, between 1941 and 1942, and between 1947 and 1948, around the sharp cutoffs generated by the reform. We exclude women who are never employed after age 50 those who claim a disability pension before age 50.

Our empirical analysis focuses on the following key outcome variables. **Exit Age** is the last age an individual has positive earnings in the individual accounts data (monthly precision). **Claiming Age** is the age an individual first starts claiming a disability or old-age pension (daily precision). **Mortality** is the probability of dying up to 2013, the last year we observe in our data. **Social Security Benefits** refer to the old age pension amount (in CHF per year). We also construct a measure of **Social Security Wealth** as the expected sum of discounted benefits after the claiming age. Specifically, SS Wealth = \( \sum_{s=R}^{T} \frac{b(s=R)}{(1+r)^{(s-R)}} \times p_{s|R} \) where \( R \) is claiming age, \( b(s=R) \) is the pension benefit at that claiming age, \( T \) is the maximum age an individual can live to (assumed to be 110 years), \( r \) is the discount rate (set at 2%), and \( p_{s|R} \) is the probability of being alive at date \( s \) conditional on claiming old age pension benefits at age \( R \).

Table 2 reports summary statistics for the three samples we use to measure the effects of increasing the FRA from 62 to 63 years (column 1) and from 63 to 64 years (column 2), and re-instating actuarial fairness (column 3). Panel A provides statistics on the key outcome variables. Women leave the labor force about two to three years before the FRA. The average claiming age is between 0.4 to 1.7 years below the FRA. Average social security benefits are around 19,000 CHF for one year. Discounted social security wealth is about 19 times larger than the annual pension benefit.
Panel B of Table 2 shows summary statistics on key background variables. About one in five or six women has a non-Swiss nationality. About 63% of women are married. About 30% of women in FRA63 sample get a supplementary pension. Supplementary pensions are less frequent in the FRA64 and MAF samples; only about 20% in the FRA64 sample and 8% in the MAF sample receive one because the 1997 reform abolished the supplemental pension for women born in 1942 or after. Indexed average earnings – the base for setting the benefit amount – are 50,497 CHF per year for the women affected by the FRA increase from 62 to 63, about 2,500 CHF larger for women affected by the change in the FRA from 63 to 64 years, and about 3,400 CHF larger for women affected by the MAF change. Old age benefits replace about 37% (=18,999/50,956 * 100) of indexed earnings in the 62 to 63 years sample, and the replacement rate is similar for the FRA64 and MAF samples. Annual earnings at age 55 are about 34,645 CHF in the FRA63 sample, about 36,919 CHF in the FRA64 sample and 41,098 in the MAF sample. Annual earnings are lower than indexed earnings for two reasons. First, annual earnings look at the entire year regardless of whether a women worked or not; periods of non-employment contributing zero to annual earnings. Second, indexed earnings also reflect care supplements. Old age pensions replace about 50% of annual earnings at age 55.

4 Descriptive Analysis

This section provides an overview of the effects of the 1997 reform to pension incentives. We contrast the cohort just affected by the reform with the cohort just not affected by the reform. This comparison provides a raw measure of the causal effect of the stages of the reform on claiming and labor market decisions, but may be confounded by trends or cohort composition effects.

Figure 3(a) reports effects of FRA63 on the hazard probability of disability or old age pension claiming. Women born in 1938 (blue line) are eligible for a full old age pension at 62 years, with no possibility to draw an early retirement pension before. The claiming hazard is slightly positive before age 61, reflecting disability insurance claiming, which is possible before age 62. The hazard probability peaks at close to 1 at age 62, so women almost perfectly comply with the full retirement age. Interestingly, few women take-up the possibility to retire later than the full retirement age in spite of the incentive to do so. We suspect this is due to the strong default rules built into the system, as individuals need to actively opt out of retirement at the full retirement age to delay claiming beyond it. Raising the FRA to age 63 (red line) reduces the claiming hazard at age 62 substantially, from nearly 100% to just over 20%. The hazard is again nearly 1 at the new FRA of age 63. Raising the FRA to 63 years delays pension claiming substantially, but a
sizeable proportion of women draw their pension also at the early retirement age of 62.

In Figure 3(b) we contrast the claiming hazards for the cohorts around the FRA64 cutoff. Individuals born in 1941 (blue) receive full benefits if they claim at the FRA of 63, while individuals born in 1942 (red) receive full benefits if they claim at the FRA of 64. The comparison is similar to that of the FRA63 cutoff. The hazard is near 1 for both cohorts at their respective FRAs. Interestingly, the hazards are also almost identical at roughly 20% in the year before the respective FRAs, and the hazards at 62 (two years before the FRA for the 1942 cohort) are also similar across the cohorts. There is substantial early claiming in both cohorts.

Finally, in Figure 3(c) we contrast the hazards for the cohorts around the MAF cutoff. Here, individuals born in 1947 (blue) and 1948 (red) both receive full benefits if they claim at the common FRA of 64, but the penalty for claiming before 64 is much higher for the 1948 cohort. Again the hazards for both groups are close to 1 at the FRA. The early claiming hazard is over twice as large for the 1948 cohort relative to the 1947 cohort, suggesting that the increased penalties for early claiming were effective.

The descriptive evidence in these figures seems to suggest that default effects are an important part of the story. In Figures 3(a) and 3(b) we see that the hazards move in lock-step with an increase in the FRA even though, for the average women in the treatment cohorts, claiming before the FRA maximizes pension wealth. Women who claim before the FRA and continue to work potentially enter a higher tax bracket. One might be concerned that the tax implications of claiming while working explain much of the shift in claiming behavior that we observe in Figures 3(a) and 3(b). We can check whether this is the case by excluding women who work as of age 62. The remaining individuals do not have to worry about the tax implications of claiming early because they do not have labour earnings that can be taxed. Figure 4 presents the claiming profile for women who have exited the labor market by age 61. Claiming responses are similar for these women as for the overall population, suggesting that the strong claiming response is not entirely driven by the tax implications associated with claiming early while working.

Figure 4

Figure 5(a) shows how the reform affected the retirement hazards for the cohorts in FRA63. Increasing the FRA significantly delays retirement, as the hazards at the respective FRAs are approximately equal, at just under 0.8. Interestingly, the reform also decreases the hazard at age 61, a year before the old FRA, and a small sub-group of women born in 1939 continue to leave the labor force upon reaching the old FRA of
62 years. FRA63 increases labor supply substantially, and the increase is concentrated around age 62 and 63.

Forward looking individuals might adjust labor supply already in advance of an increase in the full pension age. Although FRA63 was announced only four years before coming into effect, leaving little time to adjust, FRA64, announced 8 years before coming into force, might leave enough time for anticipatory behavior. In Figure 5(b) we compare the retirement hazards for the cohorts around the FRA64 cutoff, and we see that the patterns are roughly the same as in the case of FRA63, although the hazards in Figure 5(b) are lower at ages 61-63, suggesting some mild anticipatory behavior. Finally, Figure 5(c) presents the retirement hazards of women born around the MAF cutoff. 1947, the last cohort facing an early retirement adjustment of 3.4%, and of women born 1948, the first cohort facing the double adjustment. Labor supply patterns are fairly similar between the two groups with the exception of the ages 62 and 63, the period when drawing retirement benefits became more expensive. MAF raises labor supply, but to a lesser extent than the two increases in the FRA did.

5 RDD Results

In this section we present our empirical strategy for identifying the causal effect of the different stages of the reform on claiming decisions, labor supply and pension wealth, and then present and discuss the results.

5.1 Empirical Strategy

The 1997 reforms generate sharp cutoffs with respect to an individual’s birthdate. While women born on Dec. 31 1938 can claim and receive full benefits at age 62, women born the next day, on Jan. 1 1939, have an FRA of 63 with the option to claim early at age 62 at the price of 3.4% of benefits. The same new rules hold for women born up to Dec. 31 1941, but a woman born on Jan 1. 1942 has an FRA of 64 and can again claim early at the price of 3.4% per year early. These rules again apply to women born up to Dec. 31 1947, but a woman born on Jan. 1 1948 now pays 6.8% per year early. We can thus identify three different treatment affects, one associated with each stage of the reform, as long as the distribution of observable and unobservable characteristics is similar to the left and right of each birthdate threshold.
We estimate regressions of the following type:

\[ y_i = \alpha + \beta D_i + f_0(Z_i - z) + D_i f_1(Z_i - z) + X_i' \delta + \varepsilon_i \]  

where \( i \) indexes the individual. \( Z(i) \) is the birthdate of individual \( i \) and \( z \) is the cut-off date associated with a given stage of the reform. The variable \( D_i \) is the treatment indicator, which takes the value 1 if the woman is born to the right of the cutoff and takes the value 0 otherwise:

\[
D_i = \begin{cases} 
1, & \text{if } Z_i \geq z \\
0, & \text{otherwise}
\end{cases}
\]

\( f_0() \) and \( f_1() \) are unknown functions, allowed to differ flexibly across the threshold, included to control for trends in \( Z_i \). The coefficient of interest is \( \beta \) which measures the impact of the increase in the FRA on the outcome variable \( y_i \).

We adopt a local linear regression approach in estimating treatment effects. We present results for a bandwidth of 12 weeks, but we also present estimates for larger bandwidths. We probe sensitivity of our results to adopting a linear or quadratic specification for \( f_0() \), and \( f_1() \). Our baseline results adopt a linear specification.

Validity of the RDD requires that women cannot manipulate the assignment variable (Lee and Lemieux, 2010). In our context, the assignment variable is the date of birth of women in the birth cohorts 1938 and 1939. Clearly, it is impossible that women or their parents manipulated the date of birth in anticipation of the policy change. But seasonality in births or other policy changes or anticipation of WWII could still have been driving dates of birth. We are not aware of any change in the incentive to give birth in 1939 as opposed to 1938, for example. There is no change in the number of women born in the weeks around the cutoff dates (Appendix Table 9).

