# How do Pension Wealth Shocks affect Working and Claiming?

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**Abstract**

We study how people respond to pension wealth shocks in Switzerland, where working while claiming a pension is not discouraged. A 1997 reform increased women's full retirement age (FRA) by two years, from 62 to 64, lowering pension wealth by 10.4%, and the reform introduced early claiming, at age 62, reducing pensions by 3.4%, then by 6.8%, the actuarially fair rate. We find that women delay pension claiming by about 7 to 8 months, and delay labor market exit by 5 to 6 months. Doubling the price of early retirement delays pension claiming by 4 to 5 months and has no effects on labor market exit. Women buffer about 35% of the wealth shock triggered by an FRA increase, mostly through working longer, and 100% of the wealth shock due to doubling the early retirement price. Most women either delay both, labor market exit and benefit claiming, or none of the two, suggesting that costs to delay claiming and labor market exit are positively correlated.

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

**JEL Classification: H55, J21, J26**

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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 has declined by approximately three years (OECD, 2011a). These forces have substantial fiscal ramifications for social security. Social security reforms in the United States and other countries have implemented measures aimed at delaying labor force exit of older workers to decrease the pressure on their pension systems.

A popular pension reform is to increase the full retirement age (FRA), the age at which individuals can draw a full, or normal, pension. This policy is attractive as it immediately leads to savings to the pension system by reducing the generosity of pensions. From the point of view of individuals, increases in the FRA represent sizeable, negative shocks to pension wealth that lower life-time consumption, unless individuals find ways to accommodate them. Workers can extend their working life, generating work income, and buffer part of the wealth shocks. By choosing when to claim a pension, people can also buffer pension wealth shocks, especially in systems that offer early or late claiming options at a price that is actuarially advantageous.

Understanding how people adjust to pension wealth shocks is interesting. Individuals who accommodate pension wealth shocks by working longer have low costs of extending their work life. The costs of extending work life include the value of leisure of individuals who work until the claiming age, and the costs of looking for work for individuals who left the labor market before the claiming age. Individuals who respond to pension wealth shocks by adapting the timing of pension claiming reveal information about the costs of delaying pension claiming, primarily life-expectancy and impatience. Understanding how individuals use the labor supply and the claiming margin to deal with pension wealth shock informs on the distribution of costs of working longer, and the costs of waiting for a pension longer.

Unfortunately, many countries view the pension claiming, and labor market exit decision as one and the same thing. For instance, workers who want to claim benefits early, and work at the same time, face an earnings test in the United States. Most continental European system do not allow working and claiming benefits at the same time, except the Nordic countries. As a result of this restriction, not much is known so far about how people use the working and claiming margin

when faced with shocks to pension wealth. Forcing people to leave work and claim a pension at the same time could be costly to those who are able to work but impatient, or patient and unable to work. Unless the costs of delaying work and pension claiming are perfectly correlated, these types of individuals exist and bear the cost of synchronized labor market exit and pension claiming.

We study pension claiming and exit from work decisions in Switzerland. The Swiss context is interesting from a conceptual point of view. There is no mandatory retirement in Switzerland. Moreover, there is no earnings test so individuals can both draw retirement benefits and continue working. Changes to retirement benefits affect wealth but do not change the incentive to work or not. The Swiss reform allows us to study wealth effects on labor supply. Moreover, we use the Swiss Social Security Database (SSSD) which contains the complete labor market and earnings histories of all workers and their spouses in Switzerland. We can go beyond studying individual labor supply and examine pension claiming.

We study the effects of a 1997 reform of the old age survivors' insurance (OASI) with two key elements. First, the reform increased the FRA in two steps, from 62 to 63 years, FRA63, and from 63 to 64 years, FRA64, each step reducing social security wealth (SSW) by 5.2%. Both FRA increases were implemented sharply for all women born on the cut-off date January 1, 1939 or later for FRA63, and for women born on January 1, 1942 or later for FRA64. Second, the reform introduced early pension claiming at the early retirement age (ERA), 62 years, reducing pensions by 3.4%, for women born on January 1, 1939 or later, and by 6.8% for women born January 1, 1948 and later. A pension reduction of 3.4% is actuarially advantageous for a women with average life-expectancy, and discount rate of 2.5%. Doubling the price to 6.8% is return to what is considered actuarially fair (RAF). Our analysis adopts a regression discontinuity design (RDD) comparing women born just after the cut-off dates to those born before.

The 1997 reform provides an interesting empirical design to study labor supply and pension claiming responses. The reform offers an opportunity to study two pension wealth shocks. OASI is the prime source of income for low income earners, losing pension wealth of up to 10% due to the reform. Admitted, the true magnitude of the wealth shock is considerably smaller for high income earners as these draw pensions mainly from company pension plans, and tax deferred pension accounts. The Swiss context allows studying who responds to wealth effects on labor supply since the decision to work is not, to first order, affected by claiming. Responses to the FRA increases

inform on the elasticity of labor supply, governed by the distribution of costs of delaying labor force exit. In contrast, the doubling of the early retirement price, RAF, targets pension claiming decisions. As the reform offers early claiming both at a low and a high price, allowing us to bound the distribution of cost of delays in claiming, governing the elasticity of pension claiming decisions.

We find that increasing the FRA by one year delays labor market exit by about 6 to 7 months. Interestingly, increasing the FRA has no effect on about 20% of all women's claiming age, but the average delay in claiming a pension is still about 7 to 8 months. Adjustments in pension claiming accommodate about 10% of the initial wealth shock, and earnings about 25%. Increasing the price of early claiming, women delay pension claiming by about 4 months, and do not delay exit from work. These adjustments fully accommodate the RAF pension wealth shock, originally of the same size as a one year FRA wealth shock.

We also study how the reform affects labor market and pension claiming decision jointly. Conceptually there are three interesting groups of women. Consider first, women who claim benefits at the ERA, and leave work at the same time. Increasing the FRA strongly delays the benefit claiming date for women who claim without working, indicating that these women have high costs of work, and low costs of delaying pension benefits. Second, women who work until the ERA, and do not claim benefits at the same time. We find that most of these women delay labor market exit, without claiming pension benefits as a response to increasing the FRA. These women have low costs of delaying both, labor market exit, and pension claiming. Third, women who work while claiming benefits at the ERA. We find that these women show no response to an increase in the FRA that offers early claiming at a low price. These women would have worked beyond the FRA anyhow, and have high costs of delaying pension benefits. The response to doubling the early retirement price is different. Many women who claim while working at the ERA stop doing so, delaying benefit claiming until reaching the FRA. A few women who claim without working at the ERA delay pension claiming and continue working until the FRA.

A growing literature studies the impact of FRA increases on labor force participation for men. Fewer studies focus on labor supply of women, and fewer still examine the effects of pension reform on income and well-being of older workers. Understanding when women decide to leave the labor force is interesting for several reasons. Many countries grant women the right to leave the labor force earlier than men even though women have a longer life horizon due to their higher life-expectancy.

Focusing on women is also interesting since women could respond to incentives to delay labor force exit more strongly than men. Studying outcomes beyond labor supply is important. Whether and how much pension reform decreases income is a central piece of information when discussing welfare implications of pension reform.

This paper is related to several strands of the literature. First, U.S. studies examine how the Social Security Amendments of 1983, which increased the FRA from 65 to 67, affected labor force participation of older workers in the U.S. Blau and Goodstein (2010); Mastrobuoni (2009); and Song and Manchester (2007) 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 role of financial incentives for retirement on labor supply (Krueger and Pischke, 1992; Gruber and Wise, 1999; Coile and Gruber, 2007; Manoli and Weber, ming; and Gelber *et al.*, 2016) and the literature on the impact of retirement on health (Kuhn *et al.*, 2010; Coe and Zamarro, 2011; Hernaes *et al.*, 2013).

This paper complements the existing literature in several ways. We study a context that allows people to deal with pension wealth shocks by timing their pension, working longer, or both. These decision margins are conceptually different, and understanding how retirement reforms affect these margins is important. Our empirical design is rich, embedding both wealth effects, and changes in the price of early claiming. This design allows learning about features the joint distribution of costs that prohibit people to adjust claiming and labor force exit, as well as their joint distribution

is feasible. From the identification point of view, it is advantageous that increases in the FRA were implemented sharply, rather than more gradual increases of the FRA of a few months per age cohort, as in the UK for instance. The drastic increase in the FRA allows adopting the RDD, a transparent and powerful empirical design. Previous studies adopt a difference-in-differences or interrupted time series design, both vulnerable to violations of identifying assumptions.

The outline of this paper is as follows. We next discuss the institutional background. Section 3 presents the data and descriptive analyses. Section 4 presents the conceptual framework. Section 5 presents a descriptive preview of our main results. Section 6 discusses our empirical strategy and tests of its validity. Section 7 presents the main results. Section 8 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 retiring at the full retirement age (FRA), 62 years for women, and 65 years for men, before 2000. Men and women need to contribute to the pension system by paying social security taxes of 8.4% on their wage, or their unemployment benefits. The contribution requirement is from age 20 until the FRA, reducing pensions 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.[1]

Women and men with full contribution history receive a pension whose level depends on average index mean annual earnings (AIME).[2] Individuals with AIME of 14,000 CHF, or lower, receive the

[1] 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.

[2] Average earnings are supplemented for parents who have taken care of children below age 16, or individuals who care for relatives in need of care. Supplements are equivalent to three times the minimal pension.

minimum pension of 14,000 CHF, so the replacement rate is 100% or higher. Individuals with AIME of about 83,000 CHF, or higher, receive an annual pension of 28,000 CHF, so the replacement rate is 34% at the maximum 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.