We carefully examine the distribution of co-variates and see no evidence of a significant change in the means of background variables (Appendix Table ??) around the cutoff dates. These checks do not indicate concerns with the validity of the RDD.

The RDD identifies the effects of an increase in the FRA only if there is no other policy change at the same age cutoff. The 1997 reform also introduced a new algorithm to separately calculate old age pensions for husbands and wives. This splitting algorithm does not affect our estimates of the effects of increasing the FRA since it applies to all women regardless of their date of birth. The reform also abolished the supplementary pension for women born after 1942. This aspect of the reform could confound our
estimate of an increase in the FRA from 63 to 64 years. We explore sensitivity of our results for FRA64 in a sub-sample of women that were not affected by abolishment of the supplementary pension.

5.2 RDD Estimates

Panel B of Table 3 presents our estimates of the effect of the different stages of the reform on claiming and labor market exit behavior. We present estimates for two different bandwidths, a “local” one (12 weeks) and a “global” one (30 weeks). The FRA63 and FRA64 stages of the reform increase the age of claiming by 7-8 months, and the age of retirement by 5-8 months. The MAF stage of the reform has a much more modest effect on claim age, increasing it by just over 4 months and has no effect on the age of retirement. These effects are consistent with the hazards in Figure 3(a)-(c). The estimates depend only slightly on the bandwidth. Figures 7(a)-(f) graphically correspond to the estimates in Panel B and depict claiming and retirement behavior around the cutoff.

Panel A of Table 3 presents our RD estimates of the effect of each stage of the reform on pension benefits. Consider first the effect of FRA63 in column 1. There is no significant effect of the reform on annual benefits, but a substantial decrease in pension wealth. This is perfectly consistent with the hazard estimates in Figure 3(a), where we see that most individuals adjust their claim age to the FRA, and thus receive full benefits, but for one fewer year. The result is a decrease by about 6% of lifetime pension wealth. In the second column we see that FRA64 decreases not only pension wealth, but also the size of annual pension benefits. This is also consistent with Figure 3(b), where we saw substantial early claiming so that many individuals receive penalized annual benefits. Figures 6(a)-(f) graphically correspond to the estimates in Panel B and depict individual pension benefits and Social Security Wealth around the cutoff.

The third row of Panel A provides estimates of the component of the decrease in SSW that is due to a behavioral response. To obtain this quantity, we first calculate the pension wealth that individuals in the control group (on the right hand side of the thresholds) would receive with the treatment benefit schedule, holding their decisions fixed. This is graphically depicted in Figures 6(a)-(f) by the dotted line on the left of the cutoff. The difference between the actual pension wealth of individuals in the treatment group (the line on the RHS of the cutoff) and this quantity yields the amount of SSW lost as a result purely of behavior. The lost SSW due to behavioral response for FRA63 and FRA64 is about 40% of the total lost SSW. A substantial amount of wealth could have been saved had individuals not adjusted their claim behavior as they did.

12 All specifications use a local linear or quadratic regression with triangular kernel with a bandwidth of 12 weeks on each side of the cut-off birthdate.
In Figures 8-10 we study the costliness of claiming mistakes in another way. We first calculate for each individual, given her birthdate and mortality rate (a function of observable characteristics), what claim age would maximize $ssw$. We then take this maximum $ssw$ and subtract it from the individual’s observed $ssw$, creating a new outcome variable to measure loss. We then study how this loss changes around the cutoff for each stage of the reform in Figure 8. If individuals always claim to maximize pension wealth, the reform should have no effect on this variable because it would always be zero. Individuals born before 1939 do not make mistakes, because there is no option to claim early (before the FRA of 62), and the rewards for claiming late are set in an actuarially fair way. Individuals born after Jan 1, 1939 make costly mistakes on the order of about 5000 CHF, as most increase their claim age to 63 with the increase in the FRA, although claiming at the Era would maximize pension wealth given the low price of early claiming and their life expectancy. The cost nearly doubles for individuals born after 1941. Here a substantial fraction of individuals raised their claiming age again to the new FRA of 64, though early retirement was available at 62 or 63 again at a low price. Finally with the MAF stage of the reform the cost of mistakes made drops to about 1000 CHF, as early claiming becomes very costly and most individuals claim at the FRA of 64.

In Figures 9 and 10 we look at how the costliness depends on observable characteristics of individuals. In Figure 9(a) we see that the cost is highest as a fraction of lifetime earnings (AIME) for the lowest income individuals. This can not necessarily be interpreted as higher income individuals making less mistakes than lower income individuals, however. Benefits are relatively flat with respect to AIME (the system is redistributive - see section 2 above), so that the cost of a mistake does not increase in AIME at a one to one rate. In Figure 9(b) we plot RD estimates at each level of AIME for each stage of the reform, and we see that the causal effect of the reforms on lost $ssw$ as a fraction of AIME also increases with AIME for the first two stages of the reform, but that the MAF stage of the reform seems to decrease costly mistakes, and have a smaller effect the higher is AIME. Reforms that change the FRA with little penalty to claiming early causes costly mistakes, and disproportionately so among lower income individuals, while the reform that kept the FRA fixed but significantly increased the price of early claiming corrected costly mistakes, and disproportionately so for lower income individuals, largely because lower income individuals in the control group of MAF reform were the ones making costly mistakes.
In Figure 10 we look at how the cost of claiming decisions as a fraction of AIME depends on a set of observable characteristics. Most notably, Swiss nationals forego a larger amount of SSW as a fraction of AIME than do foreigners, and private sector workers lose more than do public sector workers. Consistent with Figures 9(a) and (b), individuals with higher earnings at age 55 lose less SSW as a fraction of AIME than those with lower earnings.

In sum, individuals responded strongly to the first two stages of the reform, which each increased the FRA by a year and introduced early retirement at a low price that actually makes early claiming more financially attractive than delay. They had a much smaller response to the third stage of the reform, which held the FRA constant but increased the penalty for early claiming to the point that delay was financially more attractive. These strongly suggest that, even though the design of the Swiss system (by keeping retirement and benefits claiming separate) encourages claiming at an age that maximizes lifetime pension wealth, a substantial fraction of the population does not do so, instead passively complying with the FRA as a default claiming age, a response that is costly in terms of foregone social security wealth.

5.3 Fiscal Implications

In Table 6 we study the fiscal implications of the reform for government’s social insurance budget—how individual benefits and contributions were affected. We report the present discounted value of benefits and contribution, discounted to the FRA for a woman with average life expectancy. In Panel A we consider the effects on benefits and income, and in Panel B we consider the effects on individual contributions. Increasing the FRA to 63 reduces social security benefits by about 17360 CHF in discounted present value terms, or by almost 5%, and raises contributions by about 4776 CHF in present value terms, due to the delayed exit from the labor force as a result of the reform. Unemployment benefits increase slightly, but contributions to the unemployment insurance fund do increase significantly, again a consequence of individuals working and contributing longer. Qualitatively, the effects of the FRA64 and MAF stages of the reform on benefits and contributions are the same as for FRA63, though many of the effects of the MAF stage are not statistically significant. In net, increasing the FRA in the FRA63 reform lowers the present discounted cost of one women by almost 20000 CHF. FRA64 has a stronger effect, reducing the net cost by just over 30000 CHF, due largely to a bigger decrease in Social Security Wealth as a result of the FRA64 reform. As a response to this reform, we see significant delay to age 64, when individuals had the option to claim two years (or one year) earlier with small penalty. This is why the FRA64 reform reduced wealth more

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13 The reform also affects income tax receipts, not shown in the table. Our estimates are a lower bound for the effect on the budget.
than the FRA63 reform, where there was only one possible year of early claiming. By contrast, doubling the price of early retirement in the MAF stage of the reform does not have a statistically significant effect on net fiscal costs, at least in the smaller bandwidth regression. As discussed above, MAF did not shift claim ages significantly, so individuals on both sides of the threshold are likely to claim at 64.

\textbf{Table 6}

\subsection*{5.4 Robustness}

We have explored estimates with larger and smaller bandwidths, or with control variables to assess the sensitivity of our results to bandwidth choice. Our estimates are robust to these alternative specifications. Figure \textbf{18} reports estimates of the effects on labor market exit, and claiming age, varying bandwidth between 4 and 38 weeks. Effects are broadly robust to varying the bandwidth. We have also looked into Placebo and real RDD estimates (Figure \textbf{19}). Reform effects are orders of magnitude larger than effects of Placebo reforms.

Recall that the reform abolished supplementary pensions for couples with a retired husband, and a non-retired wife older than 55 years and born after 1942. Supplementary pensions were abolished at the same time as the FRA was increased for wives whose husbands were older. We assess sensitivity of our results for FRA63 by considering single women, or women living with a husband who is at most two years older. Indeed, supplementary pensions are much less frequent among women born 1942 or later, compared to women born at the end of 1941 (Appendix Figure \textbf{26}(a)). But single women and age balanced couples were not affected by the reform, since these couples had no access to a supplementary pension (Appendix Figure \textbf{26}(a)).

We assess robustness of our results for the FRA64 element of the reform in the sub-sample of single or age balanced couples (Table \textbf{4A}). Results for this sample are virtually identical to main results (Table \textbf{??}). Abolishing the supplementary pension does not appear to affect labor supply and claiming decisions.

\textbf{Table 4}

We also assess to what extent spouses react to their partner’s wealth shock (Table \textbf{4B}). Partners do not work longer to help accommodate the pension wealth shock, nor do they adapt pension claiming in response to the FRA increases. Interestingly, husbands whose wife was affected by the substantial increase in the price of early retirement, MAF, decided to claim benefits somewhat earlier, by about one month. We

\footnote{We have explored how different sub-groups react to pension wealth shocks (see Tables \textbf{5} and \textbf{??} in the appendix.}
speculate that MAF, by offering early retirement at the same price to both spouses, might have facilitated early retirement coordination, but hesitate to draw strong conclusions as the estimate is only significant in one specification.\footnote{Cribb et al. (2013) show that increasing the U.K. state pension age for wives by one year increases their husband’s employment rate by 4-5 percentage points, a result we do not find for the Swiss reform, perhaps because wealth shocks were smaller for Swiss women, compared to U.K. women.}

6 Active and Passive Types

The RD evidence points to a large fraction of individuals making sub-optimal (non pension wealth maximizing) decisions in response to the reforms. Chetty et al. (2014) label individuals who make retirement savings decisions optimally given preferences and constraints as “active” and individuals that do not as “passive,” and find that the existence of “passive” decision makers is important for explaining observed patterns in retirement savings behavior. More specifically, Chetty et al. (2014) study responses to two types of reform to the Danish pension system. In the first, they find that 85% of individuals do not reduce retirement savings in response to an increase in compensation through higher employer provided automatic contribution. In the second, they find that 81% of individuals do not reallocate voluntary contributions from capital pension accounts to annuity pension accounts when the relative price of contributing to the former increases. Because interior optima with respect to a continuous choice variable (retirement savings, portfolio allocation) should move in response to a price change, Chetty et al. (2014) are able to conclude that the non-responders to these policy reforms are “passive.”

The evidence we have presented so far, in particular the large increase in claiming age in response to the increase in the FRA when financial incentives would dictate that optimizing individuals should not delay, suggests that passive individuals might comprise an important fraction of the population in our setting as well. Here, passiveness would mean claiming benefits at the default age - the FRA - regardless of the financial incentives associated with claiming earlier (or later, for that matter). However, because benefit claiming is a discrete choice, we can not take the approach of Chetty et al. (2014) and count responders or non responders. To see why, consider the MAF stage of the reform, where the government increased the price of early claiming while holding the FRA fixed at 64. Individuals who change the year they claim in response are surely active decision makers, but individuals who do not may be passive or they may be active and found it optimal to claim at 64 under both incentive regimes.

Instead, in this section we exploit the variation in incentives generated by the policy reform to identify bounds on the fraction of the population that is passive. The policy reform can be seen as having induced
three different experiments. Individuals born in the neighborhood of Jan 1, 1939 are assigned to the first experiment, FRA63, individuals born in the neighborhood of Jan 1, 1942 are assigned to the second experiment, FRA64, and individuals born in the neighborhood of Jan 1, 1948 are assigned to the third experiment, MAF. Index experiments by \( q \), and as above, denote individual \( i \)'s birthdate by \( Z_i^q \) where we now use the superscript \( q \) to make explicit the experiment that individual \( i \) is assigned to. Denote the birthdate cutoff associated with experiment \( q \) by \( z_q \).

Also as above, the variable \( D_i \) indicates whether individual \( i \) falls to the left or right of the cutoff in the experiment she is assigned to. Formally:

\[
D_i = \begin{cases} 
1, & \text{if } Z_i^q \geq z_q \\
0, & \text{otherwise}
\end{cases}
\]

Finally, let \( F_i \in \{0, 1\} \) indicate that individual \( i \) delays claiming to the FRA associated with the experiment she has been assigned to. That is, delay in experiment FRA63 means claiming at or after 63, while delay in experiments FRA64 and MAF means claiming at or after 64. Compliance with experiment \( q \) means delaying if and only if \( Z_i^q \geq z_q \).

In our setting, compliance is informative about passivity. To understand why, consider Table 7. For example, individuals that are compliant with the FRA63 experiment delay claiming to age 63 if and only if they have \( D = 1 \). All passive individuals in this experiment behave this way, as they switch their claim year with the FRA by default. But some active individuals also behave this way. Active individuals choose when to claim optimally as a function of their preferences and constraints. This could mean that they delay when faced with the incentives of FRA63 and claim early otherwise, in which case they are compliant. This would be the case if, for example, the individual has a long life expectancy, so that even the small penalty for early claiming induces delay for an active decision maker. Or it may mean they find it optimal to delay claiming for either set of incentives, or always find it optimal to claim early, either of which would make them non-compliant. By contrast, a complier in the MAF experiment can not be passive, because the FRA does not change and passive individuals do not respond in such a case.

The first and second columns have similar composition in each group (row), because both experiments raise the FRA with an associated change in incentives. The third column is different, because it does not shift the FRA. The MAF experiment is such that the FRA is the same for both cohorts; all that changes is economic incentives. Thus, in contrast to the first two stages, there can not be passive compliers.

We now show how we can exploit rates of compliance, which are directly observable from the data under
no further assumption, to identify useful bounds around the fraction of the population that is passive which we label as $\pi$.

### 6.1 Upper Bound

The upper bound on the probability of passives is simple to obtain given experiments FRA63 and FRA64. Let $C$ and $N$ denote the events “$i$ is compliant” and “$i$ is non-compliant” respectively. For experiments $q \in \{\text{FRA63}, \text{FRA64}\}$, we have:

$$\text{Prob}_q(\text{Passive}) = \text{Prob}_q(\text{Passive}|C)\text{Prob}_q(C) + \text{Prob}_q(\text{Passive}|N)\text{Prob}_q(N)$$

$$= \text{Prob}_q(\text{Passive}|C)\text{Prob}_q(C)$$

$$\leq \text{Prob}_q(C)$$

where the first equality is by the law of total probability and the second is due the fact that there are no passive non-compliers to either FRA63 or FRA64. Random assignment of birthdate implies that individuals are randomly assigned to experiments with respect to their rationality so that $P_q(\text{passive}) = P(\text{passive})$ for any $q$, and we have the upper bound:

$$\pi \leq \min\{\text{Prob}_{63}(C), \text{Prob}_{64}(C)\}$$

Since all passives are compliers in these two experiments, both $\text{Prob}_1(C)$ and $\text{Prob}_2(C)$ are upper bounds on $\pi$, and both are identified. They are only bounds because there are potentially some actives in these groups. However, given that the change in incentives implied by the two experiments make delayed claiming less attractive, we imagine that the set of active compliers is quite small, particularly in experiment 2.

### 6.2 Lower Bound

Obtaining a lower bound on $\pi$ is slightly more involved. We need to make one further assumption, and then combine experiments FRA64 and MAF to obtain this bound.

Consider what it means to be an active complier in experiment FRA64. An active complier in this experiment should find it optimal to delay claiming to age 64 if and only if $D_i = 1$. However, delayed claiming in this experiment is not actuarially fair - maximizing lifetime discounted expected benefits would dictate claiming early, for the average individual. As such, we should expect a relatively small number
of active compliers. Experiment MAF makes delayed claiming more than actuarially far relative to early claiming for individuals with $D_i = 1$. We should expect the group of active compliers in experiment MAF to be larger than in experiment FRA64. We formally make this assumption:

**Assumption A1:**

$$\text{Prob}_{MAF}(\text{active}, C) \geq \text{Prob}_{64}(\text{active}, C) \quad (10)$$

With this assumption in hand, we begin as we did in the case of the lower bound, but now consider experiment 2 specifically. The fraction of the population that is active satisfies:

$$\text{Prob}_{64}(\text{Active}) = \text{Prob}_{64}(\text{Active}|C)\text{Prob}_{64}(C) + \text{Prob}_{64}(\text{Active}|N)\text{Prob}_{64}(N)$$

$$= \text{Prob}_{64}(\text{Active}, C) + \text{Prob}_{64}(N)$$

$$\leq \text{Prob}_{MAF}(\text{Active}, C) + \text{Prob}_{64}(N)$$

$$= \text{Prob}_{MAF}(\text{Active}|C)\text{Prob}_{MAF}(C) + \text{Prob}_{64}(N)$$

$$= \text{Prob}_{MAF}(C) + \text{Prob}_{64}(N)$$

The first line is by the Law of Total Probability, the second line is due to the fact that all non compliers in experiment FRA64 are active decision makers, the third line is by Assumption A1, the fourth line is by definition and the final line is due to the fact that all compliers in experiment three are active decision makers. This gives an upper bound on the fraction on actives, so that the complement of this probability is a lower bound on the fraction of passives. As $\text{Prob}_{MAF}(C) + \text{Prob}_{64}(N)$ are both identified, our two sided bounds are:

$$1 - \text{Prob}_{MAF}(C) - \text{Prob}_{64}(N) \leq \pi \leq \min\{\text{Prob}_{63}(C), \text{Prob}_{64}(C)\}$$

### 6.3 Estimation

To estimate bounds on $\pi$, we need estimates of the 4 probabilities $\{P_{63}(C), P_{64}(C), P_{MAF}(C), P_{64}(N)\}$. These are non-parametrically identified with no further assumption. For example, $P_q(C) = E_q[D_i|T_i = 1] - E_q[D_i|T_i = 0]$, meaning we can consistently estimate $P_q(C)$ using sample counterparts.
Alternatively, we can estimate these probabilities using the following regression:

$$D_i = \alpha_0 + \alpha_1 T_i + f_0(Z_i - z_i(q)) + T_i f_1(Z_i - z_i(q)) + \varepsilon_i$$ (11)

The sample estimators (evaluated at $Z_i - z_i(q) = 0$) are then given by $\hat{P}_q(C) = \hat{\alpha}_1$, and $\hat{P}_q(N) = 1 - \hat{\alpha}_1$.

6.4 Estimates

In table 7 we present estimates of the component objects required to construct the bounds derived above, as well as the bounds themselves. We estimate that $\pi \in [0.463, 0.691]$, so that between 46.3% and 69.1% of the population passively claims at the FRA.