Women and men who claim their old age pension later than the FRA earn an actuarially fair increase in their pension. 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. But claiming late is an active decision, individuals have to inform their local OASI agency about late claiming in the year after they attain the FRA. Individuals who forget to inform an agency about delayed claiming receive the same benefits as individuals who claim at the FRA. Individuals who delay claiming 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. Claiming before the FRA was not possible before the reform as we discuss 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 supplementary pension of 30% of his individual pension.

Individuals have access to two additional sources of pension wealth. The first source 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 full retirement age that can but need not be the same as the first pillar FRA. Individuals who reach the second pillar FRA can either withdraw an annuity, a lump-sum amount, or a mix of these two. The majority of retired individuals chooses the annuity even though the first pillar already provides an annuity stream in old age (Bütler 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 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. The Swiss OASI offers actuarial adjustment for delays in claiming. Claiming and retiring from work are separate decisions.

Switzerland 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 contract can, however, be renewed. Continuing work beyond the FRA is often attractive from the financial point of view as contributions to company pensions are no longer mandatory.[3] But many employment relationships are implicitly understood to end at the FRA. On top, 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. The UI qualifying conditions are not easier for older workers on paper. But UI is more generous to individuals who are two years from the FRA, receiving extra benefits. Time on UI counts for the work requirement. DI pays higher benefits than UI. The process of receiving DI benefits is lengthier. Time on DI also counts for the work requirement.

[3]Part-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 A 1997 Reform That Shocks OASI Wealth

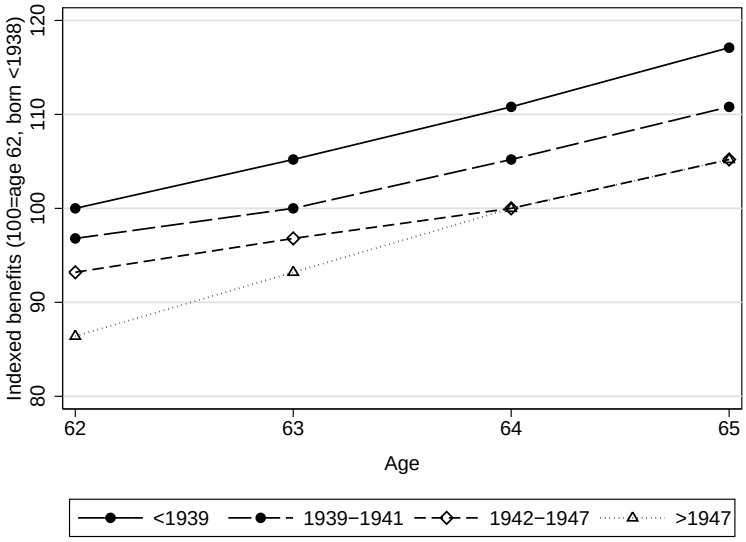
The Swiss government enacted a major reform of OASI as of January 1, 1997. The most important element of this reform was an increase in the FRA for women from age 62 to age 64. The increase occurred in three main stages. The FRA was increased to age 63 for women born between 1939 and 1941 affecting all women born January 1, 1939 or after. The FRA was further increased to age 64 for women born in 1942 or later, affecting women born January 1, 1942 or later. These FRA increases reduce OASI wealth by 5.2%, the amount pensions increase due to a one year delay in claiming.

The second major element of this reform is 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. Note that the price of one year of early retirement, 3.4%, is smaller than the premium for late retirement, 5.2%. The government aimed to make this reform more palatable to affected women by offering early retirement at a less than actuarially fair price. The price for early retirement doubled, from 3.4% to 6.8%, for women born on January 1, 1948 or after. Early retirement, priced actuarially fair, became more costly to these women. Women who wanted to claim pensions early had to inform a pension agency ideally several months in advance, one day ahead of their early retirement birthday latest. 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 places them in a higher tax bracket.

Figure 1 shows how the Swiss systems adjusts pensions for early or late claiming. The solid black line gives the pension adjustment factor (PAF) for women born in 1938, the last cohort unaffected by the reform. Women in the 1938 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 for every year of delay.

Figure 1 shows how the reform affected the PAF, in three steps. The dashed line provides the

Figure 1: Pension Adjustment Factor (PAF)




Notes: This figure shows how the Swiss social security system adjusts women's old age pensions as a function of the claiming age for different birth cohorts. Base pension amount, 100, is the pension for a women born in 1938 or before, claiming a pension at age 62 years.

Source: Own calculations based on Swiss social security rules.

adjustment factor for women born 1939 to 1941. The 1939 to 1941 birth cohorts could still claim benefits at age 62 years, albeit with a pension that was 3.4% lower than the full pension. Women born 1939 to 1941 who decided to delay claiming to age 63 were again eligible for a full pension, with actuarially fair adjustments to pensions for those claiming later than the FRA at 63 years (the FRA63 step). The dotted line gives the adjustment factor for women born 1942 to 1947. The 1942 to 1947 birth cohorts could claim an old age pension at age 62 years, albeit with a pension that was 6.8% lower than the full pension. Delaying claims by two years, to 64 years, the 1942 to 1947 women were again eligible to a full pension; pensions for those delaying to claim beyond the FRA at 64 years adjusted at an actuarially fair rate (the FRA64 step). Both FRA63 and FRA64 generate a convex kink in the pension adjustment factor at the FRA. The light dotted line refers to women born 1948 or later. These women could take retirement at age 63 years at an adjustment of 6.8% to their pension, or at age 62 years at an adjustment of 13.6%. The early claiming adjustment for women born 1948 or later is double the adjustment of the older age groups. We refer to this element of the reform as the "re-instating actuarial fairness" (RAF).

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. 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 women were born 1942 or after. This change does not affect our analysis of FRA63, or RAF. Abolishing the supplementary pension may affect our estimate of increasing the FRA from 63 to 64 years, which we assess 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.

# 3 Data and Descriptive Analysis

## 3.1 Data

Our empirical analysis uses Swiss Social Security data (SSSD) from three sources. The first data source covers all women born 1935 to 1948 and their labor market histories, starting in 1982 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 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 years and average indexed monthly earnings 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 have information on labor supply and pension claiming for them.

The third data source contains income tax records of individuals who live in a large region of Switzerland. These records cover the period between 2000 and 2010. We use these records to identify the age at which individuals start receiving retirement income from the occupational pension plan.

### 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. We exclude the following sets of women: women who are never employed after age 50 and women 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 to die by 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= $\sum_{s=R}^{T} \frac{b(s=R)}{(1+r)^{(s-R)}} * p_{s|R}$ where $R$ is claiming age, $b(s=R)$ is the pension benefit at that claiming age, $T$ is the maximum age possible (assumed to be 100 years), $r$ is the discount rate (set at 2.5%), and $p_{s|R}$ is the probability to be alive at date $s$ conditional on claiming old age

pension benefits at age $R$.

Table 1 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 one to two years before the FRA. The average claiming age is between 0.4 to 1.3 years below the FRA. Mortality is around 13.5% for the cohort affected by the reform increasing the FRA from age 62 to age 63 (in 2001), about 10% for the cohort affected by the increase from age 63 to age 64 (in 2005), and about 6% for the cohort affected by the doubling of the price for early claiming. Average social security benefits are around 19,000 CHF for one year. Discounted social security wealth is about 23 times larger than the annual pension benefit.

Panel B of Table 1 shows summary statistics on key background variables. About one in five or six women has a non-Swiss nationality. About 59% of women are married and wives are on average 2.6-3 years younger than their husband. About 30% of women in FRA63 sample get a supplementary pension. Supplementary pensions are less frequent in the FRA64 and RAF samples; only about 20% in the FRA64 sample and 8% in the RAF 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 50,956 CHF per year for the women affected by the FRA increase from 62 to 63, 1,500 CHF larger for women affected by the change in the FRA from 63 to 64 years, 2,500 CHF larger for women affected by the RAF 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 RAF samples. Annual earnings at age 50 are about 40,000 CHF in the FRA63 sample and about 44,000 CHF in the FRA64 and RAF samples. 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. This explains why annual earnings are substantially lower than indexed earnings. Old age pensions replace a substantial proportion of annual earnings: the replacement rate varies between 44.1% to 47.5%.

Table 1: Summary Statistics

| | FRA 63 (1) | FRA 64 (2) | RAF (3) |
|---|---|---|---|
| *A. Outcome variables* | | | |
| Exit Age (years) | 60.2 | 60.9 | 61.5 |
| | (3.8) | (3.9) | (3.9) |
| Claiming Age (years) | 61.6 | 62.2 | 62.7 |
| | (2.4) | (2.8) | (2.9) |
| Mortality, Pr(die by 2013) (%) | 13.5 | 9.9 | 6.1 |
| SS benefits (CHF per year) | 18,999 | 19,432 | 19,261 |
| | (7,044) | (6,755) | (6,909) |
| SS wealth (CHF) | 447,033 | 449,913 | 442,151 |
| | (165491) | (155,709) | (157,835) |
| *B. Characteristics* | | | |
| % foreign | 21.5 | 18.1 | 17.6 |
| % married | 58.5 | 59 | 59.1 |
| Age wife - age husband (years) | -3 | -2.8 | -2.6 |
| | (5.91) | (5.8) | (5.41) |
| % supplemental benefits spouse | 30.6 | 20.7 | 7.9 |
| Supplemental benefits amount (CHF per year) | 1,979 | 1,229 | 128 |
| | (3,339) | (2,796) | (966) |
| Average indexed earnings (CHF per year) | 50,956 | 52,469 | 53,409 |
| | (31,856) | (31,361) | (29,791) |
| Earnings at age 55 (CHF per year) | 39,992 | 44,101 | 43,718 |
| | (41,697) | (50,927) | (51,440) |
| Months employed until age 50 | 38.9 | 66.4 | 117 |
| | (16) | (26.2) | (47.4) |
| Months unemployed until age 50 | 0.2 | 0.3 | 1.8 |
| | (1.51) | (2.16) | (6.44) |
| Months contributing voluntary until age 50 | 0.3 | 0.4 | 0.8 |
| | (3.16) | (4.71) | (6.91) |
| No. observations | 58,932 | 67,015 | 80,663 |

Notes: This table reports summary statistics of key outcome variables in Panel A, and background characteristics in Panel B for the three samples we use to measure the effects of increasing the FRA and re-instating actuarial fairness (RAF). The FRA63 sample refers to the cohorts born 1938 and 1939, the FRA64 sample refers to the cohorts born 1941 and 1942, and the RAF sample refers to cohorts born 1947 and 1948.

Source: Own calculations, based on SSSD.

Table 2: Empirical Design

| Reform step<br>Cohort | Before<br>before 1938 | FRA63<br>1939-1941 | FRA64<br>1942-1947 | RAF<br>1948 after |
|---|---|---|---|---|
| | A. Full claiming | | | |
| Age | 62 | 63 | 64 | 64 |
| Wealth Shock | – | -5.2% | -5.2% | 0.0% |
| | B. Early claiming | | | |
| From age | – | 62 | 62 | 62 |
| Price | – | -3.4% | -3.4% | -6.8% |

Notes: Table displays the shocks to pension wealth due to the reform. FRA is the age a women receives a full pension, the full retirement age. The FRA Wealth Shock refers to the change in wealth at the FRA valid for a cohort. For instance, the figure -5.2% means that women born 1939-1941 are eligible for 5.2% life-time pension when claiming at age 63, their FRA, than women born 1938 or before. Early retirement price refers to the reduction in pension benefits per year of early retirement. For instance, the 1939-1941 cohort could go on early retirement at age 62 with a 3.4% lower pension.

# 4 Conceptual Framework

In this section, we discuss the size of the wealth shocks induced by the different elements of the reform, and how two strategies to accommodate the wealth shocks: changes in benefit claiming and changes in retirement from work.

We start with providing an overview of the shocks to pension wealth, and the price of early retirement, due to the reform (Table 2). Women born before 1938 were eligible for a full pension at age 62, and had no option to go on early retirement. Women born 1939-1941 could only attain a full pension when claiming at age 63. Pension wealth would have been 5.2% higher for women born 1938 or before. We will refer to the 5.2% reduction in OASI wealth as "the FRA wealth shock", providing a measure of how much redefining the FRA reduces people's OASI wealth.[4] Women born in 1939 could claim benefits already before the FRA, at age 62, at a price of 3.4% on their yearly pension.

FRA64 raised FRA to 64 for women born 1942-1947, generating the same FRA wealth shock, and offering early retirement at the same price as FRA63. But the wealth shock now occurs at a lower level, removing another 5.2% of SSW, and early claiming is now available for two years

[4]We will present other measures of the impact of the reform on wealth, notably on women who took retirement at age 62.

prior to the FRA. RAF doubles the price of early retirement. Women who want to claim benefits early pay 6.8% rather than 3.4% per year of early retirement. Unlike the FRA shocks, the RAF leaves pension wealth at the FRA unchanged. The RAF step rather acts on the claiming decision by drastically increasing the price of early retirement.

We now discuss how these reform steps affect social security wealth. Figure 2 shows social security wealth (SSW), claiming OASI benefits between age 62 to 65, subject to the four policy regimes.[5] Social security wealth before the reform gradually increases from age 62 to 65.[6] The wealth shock triggered by FRA63 can be inferred comparing wealth at the new full retirement age to wealth that the system would have offered in the old system. FRA63 offers the same social security wealth at age 63, the new FRA, as the old system does at age 62, so women loose one year of pension benefits. Women who delay claiming of OASI benefits receive a pension that is 5.2% higher than the normal pension. The FRA wealth shock due to the FRA63 step is 5.2%. FRA64 reduces social security wealth by an additional 5.2% at the new FRA, age 64. RAF does not affect social security wealth at age 64, the FRA.

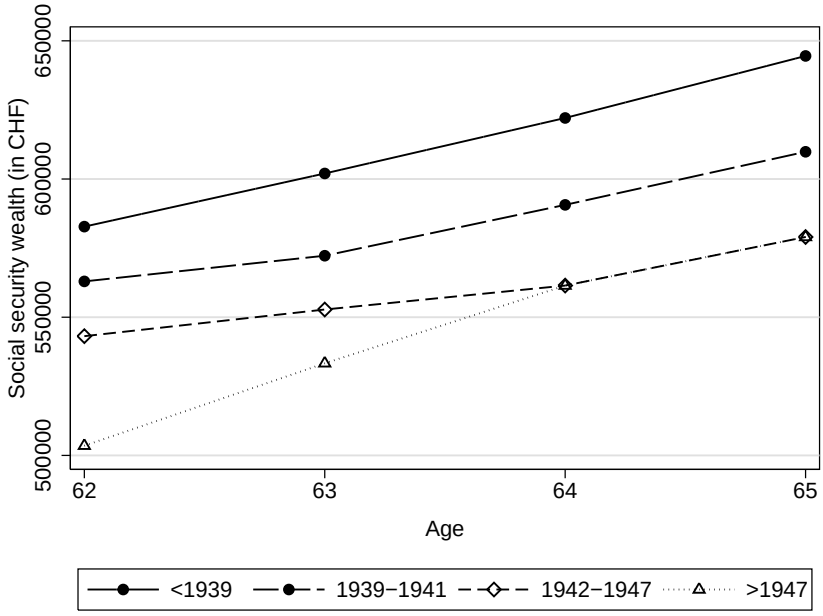
Starting from FRA63, women are not forced to claim benefits at the FRA. Figure 2 provides SSW for women claiming benefits earlier than the FRA. Women who claim benefits early, experience only a reduction in SSW of 3.4% rather than by 5.2% when claiming at the FRA. Women can accommodate a part of the wealth shock by claiming benefits early, at the old FRA. FRA64 offers a similar opportunity to partially accommodate the wealth shock by claiming benefits before the early retirement age. Interestingly, RAF even offers an opportunity to fully accommodate the wealth shock that women who claim benefits early would incur. Women with high life-expectancy, or low discount rate, achieve higher SSW by delaying benefit claiming, regardless of the policy regime.

Figure 2 shows that all reform steps had sizeable effects on OASI wealth. The Swiss reform offers an interesting opportunity to study how women deal with these wealth shocks. Conceptually, we need to understand incentives for working one year longer, and incentives for claiming benefits early or late. Consider first the incentives to work and claim without liquidity constraints. Women who work just before the FRA, and leave the work force at the FRA, are likely to continue to work,

[5] We calculate SSW as in Table 1 for a women with average life-expectancy and a discount rate of 2.5% per year.

[6] Pension adjustments are actuarially fair for the general population. Women have a higher life expectancy than the general population.

Figure 2: How the Reform Affects Social Security Wealth




Notes: Figure shows discounted social security wealth by age. We assume a discount rate of 2.5%, and average death hazard.

Source: Own calculations based on Swiss social security rules.

because they are constrained by contracts, and employers. Increasing the FRA shifts the contract and dismissal constraint by one year. Women will work longer, at least for part of the year added to their potential work life.

Turning to incentives to claim, we have seen in Figure 2 that a women can accommodate parts of the shock to pension wealth by claiming early. Whether early, or late, claiming is optimal depends on whether the price of early retirement offered by OASI is actuarially fair. The actuarially fair price for one year of late claiming is equal to the discount rate, adjusted for mortality and benefit indexation, or MIAD.[7] Individuals with a MIAD that is larger than the price of early retirement will take early retirement, and be better off than claiming at the FRA, so accommodate part of the pension wealth shock. Individuals with a MIADR that is smaller than the price of early retirement

[7]We show this in a continuous time framework. Suppose $b$ is the early retirement pension, $i$ is the indexation of benefits, $\beta$ is the discount rate, and $\gamma$ is the average death hazard, and $\delta \equiv \beta + \gamma - i$ is mortality and indexing adjusted discount rate (MIAD). Social security wealth is $b \int_0^\infty exp(-\delta t)dt = b/\delta$. Delaying to claim benefits by one year increases benefits by $exp(\alpha)$, where $\alpha$ is the early retirement price (Table 2). Benefits start one period later, and social security wealth is $bexp(\alpha) \int_1^\infty exp(-\delta t)dt = b/\delta exp(\alpha - \delta)$. An individual is indifferent between claiming early, or delaying by one year, if social security wealth from early claiming equals social security wealth from late claiming, or $b/\delta = b/\delta exp(\alpha - \delta)$.

will take late retirement, again accommodating part of the pension wealth shock. A key advantage of our design is that we observe delays in pension claiming both at a low price, of $\alpha = 3.4\%$, and a high price, $\alpha = 6.8\%$.

With liquidity constraints, women may work until reaching the FRA because they lack the means to finance early labor market exit. Increasing the FRA, while offering early claiming, leaves labor supply of liquidity constrained women unchanged. Also, women who are liquidity constrained want to access pension benefits even if they are offered at a price that is more expensive than would be actuarially fair. Lack of liquidity or access to financial markets should not constrain reactions to FRA63 or FRA64 since claiming early appears an attractive investment for a substantial proportion of women. Women can fully accommodate the wealth effect triggered by doubling the early retirement price due to RAF by claiming benefits at the FRA. Liquidity constrained women who want to leave the labor market at the ERA, will delay both claiming and retiring from work, even though delayed claiming would be optimal.