Table 7

6.5 Point Identification and Estimation of $\pi$

In this subsection we first show that given knowledge of the probability with which an active decision maker claims benefits at age $t$, the fraction of passive decision makers $\pi$ is identified. We then exploit the fact that the discounted expected pension wealth associated with each possible claiming age is observable in the data, because we observe all the variables that determine pension benefits to solve for the probability of claiming at each age for each individual in the context of a simple dynamic discrete choice model. We then estimate $\pi$ using a finite mixture likelihood model, where $\pi$ is the mixing probability over the two types of individual.

Let $1_{it}\{claim\}$ indicate that individual $i$ claims at age $t$, $1_{it}^p$ indicate that individual $i$ is a passive decision maker, and let $1_{it}^a\{claim\}$ indicate that individual $i$ claims at age $t$ conditional on being active and $1_{it}^p\{claim\}$ indicate that individual $i$ claims at age $t$ conditional on being passive. By definition:

$$1_{it}\{claim\} = (1 - 1_{it}^p)1_{it}^a\{claim\} + 1_{it}^p1_{it}^p\{claim\}$$ (12)

These random variables are themselves functions of observables $x$, but ignore these for now, as this argument applies at any $x$. Notice that $1_{it}^p\{claim\}$ takes the value of 1 if and only if the individual’s age $t$ is equal to the FRA. So we re-write Equation (12) as:

$$1_{it}\{claim\} = (1 - 1_{it}^p)1_{it}^a\{claim\} + 1_{it}^p1\{FRA_i = t\}$$ (13)
Taking expectations over individuals at age $t$ on both sides and assuming the random assignment of passivity (conditional on observables), we get:

$$Q_t = (1 - \pi)P_t + \pi FRA(t)$$  \hspace{1cm} (14)$$

where $Q_t$ is the total probability of claiming at age $t$, $P_t$ is the probability an active individual claims at age $t$ and $FRA(t)$ is the fraction of individuals whose $FRA$ is equal to age $t$. $Q(t)$ and $FRA(t)$ are identified from the data without further assumption. Assume for the moment that $P_t$ is known. Solving, we get:

$$\pi = \frac{Q_t - P_t}{FRA(t) - P_t}$$  \hspace{1cm} (15)$$

and $\pi$ is identified. Note that $\pi \in [0, 1]$ because $FRA(t) \geq P_t \Rightarrow FRA(t) \geq Q_t \geq P_t$ and $FRA(t) \leq P_t \Rightarrow FRA(t) \leq Q_t \leq P_t$.

We now show that with minimal structural assumptions, $P_t$ is identified, implying identification of $\pi$. An individual’s pension benefit is fully determined by three variables, her age, her cohort and her average indexed annual earnings ($aime$). Let $b_t(c, m)$ represent the benefit payment that an individual who belongs to cohort $c$ and has $aie = m$ receives if she claims at age $t$. The flow payoff to claiming is:

$$u_{it}(1, c, m) = b_t(c, m) + \varepsilon_{it}(1)$$  \hspace{1cm} (16)$$

while the flow payoff to not claiming is:

$$u_{it}(0, c, m) = \varepsilon_{it}(0)$$  \hspace{1cm} (17)$$

where $\varepsilon_{it}(a)$ is a choice-specific shock, observable to the agent but not to the econometrician, independent and identically distributed over $i$ and $t$.

Claiming is irreversible, and individuals who don’t claim retain the option value to claim in the future. The choice specific values associated with each choice are:
\[ v_{it}(1, c, m) = b_t(c, m) + \sum_{\tau=1}^{T-t} \beta^\tau (b_t(c, m)) \] (18)

\[ v_{it}(0, c, m) = \beta EV_{t+1}(c, m) \] (19)

where \( \beta \) is the discount factor and \( EV_t(c, m) \) is the expected value of having the option to claim at age \( t \), given the incentives associated with delaying to that point. The expectation is due to the fact that individuals die with some probability at the end of each period.

It is standard in the dynamic discrete choice literature to assume \( \epsilon_{it}(a) \) is type 1 extreme value distributed for each \( a \in \{0, 1\} \), as this yields closed form expressions for choice probabilities and value functions:

\[ EV_t(c, m) = \ln (\exp(v_{it}(1, c, m)) + \exp(v_{it}(0, c, m))) \] (20)

and:

\[ P_{it}(c, m) = \frac{\exp\{v_{it}(1, c, m)\}}{\exp\{v_{it}(1, c, m)\} + \exp\{v_{it}(0, c, m)\}} \] (21)

We can now derive the likelihood function. The contribution of an active individual at age \( t \) to the likelihood is:

\[ L^a_{it} = P_{it}(c, m)^{a_{it}} (1 - P_{it}(c, m))^{1-a_{it}} \] (22)

where:

\[ P_{it}(c, m) = \frac{\exp\{v_{it}(1, c, m)\}}{\exp\{v_{it}(1, c, m)\} + \exp\{v_{it}(0, c, m)\}} \]

The contribution to the likelihood of a passive individual is:

\[ L^p_{it} = q_{it}^{a_{it}} (1 - q_{it})^{1-a_{it}} \] (23)

where \( q_{it} = 1 \) if \( FRA_i = t \) and \( q_{it} = 0 \) otherwise. That is, given the individual is passive, the probability
the individual claims is 1 if her age is the FRA and 0 otherwise, so that the likelihood of observing a passive individual claim away from the FRA is 0 and the likelihood of observing a passive person claim at the FRA is 1. Of course, we do not observe who is active and who is passive, so the contribution to the likelihood of individual \( i \) at age \( t \) is:

\[
L_{it}(\pi) = \pi L_{it}^p + (1 - \pi) L_{it}^a
\]  

and the log likelihood is given by:

\[
\mathcal{L}(\pi) = \sum_{i,t} \ln \left( L_{it}(\pi) \right)
\]

We find the point estimate of \( \pi \) is 0.65 with a standard error of 0.007, which lies comfortably within our estimated bounds of \([0.463, 0.691]\). We thus can not reject the possibility that there are two types of individuals in the data, passive decision makers who simply claim at the FRA regardless of incentives, and active decision makers who make claim decisions to maximize discounted expected pension wealth.

The apparently large fraction of passive decision makers begs the question - why do so many individuals not respond to a change in financial incentives? Here there is a parallel with Madrian and Shea (2001) who show that the rate of participation in 401(k) plans at a major firm increase from 45% to 90% when there is a switch from “opt in” (default is out) to “opt out” (default is in). This is a massive shift in participation given that opting in or out requires only a one time cost of a few hours of paperwork - worth perhaps a few hundred dollars - and the stakes are perhaps tens of thousands of dollars in lifetime wealth. It is thus difficult to rationalize the switching patterns in the data with defaults alone.\(^1\)

In our setting, we can also view claiming at an age other than the FRA as “opting out” when the default is “in.” Individuals who wish to claim early must show up ahead of the year they wish to claim, and individuals who wish to delay past the FRA must show up and do the paperwork before they hit the FRA. Individuals who do neither will receive benefits as if they claimed at the FRA, by default. As in Madrian and Shea (2001) opting out of claiming at the FRA requires perhaps a few hours of paperwork, but could increase discounted expected pension wealth significantly. It is hard to imagine that administrative costs drive the behavior we observe. O’Donoghue and Rabin (2001) show that this type of behavior can be rationalized by individuals

\(^{16}\text{See DellaVigna (2018) for a detailed discussion.}\)
who procrastinate and are naive about whether they will procrastinate tomorrow. In other words, they find it costly to take the necessary action to claim today, but (wrongly) believe they will not find it costly tomorrow. We acknowledge that this might explain the large fraction of passive DMs in our setting, but are unable to test for this possibility.

7 Conclusion

We identify the causal effect of a major pension reform in Switzerland. We find that an increase in the Full Retirement Age (FRA) with a small penalty for early claiming causes a 7 to 8 month delay in pension claiming and a 6 to 7 month delay in labor market exit. By contrast, a large increase in the penalty for claiming early with no change in the FRA delays pension claiming by only 4 months and has no effect on labor market exit. This is consistent with the FRA serving as a default age which many individuals passively comply with. The reform has a significant effect on the Social Security Wealth of individuals, and we show that much of this is behavioral, as individuals respond to the reform in a way that does not maximize pension wealth.

The evidence points to the FRA serving as a default claiming age that many individuals passively comply with regardless of the financial implications of doing so. We label these individuals as passive decision makers, and exploit the structure of the reform to identify bounds on the fraction passive individuals in the population. The fraction of passive individuals, \( \pi \), is estimated to lie between \([0.463, 0.691]\). Finally, as benefits are a function only of observable variables, we show that under the assumption that active decision makers maximize lifetime discounted expected pension wealth the fraction of passives \( \pi \) can be point identified and estimated using a dynamic discrete choice model of benefits claiming. We estimate \( \pi \) to be 0.65, so that a model with two types of individual, passive decision makers who claim at the FRA and active decision makers who maximize discounted expected pension wealth can not be ruled out as the model that is generating the data.

That passive decision makers comprise such a substantial fraction of the population has several implications for the design of social security. Policy changes that increase the FRA while providing weak financial incentives to delay, such as the first two stages of the Swiss reform that we study, redistribute wealth from passive decision makers to active ones. If society places equal or higher welfare weight on passive individuals, then the system should be actuarially fair. We leave the study of optimal social security systems in the presence of passive decision makers for future work.
References


Figure 1: Pension Adjustment Factor (PAF)

Notes: The figure shows how the Swiss social security system adjusts women’s old age pensions as a function of the claiming age for different pension regimes. Base pension amount, 100, is the pension for a women with FRA 62 (born in 1938 or before), claiming a pension at age 62 years.
Source: Own calculations based on Swiss social security rules.