Couples could accommodate pension wealth shocks to one spouse by adjustments made by the other spouse yet the scope for men to accommodate via labor supply reaction appears limited. Most men do not leave the labor force until the FRA, or via disability insurance, so there is little unused labor force before the FRA. Men could work beyond the FRA but face the same constraints of contracts and dismissals as do women. Men could delay claiming of pensions and earn the late claiming return on this decision. Late claiming is, however, virtually absent, perhaps due to labor supply constraints and liquidity constraints.

We have discussed retiring from work and claiming benefits as two separate decisions. This is justified from the Swiss context where the pension system allows individuals to claim a pension and work at the same time. But there are links between the two decisions. For instance, women who claim a pension early, and continue to work until the FRA, will face 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.

The FRA might affect claiming and retirement decisions because it is the default claiming age. Individuals who do not become active on their own will trigger the retirement claiming process automatically in the year they reach the FRA. Both early and late retirement pension claiming requires an active decision of the individual. In a situation where agents are not perfectly informed, or not perfectly forward looking, defaults can have important consequences on behavior. In particular, the FRA steps of the 1997 reform will affect pension claiming of all women who have not drawn a retirement pension before the FRA.

The FRA does not drive labor market exit decisions through universal retirement. But reductions in employment contracts, and implicit contracts, may lead to terminating employment relations at the FRA. Bur our empirical design provides key incentives to work more prior to reaching the FRA. We are optimistic that our analysis captures changes in labor supply decisions triggered by wealth shocks.

# 5 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 some first idea of the causal effect but may be confounded by trends or cohort composition effects.

Figure 3(a) reports effects of FRA63 on disability or old age pension claiming. Women born 1938 are eligible for a full old age pension at 62 years, with no possibility to draw an early retirement pension before. Pension claiming increases somewhat already between age 54 and 61 years reflecting transitions to disability insurance. Almost all women claim a pension exactly at age 62 years, so women perfectly comply with the full retirement age. Interestingly, very few women take-up the possibility to retire later than the full retirement age. 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. Raising the FRA to age 63 reduces pension claiming at age 62 years substantially, from about 100% to somewhat less than 40%. Women who do not claim a pension at age 62, now do so at age 63 years. But a sizeable proportion of women, about 20%, make use of the possibility to draw an early retirement pension at age 62. 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.

How does increasing the FRA by one more year affect pension claiming? Figure 3(b) shows pension claiming for the 1942 cohort, eligible at age 64 years, and the 1941 cohort, eligible at age 63 years. The 1941 cohort has near universal pension claiming by age 63 years. Raising the FRA to 64 years reduces pension claiming from near 100% to about 40% at age 63 years. At age 64 years, nearly 100% of the treated cohort claim an old age pension. Raising the FRA by another year again substantially delays pension claiming to the FRA, but sizeable proportions of women claim an old age pension early, about 15% at 62 years or about 10% at age 63 years.

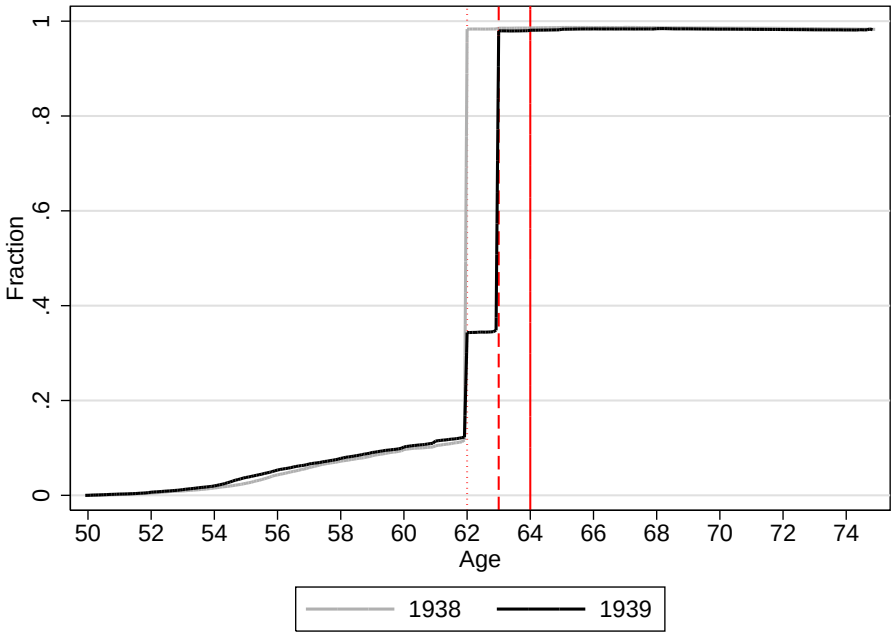
How does raising the adjustment to the actuarially fair rate affect pension claiming, the RAF step of the reform? Figure 3(c) shows pension claiming profiles for the 1948 cohort, subject to a adjustment of 6.8% for every year claimed early, and the 1947 cohort, subject to a reduced adjustment of 3.4%. Recall that sizeable fractions of women take retirement either at 62 years, about 15%, or 63 years, about 10%. The RAF reform reduces the extent of early retirement substantially, to only about 5% at age 62, and about 5% at age 63 years. The RAF reform delays pension claiming, removing early retirement incentives created by less than fair adjustments to pensions.

Figure 4(a) shows how the reform affected the timing of labor supply. Increasing the FRA by one year changes the timing of labor force exit around the old and new FRA in important ways. About 38% of women born in 1939, eligible for a full pension at age 63, work on the eve of their 63rd birthday but only about 12% of all women born 1938, eligible for a full pension at age 62 years, do so at that time. The reform also increases labor supply somewhat just before the old FRA and just after the new FRA. A small sub-group of women born in 1939 continue to leave the labor force upon reaching the old FRA of 62 years. These women make use of the possibility to take early retirement at the cost of reducing pension benefits by 3.4%. FRA63 increases labor supply substantially, and the increase is concentrated around age 62 and 63.

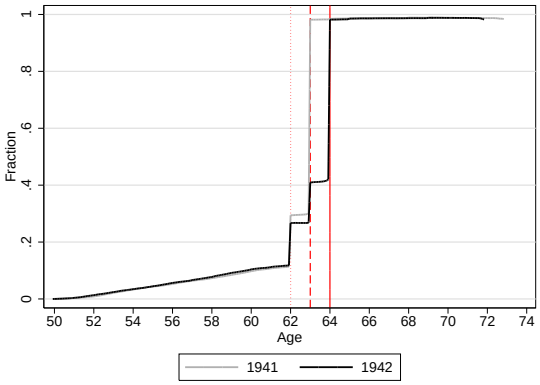
Forward looking individuals might adjust labor supply already in advance of an increase in the full pension age. FRA63 was announced only four years before coming into effect, leaving little time to adjust. But FRA64, announced 8 years before coming into force, might leave enough time for anticipatory behavior. FRA64, in graph (b) of figure 4, reveals that the largest effect of increasing

Figure 3: Effects on Pension Claiming

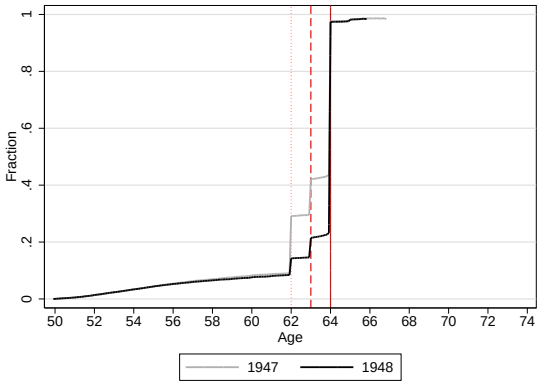
(a) FRA63




(b) FRA64




(c) RAF

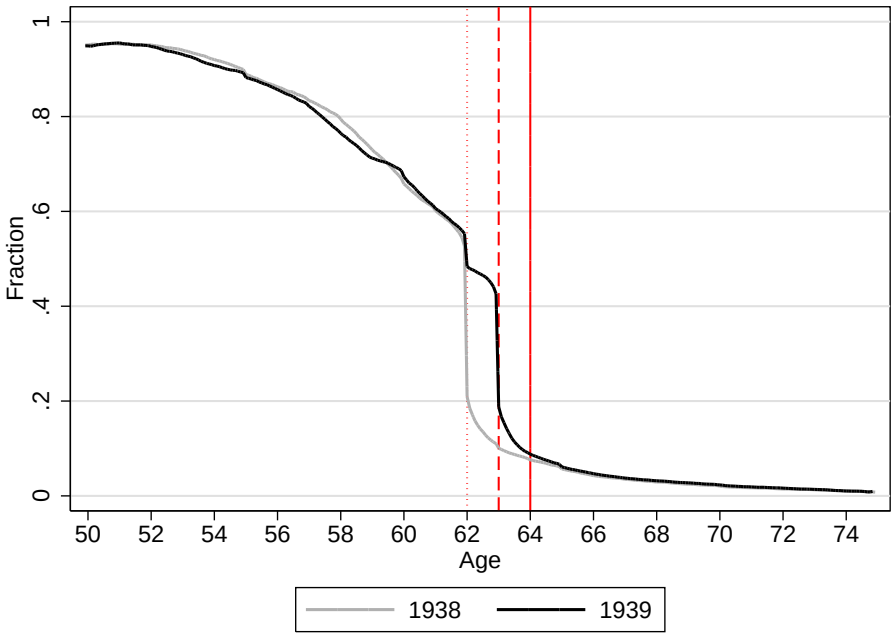



Notes: Figure shows proportion claiming an old age or disability pension, by age. Graph (a) shows the effect of increasing the FRA from 62 to 63 years, Figure (b) shows the effect of increasing the FRA from 63 to 64 years, and Figure (c) shows the effect of the double adjustment. Dark shading refers to the first cohort affected by the reform. Light shading refers to last cohort not affected by the reform.