Figure 2: How the Reform Affects Social Security Wealth

Notes: The figure shows the discounted social security wealth as a function of the claiming age for different pension regimes. We assume a discount rate of 2% and average death hazard (see Appendix A.2 for details how we estimate the death hazard).
Source: Own calculations based on Swiss social security rules.
Figure 3: Effects on Pension Claiming Hazard

Notes: The figures show the claiming hazard for an old age or disability pension by age. Graph (a) shows the effect of increasing the FRA from 62 to 63 years (FRA63), graph (b) shows the effect of increasing the FRA from 63 to 64 years (FRA64), and graph (c) shows the effect of doubling the early claiming penalty (MAF). Blue circles refers to the first cohort affected by the reform. Red triangles refers to last cohort not affected by the reform. Source: Own calculations, based on SSSD.
Figure 4: Pension Claiming Hazard, Women Who Left the Labor Market by 61

Notes: The figure show the claiming hazard for an old age or disability pension by age for women who left the labor market before age 62. Graph (a) shows the effect of increasing the FRA from 62 to 63 years (FRA63), graph (b) shows the effect of increasing the FRA from 63 to 64 years (FRA64), and graph (c) shows the effect of doubling the early claiming penalty (MAF). Blue circles refers to the first cohort affected by the reform. Red triangles refers to last cohort not affected by the reform.

Source: Own calculations, based on SSSD.
Figure 5: Effects on Retirement Hazard

(a) FRA63

(b) FRA64

(c) MAF

Notes: The figures show the retirement hazard by age. Graph (a) shows the effect of increasing the FRA from 62 to 63 years (FRA63), graph (b) shows the effect of increasing the FRA from 63 to 64 years (FRA64), and graph (c) shows the effect of doubling the early claiming penalty (MAF). Blue circles refers to the first cohort affected by the reform. Red triangles refers to last cohort not affected by the reform.

Source: Own calculations, based on SSSD.
Figure 6: Pension Benefits and Social Security Wealth

A. Actual Pension Benefits

(b) FRA63

(c) MAF

B. Actual Social Security Wealth

(e) FRA64

(f) MAF

Notes: The figures present a regression discontinuity analysis of the impacts of different pension reforms on actual pension benefits (panel A) and actual social security wealth (panel B). The horizontal axis reports the week of birth minus the reform cutoff. The solid red line plots the best local linear fit to the actual data above and below the reform cutoff. The dashed orange line plots the predicted counterfactual we would observe if individuals did not respond to the reforms.

Source: Own calculations, based on SSSD.
Figure 7: Claiming Age and Retirement Age

A. Claiming Age

(a) FRA63

(b) FRA64

(c) MAF

B. Retirement Age

(d) FRA63

(e) FRA64

(f) MAF

Notes: The figures present a regression discontinuity analysis of the impacts of different pension reforms on the claiming age (panel A) and the retirement age (panel B). The horizontal axis reports the week of birth minus the reform cutoff. The solid red line plots the best local linear fit to the actual data above and below the reform cutoff. The solid red line plots the best local linear fit to the actual data above and below the reform cutoff. Source: Own calculations, based on SSSD.
Figure 8: Cost of Mistake in Percent by Birth Cohort

Notes: The figure shows the loss in pension wealth from making mistakes by birth year-month. Vertical red lines denote birth date cutoffs where pension regimes changes. RD-estimates use a bandwidth of 30 weeks and include a linear trend on either side of the cutoff.

Source: Own calculations, based on SSSD.

Figure 9: Cost of Mistake in Percent by Average Indexed Earnings

Notes: Graph (a) shows the loss in pension wealth (relative to average indexed earnings) from making mistakes by average indexed earnings bins and pension regime. Graph (b) presents a regression discontinuity analysis of the impacts of pension reforms on the percent loss in pension wealth from making mistakes by average indexed earnings bins.

Source: Own calculations, based on SSSD.
Figure 10: Cost of Mistake in Percent for Selected Characteristics

Notes: The figure shows the loss in pension wealth (relative to average indexed earnings) from making mistakes for different characteristics. The sample consists of women born in 1938-1939, 1941-1942, and 1947-1948.
Source: Own calculations, based on SSSD.

Table 1: Percent Claiming Early: Data versus Simulations

<table>
<thead>
<tr>
<th></th>
<th>Maximize social security wealth</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Discount rate 2%</td>
<td>Discount rate 1%</td>
<td>Discount rate 0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>% early claiming</td>
<td>% early</td>
<td>% early</td>
<td>% early</td>
<td>% early</td>
</tr>
<tr>
<td></td>
<td>claiming</td>
<td>claiming</td>
<td>claiming</td>
<td>claiming</td>
<td>claiming</td>
</tr>
<tr>
<td></td>
<td>difference</td>
<td>difference</td>
<td>difference</td>
<td>difference</td>
<td>difference</td>
</tr>
<tr>
<td></td>
<td>to data</td>
<td>to data</td>
<td>to data</td>
<td>to data</td>
<td>to data</td>
</tr>
<tr>
<td>FRA63 22.3</td>
<td>70.9</td>
<td>48.6</td>
<td>47.8</td>
<td>25.5</td>
<td>35.6</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td></td>
</tr>
<tr>
<td>FRA64 29.8</td>
<td>75.5</td>
<td>45.7</td>
<td>52.3</td>
<td>22.5</td>
<td>39.4</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td></td>
</tr>
<tr>
<td>MAF 13.3</td>
<td>18.2</td>
<td>4.9</td>
<td>14.2</td>
<td>0.9</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.001]</td>
<td>[0.001]</td>
<td>[0.002]</td>
<td></td>
</tr>
</tbody>
</table>

Notes: The table presents the percent of women who claim early by pension regime in the SSSD (first column) and the percent of women who should claim early to maximize social security wealth for different discount rates (column 2, 4, and 6). Independent of the discount rate, we find that too few women claim early under FRA63 and FRA64; they lose social security wealth by delaying claiming.
Source: Own calculations, based on SSSD.
Table 2: Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>FRA63 (1)</th>
<th>FRA64 (2)</th>
<th>MAF (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Outcome variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claiming Age (years)</td>
<td>61.6</td>
<td>62.3</td>
<td>62.8</td>
</tr>
<tr>
<td></td>
<td>(2.5)</td>
<td>(2.8)</td>
<td>(2.9)</td>
</tr>
<tr>
<td>Exit Age (years)</td>
<td>60.3</td>
<td>61.0</td>
<td>61.7</td>
</tr>
<tr>
<td></td>
<td>(3.9)</td>
<td>(4.0)</td>
<td>(4.0)</td>
</tr>
<tr>
<td>SS benefits (CHF per year)</td>
<td>18,883</td>
<td>19,237</td>
<td>19,340</td>
</tr>
<tr>
<td></td>
<td>(7,084)</td>
<td>(6,738)</td>
<td>(6,640)</td>
</tr>
<tr>
<td>SS wealth (CHF)</td>
<td>359,729</td>
<td>352,760</td>
<td>346,022</td>
</tr>
<tr>
<td></td>
<td>(134,757)</td>
<td>(122,342)</td>
<td>(116,837)</td>
</tr>
<tr>
<td><strong>B. Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Supplemental benefits spouse</td>
<td>30.4</td>
<td>20.6</td>
<td>8.0</td>
</tr>
<tr>
<td>Supplemental benefits amount (CHF per year)</td>
<td>2,047</td>
<td>1,272</td>
<td>374</td>
</tr>
<tr>
<td></td>
<td>(3,439)</td>
<td>(2,858)</td>
<td>(1,613)</td>
</tr>
<tr>
<td>% Foreign</td>
<td>21.5</td>
<td>18.0</td>
<td>16.7</td>
</tr>
<tr>
<td>% German-speaking region</td>
<td>70.8</td>
<td>70.1</td>
<td>69.1</td>
</tr>
<tr>
<td>% Married</td>
<td>62.6</td>
<td>62.9</td>
<td>62.4</td>
</tr>
<tr>
<td>% Self-employed</td>
<td>8.6</td>
<td>10.3</td>
<td>12.2</td>
</tr>
<tr>
<td>% Public sector</td>
<td>18.8</td>
<td>17.4</td>
<td>16.6</td>
</tr>
<tr>
<td>Months employed until age 55</td>
<td>116.3</td>
<td>144.0</td>
<td>190.9</td>
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<tr>
<td></td>
<td>(38.5)</td>
<td>(47.0)</td>
<td>(67.9)</td>
</tr>
<tr>
<td>Months unemployed until age 55</td>
<td>0.9</td>
<td>1.8</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>(1.51)</td>
<td>(2.16)</td>
<td>(6.44)</td>
</tr>
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<td>Average indexed earnings (CHF per year)</td>
<td>50,497</td>
<td>53,071</td>
<td>54,836</td>
</tr>
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<td></td>
<td>(32,223)</td>
<td>(31,426)</td>
<td>(29,482)</td>
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<tr>
<td>Earnings at age 55 (CHF per year)</td>
<td>34,645</td>
<td>36,919</td>
<td>41,098</td>
</tr>
<tr>
<td></td>
<td>(35,938)</td>
<td>(48,377)</td>
<td>(40,059)</td>
</tr>
<tr>
<td><strong>No. observations</strong></td>
<td>56,936</td>
<td>64,906</td>
<td>78,746</td>
</tr>
</tbody>
</table>

Notes: The table reports summary statistics of key outcome variables (panel A) and background characteristics (panel B) for the three samples we use to measure the impacts of the reform steps FRA63, FRA64, and MAF. The FRA63 sample includes cohorts born 1938 and 1939, the FRA64 sample includes cohorts born 1941 and 1942, and the MAF sample includes cohorts born 1947 and 1948.

Source: Own calculations, based on SSSD.
Table 3: Effects on Pension Benefits, Pension Claiming, and Retirement

<table>
<thead>
<tr>
<th></th>
<th>FRA 63</th>
<th>FRA 64</th>
<th>MAF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>local</td>
<td>global</td>
<td>local</td>
</tr>
<tr>
<td><strong>A. Effects on benefits</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual pension benefits</td>
<td>-348</td>
<td>-195</td>
<td>-552**</td>
</tr>
<tr>
<td></td>
<td>(254)</td>
<td>(161)</td>
<td>(235)</td>
</tr>
<tr>
<td>SSW, total (CHF)</td>
<td>-21,276***</td>
<td>-18,322***</td>
<td>-25,162***</td>
</tr>
<tr>
<td></td>
<td>(4,809)</td>
<td>(3,052)</td>
<td>(4,245)</td>
</tr>
<tr>
<td>SSW, behavioral effect (CHF)</td>
<td>-8,505*</td>
<td>-5,680*</td>
<td>-10,457***</td>
</tr>
<tr>
<td></td>
<td>(4,725)</td>
<td>(2,996)</td>
<td>(4,162)</td>
</tr>
<tr>
<td><strong>B. Claiming and labor supply effects</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claiming age (years)</td>
<td>0.722***</td>
<td>0.702***</td>
<td>0.681***</td>
</tr>
<tr>
<td></td>
<td>(0.085)</td>
<td>(0.054)</td>
<td>(0.096)</td>
</tr>
<tr>
<td>Retirement age (years)</td>
<td>0.659***</td>
<td>0.598***</td>
<td>0.408***</td>
</tr>
<tr>
<td></td>
<td>(0.141)</td>
<td>(0.09)</td>
<td>(0.136)</td>
</tr>
<tr>
<td>No. observations</td>
<td>14,316</td>
<td>36,086</td>
<td>16,100</td>
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<tr>
<td>Bandwidth (months)</td>
<td>12</td>
<td>30</td>
<td>12</td>
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Notes: The table presents regression discontinuity estimates of the impacts of different reform steps on pension benefits and social security wealth (panel A) as well as on the claiming age and retirement age (panel B). The local (global) specification uses a bandwidth of 12 (30) weeks and includes a linear trend on either side of the cutoff. Observations are weighted using a triangular kernel.

Source: Own calculations, based on SSSD.
### Table 4: Household Considerations

<table>
<thead>
<tr>
<th></th>
<th>FRA63</th>
<th>FRA64</th>
<th>MAF</th>
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<tbody>
<tr>
<td></td>
<td>local</td>
<td>global</td>
<td>local</td>
</tr>
<tr>
<td><strong>(1)</strong></td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td><strong>A. Single or Age Balanced</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claiming age (years)</td>
<td>0.666***</td>
<td>0.681***</td>
<td>0.708***</td>
</tr>
<tr>
<td></td>
<td>(0.129)</td>
<td>(0.083)</td>
<td>(0.139)</td>
</tr>
<tr>
<td>Retirement age (years)</td>
<td>0.503***</td>
<td>0.544***</td>
<td>0.463**</td>
</tr>
<tr>
<td></td>
<td>(0.189)</td>
<td>(0.122)</td>
<td>(0.182)</td>
</tr>
<tr>
<td>No. observations</td>
<td>7,720</td>
<td>19,559</td>
<td>9,002</td>
</tr>
<tr>
<td><strong>B. Husband’s response</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claiming age (years)</td>
<td>0.005</td>
<td>-0.039</td>
<td>-0.117</td>
</tr>
<tr>
<td></td>
<td>(0.089)</td>
<td>(0.056)</td>
<td>(0.093)</td>
</tr>
<tr>
<td>Retirement age (years)</td>
<td>-0.047</td>
<td>0.013</td>
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<td>(0.149)</td>
<td>(0.095)</td>
<td>(0.146)</td>
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<tr>
<td>Bandwidth (weeks)</td>
<td>12</td>
<td>30</td>
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</tbody>
</table>

Notes: Panel A presents regression discontinuity estimates of the impacts of different reform steps on the claiming and retirement age for women who are single or have a same-age husband. Panel B presents regression discontinuity estimates of the impacts of different reform steps on the husband’s claiming and retirement age. The local (global) specification uses a bandwidth of 12 (30) weeks and includes a linear trend on either side of the cutoff. Observations are weighted using a triangular kernel.

Source: Own calculations, based on SSSD.
Table 5: Heterogeneity in Claiming and Retirement Age, 30 Weeks

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<th>Retirement Age</th>
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<th></th>
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<td>FRA 64 (2)</td>
<td>MAF (3)</td>
<td>FRA 63 (4)</td>
<td>FRA 64 (5)</td>
<td>MAF (6)</td>
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<tr>
<td>Full sample</td>
<td>0.702***</td>
<td>0.643***</td>
<td>0.400***</td>
<td>0.598***</td>
<td>0.447***</td>
<td>-0.029</td>
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<td></td>
<td>(0.054)</td>
<td>(0.059)</td>
<td>(0.056)</td>
<td>(0.090)</td>
<td>(0.086)</td>
<td>(0.078)</td>
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<tr>
<td>Died before last age</td>
<td>0.484**</td>
<td>0.381</td>
<td>0.177</td>
<td>0.597***</td>
<td>0.271</td>
<td>0.119</td>
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<td></td>
<td>(0.203)</td>
<td>(0.256)</td>
<td>(0.326)</td>
<td>(0.229)</td>
<td>(0.269)</td>
<td>(0.317)</td>
</tr>
<tr>
<td>Alive at last age</td>
<td>0.724***</td>
<td>0.692***</td>
<td>0.399***</td>
<td>0.575***</td>
<td>0.485***</td>
<td>-0.048</td>
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<tr>
<td></td>
<td>(0.045)</td>
<td>(0.053)</td>
<td>(0.051)</td>
<td>(0.095)</td>
<td>(0.089)</td>
<td>(0.078)</td>
</tr>
<tr>
<td>Exits at/after 62</td>
<td>0.749***</td>
<td>0.722***</td>
<td>0.397***</td>
<td>0.621***</td>
<td>0.575***</td>
<td>0.052*</td>
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<tr>
<td></td>
<td>(0.038)</td>
<td>(0.047)</td>
<td>(0.042)</td>
<td>(0.052)</td>
<td>(0.040)</td>
<td>(0.030)</td>
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<tr>
<td>Exits before 62</td>
<td>0.586***</td>
<td>0.484***</td>
<td>0.464***</td>
<td>0.285***</td>
<td>0.062</td>
<td>0.037</td>
</tr>
<tr>
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<td>(0.097)</td>
<td>(0.117)</td>
<td>(0.126)</td>
<td>(0.099)</td>
<td>(0.102)</td>
<td>(0.100)</td>
</tr>
<tr>
<td>Single</td>
<td>0.587***</td>
<td>0.700***</td>
<td>0.337***</td>
<td>0.570***</td>
<td>0.341**</td>
<td>0.003</td>
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<tr>
<td></td>
<td>(0.117)</td>
<td>(0.122)</td>
<td>(0.108)</td>
<td>(0.149)</td>
<td>(0.144)</td>
<td>(0.128)</td>
</tr>
<tr>
<td>Married</td>
<td>0.743***</td>
<td>0.633***</td>
<td>0.444***</td>
<td>0.610***</td>
<td>0.512***</td>
<td>-0.028</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.059)</td>
<td>(0.062)</td>
<td>(0.112)</td>
<td>(0.108)</td>
<td>(0.099)</td>
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<td>Private sector</td>
<td>0.696***</td>
<td>0.629***</td>
<td>0.400***</td>
<td>0.556***</td>
<td>0.453***</td>
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<td>(0.067)</td>
<td>(0.062)</td>
<td>(0.097)</td>
<td>(0.091)</td>
<td>(0.081)</td>
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<td>Public sector</td>
<td>0.702***</td>
<td>0.732***</td>
<td>0.426***</td>
<td>0.822***</td>
<td>0.273</td>
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<td>(0.114)</td>
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<td>(0.136)</td>
<td>(0.211)</td>
<td>(0.219)</td>
<td>(0.214)</td>
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<tr>
<td>Self-employed</td>
<td>0.624***</td>
<td>0.547***</td>
<td>0.383**</td>
<td>1.061***</td>
<td>0.500**</td>
<td>0.043</td>
</tr>
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<td></td>
<td>(0.166)</td>
<td>(0.177)</td>
<td>(0.150)</td>
<td>(0.300)</td>
<td>(0.232)</td>
<td>(0.192)</td>
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<tr>
<td>Not self-employed</td>
<td>0.707***</td>
<td>0.653***</td>
<td>0.405***</td>
<td>0.559***</td>
<td>0.418***</td>
<td>-0.041</td>
</tr>
<tr>
<td></td>
<td>(0.058)</td>
<td>(0.063)</td>
<td>(0.061)</td>
<td>(0.093)</td>
<td>(0.091)</td>
<td>(0.084)</td>
</tr>
<tr>
<td>Avg. earnings below median</td>
<td>0.620***</td>
<td>0.882***</td>
<td>0.476***</td>
<td>0.601***</td>
<td>0.496***</td>
<td>-0.087</td>
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<tr>
<td></td>
<td>(0.070)</td>
<td>(0.080)</td>
<td>(0.076)</td>
<td>(0.123)</td>
<td>(0.122)</td>
<td>(0.111)</td>
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<tr>
<td>Avg. earnings above median</td>
<td>0.784***</td>
<td>0.391***</td>
<td>0.334***</td>
<td>0.591***</td>
<td>0.455***</td>
<td>0.048</td>
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<tr>
<td></td>
<td>(0.083)</td>
<td>(0.091)</td>
<td>(0.084)</td>
<td>(0.129)</td>
<td>(0.124)</td>
<td>(0.110)</td>
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Notes:
### Table 6: Effects on Individual Income and Fiscal Costs