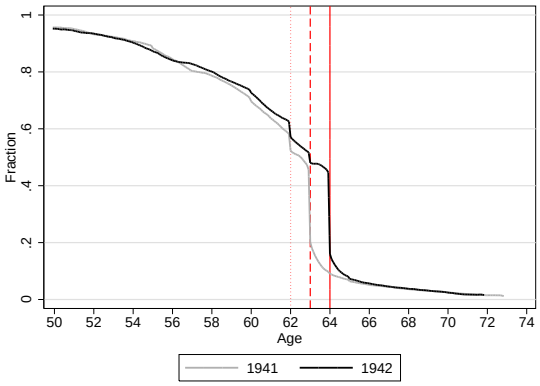
Source: Own calculations, based on SSSD.

Figure 4: Effects on Labor Supply

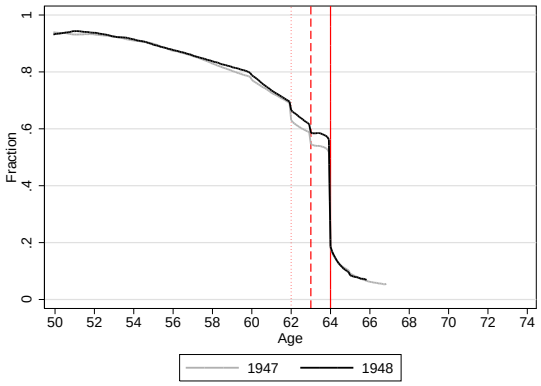
(a) FRA63




(b) FRA64




(c) RAF




Notes: Figure (a) shows the proportion working by age for women born 1938 (with FRA 62 years; dark line) and women born 1939 (with FRA 63 years; light line). Increasing the FRA changes labor supply strongly in the age bracket between the old FRA and the new FRA. Figure (b) shows the proportion working by age for women born 1941 (with FRA 63 years; light line) and women born 1939 (with FRA 64 years; dark line). Figure (c) shows the proportion working by age for women born 1947 (with early retirement penalty of 3.4% per year; light line) and women born 1948 (with early retirement adjustment of 6.8% per year; dark line). Increasing the FRA changes labor supply strongly in the age bracket between the old FRA and the new FRA. Increasing the adjustment has a smaller effect.

Source: Own calculations, based on SSSD.

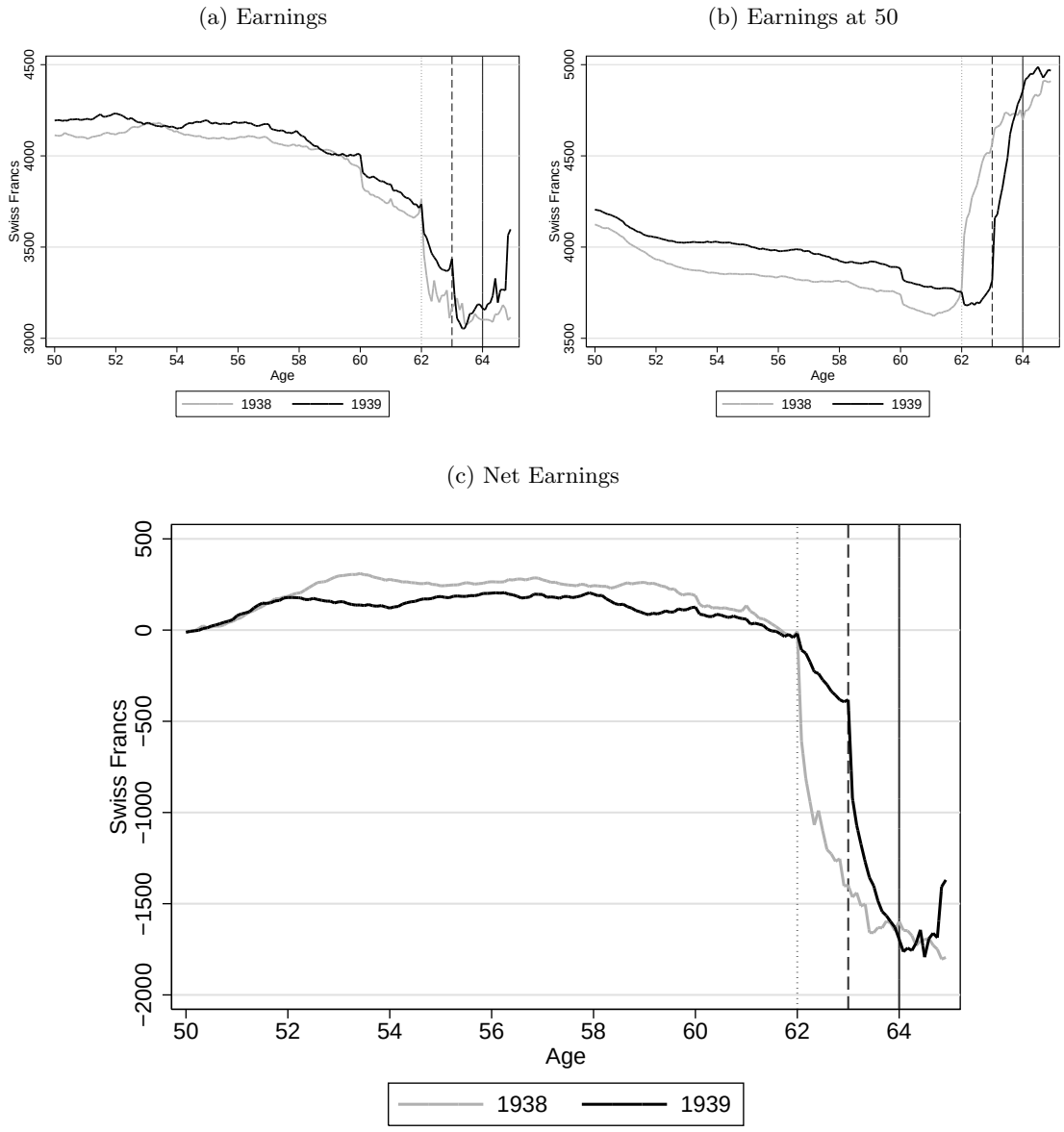
the FRA again takes place at age 63 years, the year when the younger cohort lost eligibility to a full pension. But the two profiles also indicate much higher labor supply already at age 62 years, one year before the old cohort could reaches the FRA, and at age 64 years, the year after the young cohort became eligible for a full pension. This is, perhaps, some evidence for a small anticipatory behavior. Figure 4(c) shows the labor supply profile of women born 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. RAF raises labor supply but to a lesser extent than the two increases in the FRA we just discussed.

We now look into earnings. We report results for FRA63, noting that results for FRA64 are similar, and RAF had no large labor supply effects. Figure 5(a) provides average monthly earnings for women who are currently working. Monthly earnings do not adjust for working time, as we have no information on hours. Also, working women are a sub-set of all women in each cohort, so selection issues may be important. Working women in the 1939 cohort, eligible for FRA at age 63 years, earn about 100 CHF per month more than working women in the 1938 cohort, eligible for FRA at age 62 years. But the evolution of monthly earnings with age is very similar between both cohorts, regardless of how close they are to the FRA. Even around age 62 to 64 years, when the reform shows the strongest effect, monthly earnings are similar.

But FRA63 triggered substantial labor supply responses. Merely looking at wages of women who currently work may be mis-leading because of selection. Figure 5(b) reports average monthly earnings at age 50, a measure of earnings potential, of working women to assess selection out of the labor force. Average wages at 50 are higher for the 1938 cohort than for the 1937 cohort, by a level shift of about 100 CHF per month. But the evolution of earnings potential is similar for both cohorts from age 50 until age 62. Average earnings potential of working women gradually increases at age 62, and strongly at age 63, for women eligible for the full pension at age 62, born 1938, as women with low earnings potential are leaving the labor force. A similar pattern sets in for the group eligible for a full pension at age 63 years, born 1939, with a one year delay. Women who continue to work tend to be those with high earnings potential.

How does delaying the FRA affect monthly earnings women work for? Figure 5(c) reports the difference between the current monthly earnings and monthly earnings at age 50 for women

Figure 5: Earnings and Selection




Notes: Figure (a) shows the average monthly wage of those currently working. Figure (b) shows the average wage earned at age 50 of those currently working. Figure (c) shows current wage minus wage at 50 of those currently working. We show effects for FRA64, the increase in FRA from 62 to 63 years.

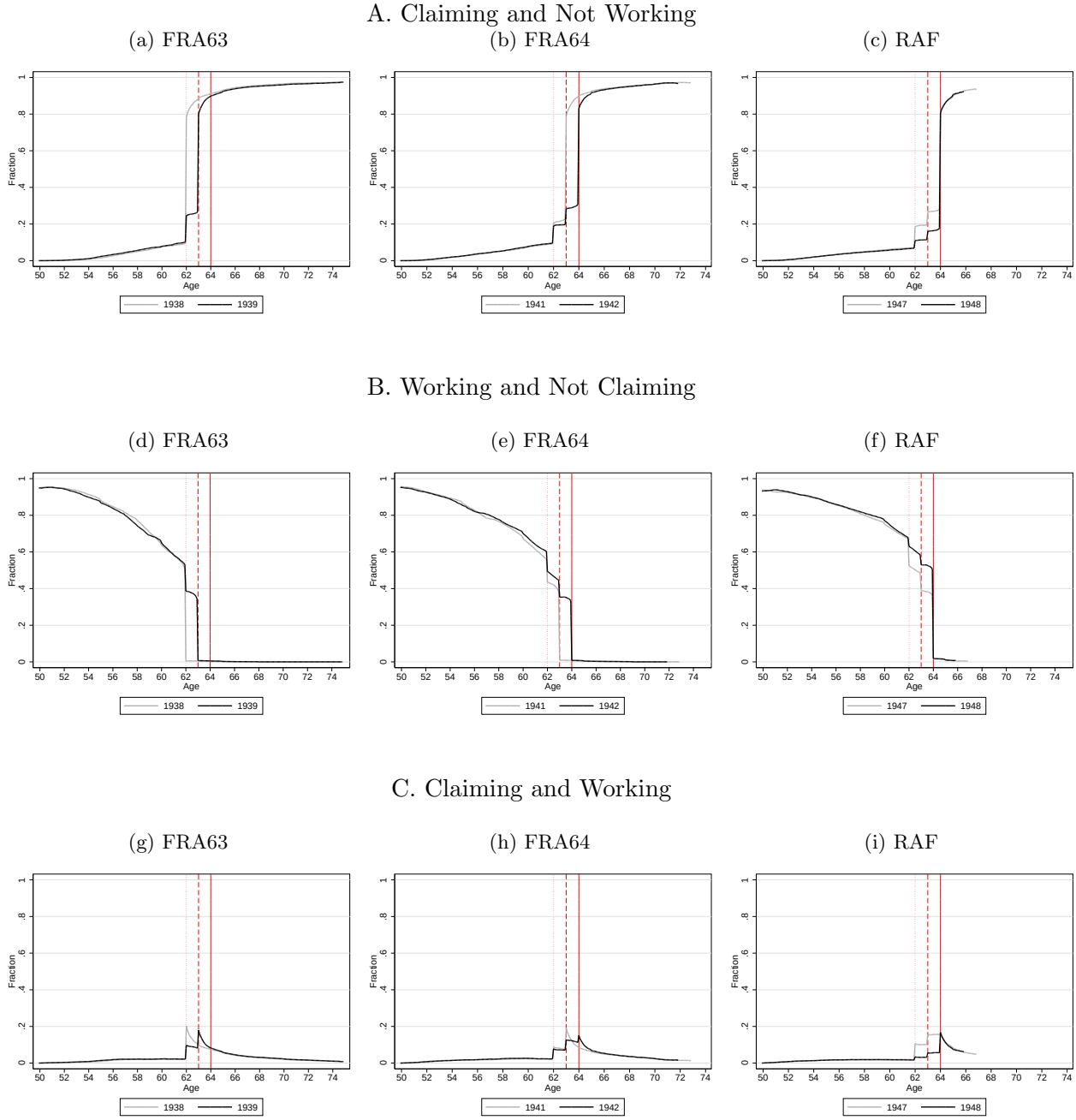
Source: Own calculations, based on SSSD.

currently working. This "net wage" adjusts for selection out of the work force. The evolution of the net wage before age 62 years is similar for both treated and control cohort, the "net wage" nets out the level shifts, documented in figures (a) and (b). Working women born 1938, eligible to go on retirement at 62 years, earn substantially less than their earnings potential if they continue to work beyond the retirement age 62 years. Working women born 1939, eligible for full retirement at age 63 years, experience two shifts in monthly earnings, a gradual shift once they work past age 62, and a substantial shift once they work past 63 years. Women who work beyond the normal age have high earnings potential, but the additional work pays less or occupies their time during fewer hours.

A central feature of our setting is that labor supply and pension claiming decisions are separate. We now illustrate how the reform affected the decision to claim without working, to work without claiming, or to claim while working. Figure 6A shows women who claim OASI or DI benefits but do not work at the same time. Before the reform, about 10% of all women claim benefits just before age 62, the FRA, essentially DI claimants. Women who claim at the FRA increase the proportion claiming without working to 80% at the FRA, gradually increasing to almost 100% at age 75. Women subject to the FRA63 rules, and would have claimed at the FRA, also do so under FRA the new rules, delaying pension claiming by one year. A mass of 10-15% of women who would have claimed at FRA 62 now do so at the ERA 62. FRA64 generates a similar delay in pension claiming, by one year, for women who would have claimed at FRA 63 and now do so at the FRA 64. RAF induces about one half of all women who claim before the FRA of 64 years to delay claiming until the FRA of 64 years.

Working without claiming is the second state we observe. Figure 6B shows how many women work without claiming. At age 50, almost all women work, reflecting our choice to focus on attached women. Just before age 62, the FRA, slightly more than half of all women work without claiming, and, upon reaching the FRA, no women works without claiming. Raising the FRA to 63 years induces a sizeable portion of the women who worked until 62 years to keep working an additional year. Interestingly, about 10-15% of all women cease to work without claiming exactly on the ERA, 62 years. These women stop working at the ERA and start claiming benefits. FRA64 incurs a similar delay in leaving the state of working without claiming. Increasing the price of ER, RAF affects a group of by about 10% of all women who are working without claiming in the period

Figure 6: Joint Claiming and Working Decisions




Notes: Figure shows women who claim benefits without working (A), work without claiming benefits (B), and claim benefits while working (C). Each figure is produced using women adjacent to the reform step, 1939 and 1939 for FRA63, 1941 and 1942 for FRA64, and 1947 and 1948 for RAF.

Source: Own calculations, based on SSSD.

between the ERA and the FRA.

Women can claim benefits and work at the same time. Figure 6C shows how many women

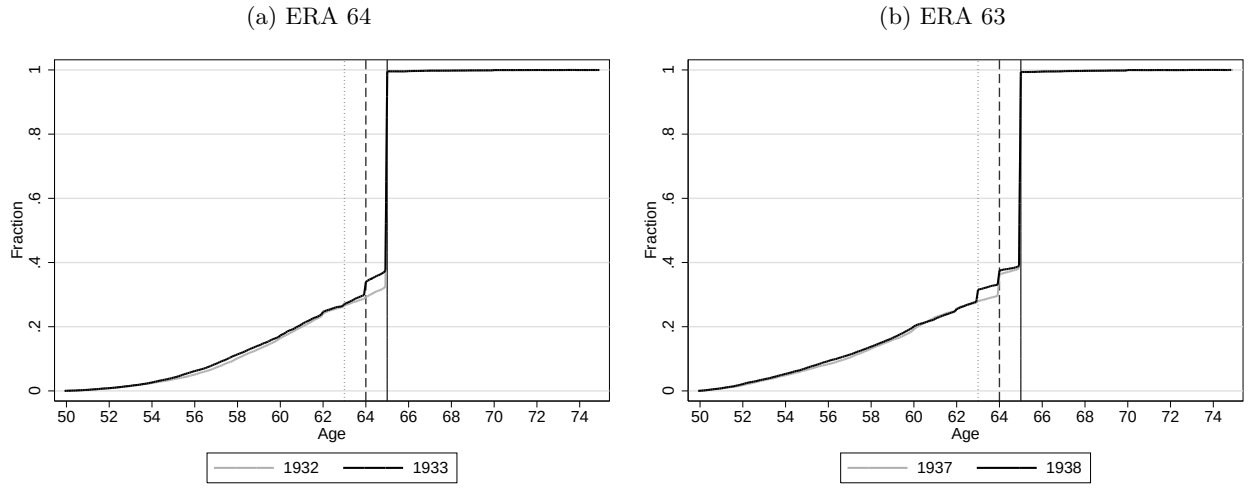
claim benefits and work. Just short of 20% of all women claim and work at the same time, women who work beyond the full retirement age, possibly because of self-employment or strong labor market attachment. While this number may appear low in absolute value, recall that not more than 50% of all women in our sample work when reaching the ERA of 62. FRA62 and 63 do not affect the proportion of women claiming and working, possibly because of the low price of taking early retirement. RAF, doubling the ER price, induces most women who claim and work to stop claiming at the early retirement age, and delay claiming to the FRA. In graphs we do not show due to space constraints, FRA63, FRA64, and RAF induce women to substantially delay claiming without working, and working without claiming. This would be expected for RAF's strong incentive for early claimers to accommodate the wealth shock through delayed claiming. FRA63 and 64 would also delay claiming benefits, but only for women with a very long time horizon.

Decomposing the response by state informs on the costs of extending work, and the costs of delaying benefit claiming. Women who delay claiming without working have high life expectancy, or patience, or both. Women who continue to work without claiming have low costs of extending work, and high life expectancy, or are patient. Women who claim and work have high value of extending work and low life expectancy or impatience. We find that most of the claiming response is due to women with low costs of delaying claiming, and low value of work. The labor supply response is due, mostly, to women with high life expectancy and high value of work. Women with high value of work, and low life expectancy, do not contribute to the FRA changes substantially as these women work beyond the FRA, and claim early, so they were not affected by the policy changes.