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<th>MAF</th>
<th></th>
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<tbody>
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<td>local (1)</td>
<td>global (2)</td>
<td>local (3)</td>
<td>global (4)</td>
<td>local (5)</td>
<td>global (6)</td>
</tr>
<tr>
<td><strong>A. Individual income</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSW, total (CHF)</td>
<td>-21,276 ***</td>
<td>-18,322 ***</td>
<td>-25,162 ***</td>
<td>-23,735 ***</td>
<td>-3,389</td>
<td>-5,608 ***</td>
</tr>
<tr>
<td>(A)</td>
<td>(4,809)</td>
<td>(3,052)</td>
<td>(4,245)</td>
<td>(2,673)</td>
<td>(3,684)</td>
<td>(2,304)</td>
</tr>
<tr>
<td>Earnings (CHF)</td>
<td>6,442 ***</td>
<td>6,276 ***</td>
<td>3,849 *</td>
<td>4,343 ***</td>
<td>3,124</td>
<td>889</td>
</tr>
<tr>
<td>(B)</td>
<td>(1,718)</td>
<td>(1,089)</td>
<td>(2,331)</td>
<td>(1,461)</td>
<td>(2,446)</td>
<td>(1,551)</td>
</tr>
<tr>
<td>UI income (CHF)</td>
<td>67 ***</td>
<td>70 ***</td>
<td>601 ***</td>
<td>340 ***</td>
<td>-21</td>
<td>159</td>
</tr>
<tr>
<td>(C)</td>
<td>(21)</td>
<td>(13)</td>
<td>(189)</td>
<td>(115)</td>
<td>(204)</td>
<td>(127)</td>
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<tr>
<td>Total lifetime income (CHF)</td>
<td>-14,501 ***</td>
<td>-11,548 ***</td>
<td>-20,252 ***</td>
<td>-18,800 ***</td>
<td>-275</td>
<td>-4536</td>
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<tr>
<td>(A+B+C)</td>
<td>(5,350)</td>
<td>(3,387)</td>
<td>(5,168)</td>
<td>(3,253)</td>
<td>(4,783)</td>
<td>(3,004)</td>
</tr>
<tr>
<td><strong>B. Government expenses</strong></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>OASI contributions (CHF)</td>
<td>4,776 ***</td>
<td>4,843 ***</td>
<td>6,179 ***</td>
<td>5,883 ***</td>
<td>1,613 ***</td>
<td>1,238 ***</td>
</tr>
<tr>
<td>(D)</td>
<td>(291)</td>
<td>(184)</td>
<td>(520)</td>
<td>(330)</td>
<td>(542)</td>
<td>(346)</td>
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<tr>
<td>UI contributions (CHF)</td>
<td>271 ***</td>
<td>269 ***</td>
<td>253 ***</td>
<td>253 ***</td>
<td>107*</td>
<td>45</td>
</tr>
<tr>
<td>(E)</td>
<td>(43)</td>
<td>(27)</td>
<td>(56)</td>
<td>(35)</td>
<td>(56)</td>
<td>(36)</td>
</tr>
<tr>
<td>Net fiscal expenses (CHF)</td>
<td>-23,390 ***</td>
<td>-21,872 ***</td>
<td>-30,972 ***</td>
<td>-29,548 ***</td>
<td>-5,635</td>
<td>-6,862 ***</td>
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<tr>
<td>(A+C-D-E)</td>
<td>(5,480)</td>
<td>(3,267)</td>
<td>(4,147)</td>
<td>(2,618)</td>
<td>(3,563)</td>
<td>(2,230)</td>
</tr>
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<td>Bandwidth (weeks)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>12</td>
<td>30</td>
<td>12</td>
<td>30</td>
<td>12</td>
<td>30</td>
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<td>No. observations</td>
<td>14,494</td>
<td>36,564</td>
<td>16,131</td>
<td>42,357</td>
<td>19,868</td>
<td>50,344</td>
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</table>

Notes: Panel A presents regression discontinuity estimates of the impacts of different reform steps on social security wealth, lifetime earnings, lifetime UI benefits, and total lifetime income. Panel B presents regression discontinuity estimates of the impacts of different reform steps on the husband’s claiming and retirement age. The local (global) specification uses a bandwidth of 12 (30) weeks and includes a linear trend on either side of the cutoff. Observations are weighted using a triangular kernel.

Source: Own calculations, based on SSSD.

### Table 7: Categorizing Actives and Passives by Compliance

<table>
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<tr>
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<th>FRA63</th>
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<th>FRA64</th>
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<th>MAF</th>
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<tbody>
<tr>
<td></td>
<td>All Passives</td>
<td>Some Actives</td>
<td>All Passives</td>
<td>Some Actives</td>
<td>No Passives</td>
<td>Some Actives</td>
</tr>
<tr>
<td>Compliers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Compliers</td>
<td>No Passives</td>
<td>Some Actives</td>
<td>No Passives</td>
<td>Some Actives</td>
<td>All Passives</td>
<td>Some Actives</td>
</tr>
</tbody>
</table>

46
Figure 11: Comparison of Estimated and Official Survival Curves for Women

Notes: Figure shows female survival rates by age using a Gompertz model and from the official statistic.

Source: Predicted survival rates are based on a Gompertz model estimated on the SSSD. Official statistics are based on the survival rates by birthyear, gender, and age reported by the Federal Statistical Office.

A Appendix

A.1 Data

A.2 Estimating mortality a la Chetty et al.

If at all, we oberpredict survival rates. The rate of early claiming should be even higher using official statistics.

A.2.1 Allowing for heterogeneity in survival rates by income and marital status

Allowing for heterogeneity in mortality by income and marital status, assuming that after age 85 same for everybody again.

A.2.2 Testing validity of RD design

Table 9 in the Appendix shows RD estimates of a regression with the dependent variable being the number of individuals in a bin for different bandwidth.
Figure 12: Estimated Survival Curves for Women by Marital Status and Income

![Survival Curves Diagram]

Notes:

Table 8: Percent Claiming Early: Data versus Simulations with Heterogeneous Survival Rates

<table>
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<tr>
<th></th>
<th>Data</th>
<th>Model</th>
<th></th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>% early claiming</td>
<td>% early claiming</td>
<td>difference to data</td>
<td>% early claiming</td>
<td>difference to data</td>
<td>% early claiming</td>
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<tr>
<td>discount rate 2%</td>
<td>discount rate 1%</td>
<td>discount rate 0%</td>
<td>discount rate 2%</td>
<td>discount rate 1%</td>
<td>discount rate 0%</td>
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<tr>
<td>FRA63</td>
<td>22.3</td>
<td>71.3</td>
<td>49.1</td>
<td>48.3</td>
<td>26.2</td>
<td>36.2</td>
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<tr>
<td></td>
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<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
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<td>FRA64</td>
<td>29.8</td>
<td>75.8</td>
<td>45.9</td>
<td>52.7</td>
<td>22.9</td>
<td>40.1</td>
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<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td></td>
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<td>MAF</td>
<td>13.3</td>
<td>18.2</td>
<td>4.9</td>
<td>14.2</td>
<td>0.9</td>
<td>12.5</td>
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<td>[0.000]</td>
<td>[0.001]</td>
<td>[0.002]</td>
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</table>

Notes:
Figure 13: Number of Women per WOB

Notes: Panels show the mean number of women per WOB around the threshold separating the 1939 and 1938 birth cohorts (panel a), the 1941 and 1942 birth cohorts (panel b), and the 1947 and 1948 birth cohorts (panel c).
Source: Own calculations, based on SSSD.

Table 9: Number of Women per WOB

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<tr>
<th></th>
<th>linear local</th>
<th>linear CCT</th>
<th>linear global</th>
<th>quadratic local</th>
<th>quadratic CCT</th>
<th>quadratic global</th>
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<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td><strong>A. FRA63</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of individuals</td>
<td>-17</td>
<td>-19</td>
<td>52***</td>
<td>-23</td>
<td>-23</td>
<td>-9</td>
</tr>
<tr>
<td>Bandwidth (weeks)</td>
<td>12</td>
<td>8</td>
<td>36</td>
<td>12</td>
<td>12</td>
<td>36</td>
</tr>
<tr>
<td><strong>B. FRA64</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of individuals</td>
<td>25</td>
<td>30</td>
<td>58***</td>
<td>39</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>Bandwidth (weeks)</td>
<td>12</td>
<td>9</td>
<td>36</td>
<td>12</td>
<td>14</td>
<td>36</td>
</tr>
<tr>
<td><strong>C. MAF</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of individuals</td>
<td>33</td>
<td>20</td>
<td>112***</td>
<td>7</td>
<td>9</td>
<td>39*</td>
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<tr>
<td>Bandwidth (weeks)</td>
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<td>7</td>
<td>30</td>
<td>12</td>
<td>16</td>
<td>30</td>
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Notes:
Table 10: Selection on Observable Characteristics