We have documented early claiming among women. Do men take early retirement as well? Recall that the same 1997 reform introduced an option to claim benefits one year early, born 1933 or later, or two years early, born 1938 or later, at a price of 6.8% of a pension per year of early retirement. Figure 7(a) shows the pension claiming profile for men born 1933, compared to men born 1932. The pension claiming profile does not differ substantially between these two cohorts. But, between the ERA of 64, and the FRA of 65, about 5% more men claim OASI pensions in the 1933 cohort than in the 1932 cohort. Figure 7(b) shows the pension claiming profile for men born 1938, compared to men born 1937, again, very similar overall. Yet again, between the new ERA at 63 and the old ERA at 64, bout 5% more men claim benefits in the 1938 cohort compared to

the 1937 cohort. Early claiming is attractive to about 5 of 100 men, about half as many as among women.[8]

Figure 7: Men's Pension Claiming




Notes: This Figure shows pension claiming for men. The 1933 cohort could claim a pension one year before the FRA, 65 years, accepting a reduction of their pension of 6.8%. The 1938 cohort could claim a pension up to two years before the FRA, paying the same 6.8% price of early retirement, per year of early claiming. In both cohorts, about 5% of all men accept a reduced pension in exchange of early claiming.
Source: Own calculations, based on SSSD.

# 6 Empirical Strategy

We build our identification strategy on the quasi-experimental increase in the FRA for women. Specifically, we exploit the increase in the FRA to 63 for women born in 1939, as well as the fact that the FRA remained at 62 years for their counterparts born in 1938. We can estimate the causal effects of increasing the FRA by comparing women born on January 1, 1939 or after (treated group) with women born on December 31, 1938 or before (control group). A similar discontinuity in the birth date can be exploited to examine the second increase in the FRA for women from 63 to 64, and for RAF. This comparison will yield unbiased estimates if the distribution of observable and unobservable characteristics is similar to the left and to the right of the age threshold.

[8]Early claiming does not affect men's labor force participation.

We implemented the RDD by estimating regressions of the following type:

$$y_i = \alpha + \beta D_i + f_0(Z_i - c) + D_i f_1(Z_i - c) + X_i'\delta + \varepsilon_i \quad (1)$$

where $i$ denotes individual, $D_i$ is a dummy that is equal to 1 if a woman is born after December 31, 1938 and 0 otherwise, $Z_i$ denotes a woman's birth date, $c$ is the cut-off date, January 1, 1939, for the FRA63, and $f_0()$ and $f_1()$ are unknown functions, allowed to differ across the threshold. 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, 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. There is no change in the number of women born in the weeks around the cutoff dates of January 1, 1939 (Appendix Table A.1).

We carefully examine the distribution of co-variates and see no evidence of a significant change in the means of background variables (Appendix Table A.2). These checks do not indicate concerns with the validity of the RDD. We have conducted the same statistical tests of the validity of the research design for FRA64 and RAF and find no indications that the RDD would fail.

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.

# 7 Results

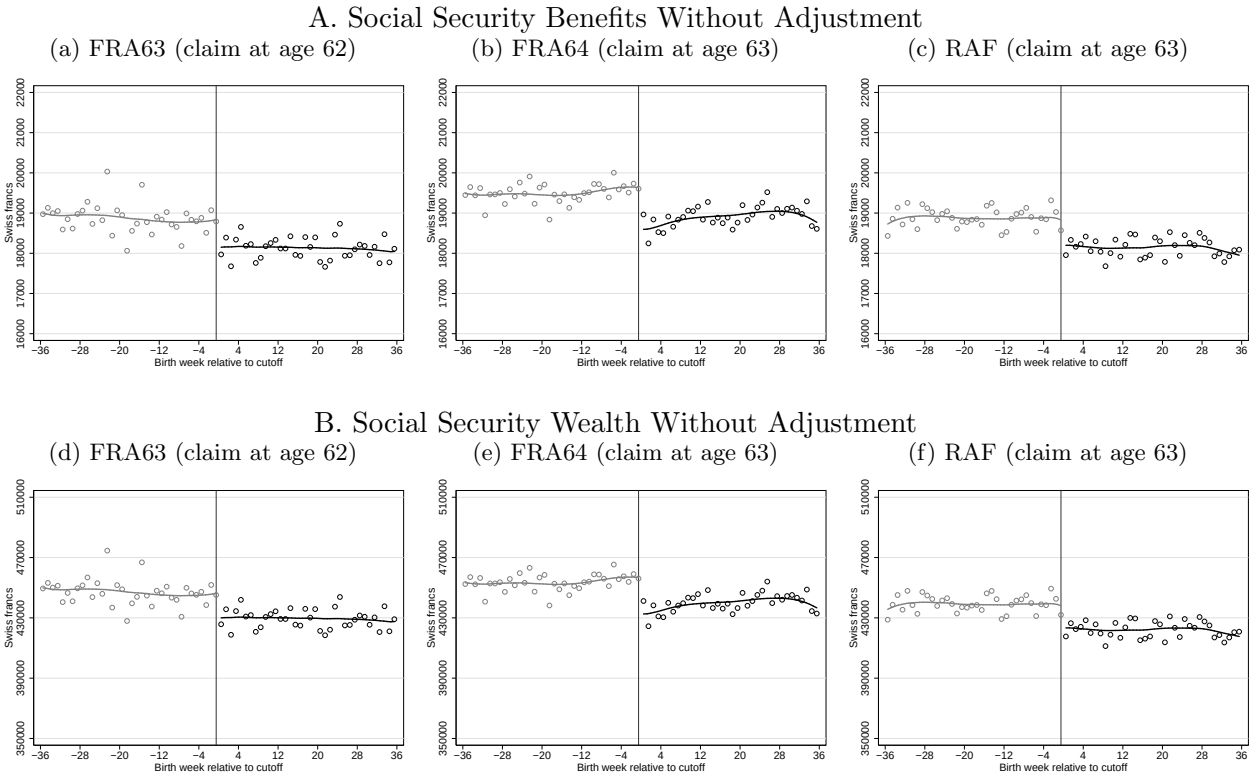
This section discusses how increasing the FRA affects labor supply, pension claiming, and income, in the regression discontinuity framework outlined earlier.

## 7.1 Pension Wealth Shocks

How strong is the incentive to post-pone retirement? Figure 8 shows how increasing the FRA would have affected old age pensions if all women had taken retirement at the old FRA of 62 years. We look at both social security benefits and social security wealth. We use observed social security benefits for women born before January 1, 1939 and we reduce social security benefits of women born in 1939 by 3.4% to reflect the change due to the reform. Social security wealth sums up discounted social security benefits as explained earlier. Figure 8(a) shows that social security benefits were about 20,000 CHF per year for women born in 1938 with no strong change in this benefit level by season of birth. Women born in 1939 earned about 18,300 CHF per year if they entered retirement at age 62, or about 3.5% less than women born in 1938. Importantly, the drop in social security benefits occurs exactly at the birthdate cutoff, leading to a discontinuous change in the financial incentive to retire at age 62. Social security wealth is just about 445,000 CHF for women born in 1938, and around 430,000 CHF for women born after the 1939 birthday cutoff. Again, the reform introduces a discontinuous decline in social security wealth of around 3.5% exactly at the birthdate cutoff.

The FRA64 wealth shock is of similar magnitude as the FRA63 wealth shock, albeit from a lower level, since women already lost part of their wealth in the FRA63. RAF also induces a wealth shock on all individuals who claim a pension early. These individuals experience a reduction of 3.5% of their social security wealth.

Figure 8: Effects on Social Security Benefits and Social Security Wealth Without Adjustment




Notes: This figure shows mean social security benefits (a) and mean social security wealth (b) that women would have received if they had not adjusted claiming to the reform steps FRA63, FRA64, and RAF. 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.

## 7.2 Effects on Pension Claiming and Income

How does increasing the FRA affect pension claiming behavior? Figure 9A displays how increasing the FRA from 62 to 63 years affects the pension claiming age. Women who are not subject to the reform start claiming a pension at age 61.5 years. The all pension claiming age is lower than the FRA because some women enter disability insurance before claiming an old age pension. Increasing the FRA from 62 to 63 years raises the all pension claiming age to 62 years, or by about 0.5 years. Women also respond strongly to the increase of the FRA from 63 to 64 years (figure 9(b)). Women born before the January 1, 1942 cutoff draw an old age or disability pension on average at age 62.5 years. Women born just after the reform cutoff draw a pension at 63 years on average, a delay of about 0.5 years in pension claiming. Women also respond to doubling the