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<th>FRA63 global</th>
<th>FRA64 local</th>
<th>FRA64 global</th>
<th>MAF local</th>
<th>MAF global</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Foreign</td>
<td>0.7 (1.5)</td>
<td>-1.2 (1.0)</td>
<td>1.6 (1.3)</td>
<td>0.9 (0.8)</td>
<td>1.5 (1.2)</td>
<td>0.7 (0.7)</td>
</tr>
<tr>
<td>German-speaking region</td>
<td>0.3 (1.5)</td>
<td>-0.8 (1.0)</td>
<td>-2 (1.4)</td>
<td>0.5 (0.9)</td>
<td>1.9 (1.3)</td>
<td>1.5* (0.8)</td>
</tr>
<tr>
<td>% Married</td>
<td>2 (1.7)</td>
<td>1.1 (1.1)</td>
<td>-2.4 (1.7)</td>
<td>-1.4 (1.1)</td>
<td>0.5 (1.5)</td>
<td>-0.1 (1.0)</td>
</tr>
<tr>
<td>% Husband born 1933</td>
<td>0.7 (0.8)</td>
<td>0.1 (0.5)</td>
<td>-0.8 (0.5)</td>
<td>-0.2 (0.3)</td>
<td>0.2 (0.2)</td>
<td>0.2</td>
</tr>
<tr>
<td>% Husband born 1938</td>
<td>-0.7 (1.0)</td>
<td>-0.7 (0.6)</td>
<td>0.4 (0.9)</td>
<td>-0.4 (0.6)</td>
<td>-0.5 (1.0)</td>
<td>-0.1 (0.1)</td>
</tr>
<tr>
<td>% Self-employed</td>
<td>-0.1 (1.0)</td>
<td>-0.5 (0.6)</td>
<td>-0.1 (0.9)</td>
<td>1.2* (0.7)</td>
<td>0.5 (1.0)</td>
<td>0.8</td>
</tr>
<tr>
<td>% Public sector</td>
<td>1.2 (1.4)</td>
<td>0.6 (0.9)</td>
<td>-2.1 (1.3)</td>
<td>-1.4* (0.8)</td>
<td>-1.5 (1.1)</td>
<td>0.1</td>
</tr>
<tr>
<td>Months employed until age 55</td>
<td>-2.4* (1.4)</td>
<td>-1 (0.9)</td>
<td>-0.9 (1.6)</td>
<td>-1.3 (1.0)</td>
<td>0.2 (2.1)</td>
<td>-0.7</td>
</tr>
<tr>
<td>Months unemployed until age 55</td>
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<td>0.1 (0.1)</td>
<td>0 (0.2)</td>
<td>-0.2 (0.1)</td>
<td>-0.1 (0.3)</td>
<td>0.1</td>
</tr>
<tr>
<td>Average annual indexed earnings (2016 CHF)</td>
<td>-525 (1,111)</td>
<td>-42 (687)</td>
<td>-1,531 (1,110)</td>
<td>-1,236* (693)</td>
<td>-615 (911)</td>
<td>-257 (578)</td>
</tr>
<tr>
<td>Annual earnings at age 55 (2016 CHF)</td>
<td>94 (1,222)</td>
<td>32 (767)</td>
<td>-673 (1,194)</td>
<td>-1,401* (809)</td>
<td>1743 (1,193)</td>
<td>1,048 (757)</td>
</tr>
<tr>
<td>Bandwidth (weeks)</td>
<td>12 (14,494)</td>
<td>30 (36,564)</td>
<td>12 (16,131)</td>
<td>30 (42,357)</td>
<td>12 (19,868)</td>
<td>30 (50,344)</td>
</tr>
</tbody>
</table>
Notes: Panels show the mean number of women per WOB around the threshold separating the 1939 and 1938 birth cohorts (panel a), the 1941 and 1942 birth cohorts (panel b), and the 1947 and 1948 birth cohorts (panel c).

Source: Own calculations, based on SSSD.
Figure 15: Characteristics per WOB, FRA64

Notes: Panels show the mean number of women per WOB around the threshold separating the 1939 and 1938 birth cohorts (panel a), the 1941 and 1942 birth cohorts (panel b), and the 1947 and 1948 birth cohorts (panel c).
Source: Own calculations, based on SSSD.
Figure 16: Characteristics per WOB, MAF

Notes: Panels show the mean number of women per WOB around the threshold separating the 1939 and 1938 birth cohorts (panel a), the 1941 and 1942 birth cohorts (panel b), and the 1947 and 1948 birth cohorts (panel c).

Source: Own calculations, based on SSSD.
Figure 17: Sensitivity of FRA64 Estimates

A. Supplementary pension before 62

(a) Full sample

(b) Single or "young" spouse

B. Labor market exit and pension claiming

(c) Labor force exit

(d) Pension claiming

Notes: Women born in 1942 were not eligible anymore for spousal supplemental benefits whereas those born in 1941 still were eligible, panel A. To see whether the effects are sensitive to the abolishment of spousal benefits, we focus on women who are single or whose husband is "young", i.e. at most two years older. These women are not affected by the policy change, panel A. (Note that women who are on the disability program are still eligible for spousal benefits.) Claiming and labor market exit for single women, or women living in age balanced couples respond similar to the entire sample to FRA64, see panel B.

Source: Own calculations, based on SSSD.

A.2.3 Validity by excluding supplemental benefit wives

A.2.4 Robustness with respect to bandwidth and birthdate cutoff

A.2.5 Early retirement among men

Calonciao etc optimal bandwidth between 16-25 weeks approx.
Figure 18: Sensitivity to Changes in Bandwidth

Notes: Figure shows the RDD estimates, by varying the bandwidth from 4 to 48 weeks. Optimal bandwidth is 12 weeks.
Source: Own calculations, based on SSSD.

A.2.6 Other outcomes

Husband’s retirement and claiming response

Mortality

Consumption

Occupational pensions

A.3 Additional Tables and Figures
Table 11: Effects on Pension Claiming and Retirement Age, Men

<table>
<thead>
<tr>
<th></th>
<th>ERA64</th>
<th>ERA63</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>local</td>
<td>global</td>
</tr>
<tr>
<td>Claiming age (years)</td>
<td>-0.028</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td>(0.14)</td>
<td>(0.088)</td>
</tr>
<tr>
<td>Retirement age (years)</td>
<td>-0.141</td>
<td>-0.016</td>
</tr>
<tr>
<td></td>
<td>(0.137)</td>
<td>(0.087)</td>
</tr>
<tr>
<td>No. observations</td>
<td>10,792</td>
<td>27,192</td>
</tr>
<tr>
<td>Bandwidth (weeks)</td>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>

Notes: Table 12: Effects on Probability to Die and Age at Death

<table>
<thead>
<tr>
<th></th>
<th>FRA63</th>
<th>FRA64</th>
<th>MAF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>local</td>
<td>global</td>
<td>local</td>
</tr>
<tr>
<td>Died by last age</td>
<td>0.002</td>
<td>-0.004</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.008)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Age at death</td>
<td>0.03</td>
<td>0.105*</td>
<td>-0.059</td>
</tr>
<tr>
<td></td>
<td>(0.1)</td>
<td>(0.064)</td>
<td>(0.061)</td>
</tr>
<tr>
<td>Bandwidth (weeks)</td>
<td>12</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>Obs</td>
<td>13556</td>
<td>34183</td>
<td>15413</td>
</tr>
</tbody>
</table>

Notes: This table reports RDD estimates of the effects of FRA63, FRA64, and MAF, adopting 12 and 30 weeks bandwidths. 
Source: Own calculations, SSSD.

Table 13: Effects on Claiming and Retirement Age, Men

<table>
<thead>
<tr>
<th></th>
<th>FRA64</th>
<th>MAF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>local</td>
<td>global</td>
</tr>
<tr>
<td>Claiming age (years)</td>
<td>-0.071</td>
<td>-0.052</td>
</tr>
<tr>
<td></td>
<td>(0.601)</td>
<td>(0.351)</td>
</tr>
<tr>
<td>Annual amount (CHF)</td>
<td>-3108</td>
<td>-1087</td>
</tr>
<tr>
<td></td>
<td>(2995.899)</td>
<td>(1875.569)</td>
</tr>
<tr>
<td>No. observations</td>
<td>221</td>
<td>553</td>
</tr>
<tr>
<td>Bandwidth (weeks)</td>
<td>12</td>
<td>30</td>
</tr>
</tbody>
</table>

Notes:
Figure 19: Placebo Regression Discontinuity Estimates

(a) Exit Age

(b) Claiming Age

Notes: Figure shows RDD estimates at the true cohort cut-offs, 1939, 1942, and 1942, along with Placebo cut-offs, before 1939, and between the policy changes. Bandwidth is 36 weeks.
Source: Own calculations, based on SSSD.

Figure 20: Social Security Wealth at Different Claiming Ages, Men

Notes: Figure shows discounted social security wealth by age. We assume a discount rate of 2%, and average death hazard.
Source: Own calculations based on Swiss social security rules.
Figure 21: Pension Claiming and Retirement Hazard, Men

A. Claiming Hazard

(a) ERA64

(b) ERA63

B. Retirement Hazard

(c) ERA64

(d) ERA63

Notes:
Source: Own calculations, based on SSSD.
Figure 22: Claiming and Retirement Age, Men

A. Claiming Age

(a) ERA64

(b) ERA63

B. Retirement Age

(c) ERA64

(d) ERA63

Notes:
Source: Own calculations, based on SSSD.
Figure 23: Husbands’ Retirement and Claiming Age

A. Husbands’ Retirement Age

(a) FRA63

(b) FRA64

(c) MAF

B. Husbands’ Claiming Age

(d) FRA63

(e) FRA64

(f) MAF

Notes: This figure reports the average age when husbands exit the labor force (A) and the average claiming age of any pension (B). The x-axis reports the date of birth minus the reform cutoff. The light line refers to women born just not affected by the reform, the solid line refers to women just affected by the reform.

Source: Own calculations, based on SSSD.
Figure 24: Probability to Die and Age at Death

A. Probability to die
(a) FRA63
(b) FRA64
(c) MAF

B. Age at death
(d) FRA63
(e) FRA64
(f) MAF

Notes:
Source: Own calculations, based on SSSD.

Figure 25: Effects on Consumption at Different Ages

(a) FRA64
(b) MAF

Notes:
Source: Own calculations, based on SSSD.
Figure 26: Effects on Occupational Pension

A. Claiming age of occupational pension

(a) FRA64

(b) MAF

B. Amount of occupational pension

(c) FRA64

(d) MAF

Notes:
Source: Own calculations, based on SSSD.