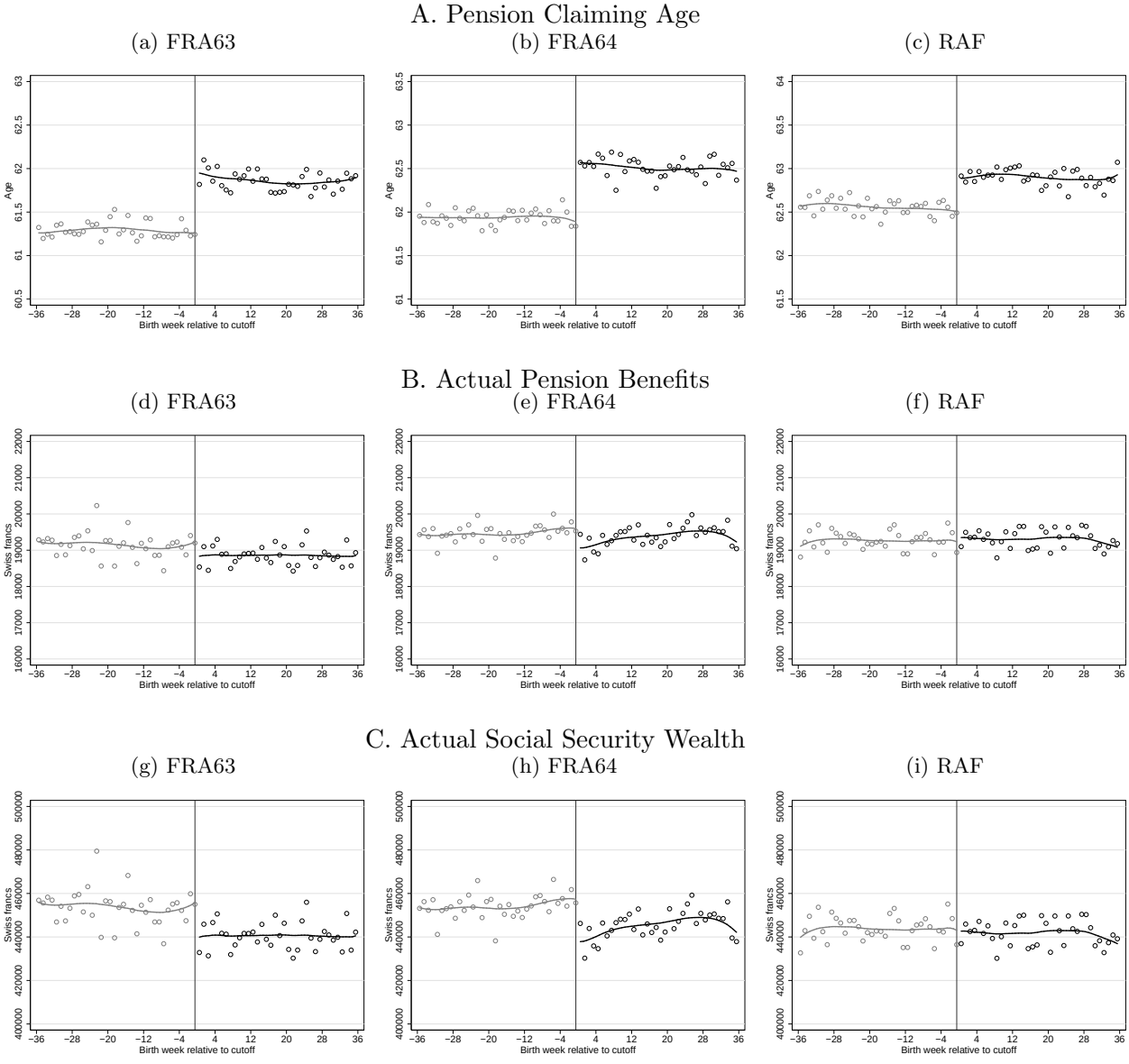
adjustment factor an old age pension early (figure 9(c)). Women born before the January 1, 1948 cutoff, facing a reduced adjustment of 3.4%, start claiming an old age pension at about 63.1 years. Women born just a month later, facing an adjustment of 6.8%, start claiming a pension at about 63.4 years. The RAF reform delays pension claiming considerably, but not to the extent as the two FRA reforms.

Comparing women born just before or after a January 1 cutoff date may be problematic if there are other elements of the pension system that change. We have explored cohort contrasts on January 1 in all years covered by our data (Appendix Figure A.2). We do not find any significant effect at Placebo reform dates. On actual reform dates, the effects we document clearly stand out. We are confident that main estimates do not pick up other changes at the January 1 cutoff date.

Figure 9B shows how the reform affects social security pensions. Women born in 1938, not affected by the reform, earn about 19,000 CHF per year in old age pension benefits. Increasing the FRA from 62 to 63 years reduces annual pension benefits to somewhat less than 19,000 CHF. Increasing the FRA to 64, FRA64, appears to decrease social security benefits somewhat, but the effect might be driven by upward trends to either side of the birthdate cutoff. The double adjustment reform RAF does not affect social security benefits. This is remarkable as the doubling of the pension adjustment factor introduced strong reductions in pension benefits for those taking up early retirement. But we have seen earlier that the RAF reform eliminated almost all early retirement.

Social security benefits were not strongly affected by the reform. How about social security wealth? Figure 9C shows that the annuity value of social security benefits is on the order of 450,000 CHF to women born just before the reform cutoff; that value decreases to about 435,000 CHF for women born just after the reform cutoff. Interestingly, increasing the FRA reduces social security wealth by about 3 percentage points, an effect that is substantially larger than the effect of that reform on pension benefits. This is because social security wealth not only looks at pension benefits (which decrease only marginally) but also at the duration of benefit receipt (which decreases due to the later claiming). Increasing the FRA by one more year, FRA64, also reduces social security wealth. The reduction in social security wealth appears larger than for the first increase in the FRA, FRA63, but this might, again, be due to upward trends on either side of the threshold. Re-instating actuarial fairness, RAF, has no impact on social security wealth, because it triggered

Figure 9: Wealth Shocks Cause Claiming Responses



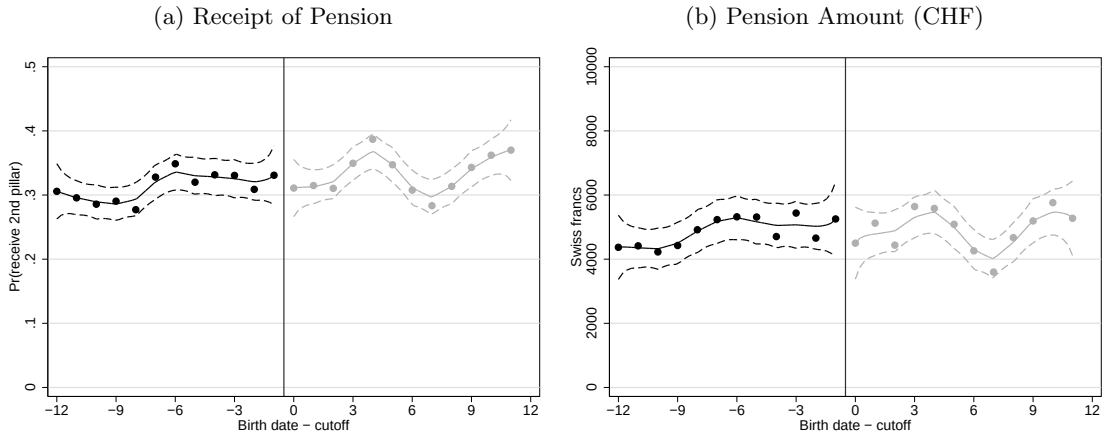

Notes: This figure reports the average age when women start claiming any pension (A), actual pension benefits when claiming (B), and actual social security benefits (C). The x-axis reports the date of birth minus the reform cutoff. The light line refers to women born just not affected by the reform,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

Source: Own calculations, based on SSSD.

substantial adjustment in pension claiming.

Women also receive retirement income from the occupational benefit plan (second pillar). Figure 10 reports receipt of an occupational pension benefit (a) and its level (b) for a sub-set of women

Figure 10: Occupational Pension Benefits, FRA63



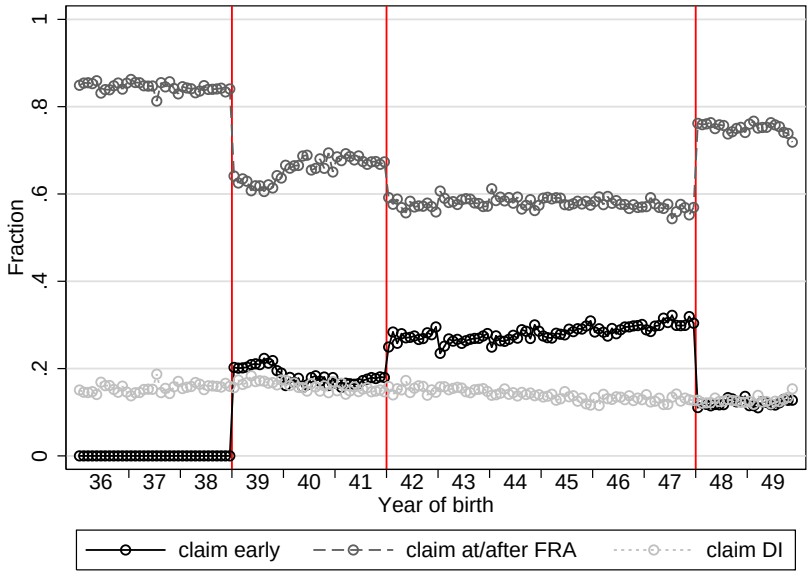

Notes: This figure reports receipt of an occupational pension benefit (a) and its level (b) for women born just before (dark line) and just after (light line) the January 1, 1939 cutoff for raising the FRA from 62 to 63 years.
Source: Own calculations, based on tax records.

who live in a large region in Switzerland. About one in three women receives income from the occupational benefit plan (Figure 10(a)) and occupational benefits add about 5000 CHF to the annual income of retired women in Switzerland (Figure 10(b)). Coverage of occupational benefit plans is low because only incomes above an upper threshold of about 20,000 CHF need to be insured. Increasing the FRA from 62 to 63 years neither affects the probability of receipt nor its level.

The proportion claiming at the ERA, when early claiming is available at the low price of 3.4%, could be low because early claiming was not available before the 1997 reform. People might have lacked information to fully exploit it initially, or have had little experience with early claiming. Figure 11 reports the fraction of women claiming before the FRA, at the FRA, or claiming DI pensions, by month of birth. The proportion of women claiming benefits before the FRA is zero for cohorts born before January 1939 because claiming before the FRA was not possible. The FRA63 change, increases early claiming to 20%, a proportion resting stable, or declining a bit. The FRA64 policy change immediately increases early claiming to 25%, a proportion that increases gradually to somewhat more than 30%. The cohorts born 1942 to 1947 may have benefitted from some learning over time. RAF reduces early retirement immediately to about 10%, the proportion increasing somewhat to 14% for women born in 1949. Overall, Figure 11 does not suggest that lack

of information, or learning over time, explains why comparably few women take early retirement.

Figure 11: Claiming DI, before the FRA, on or after the FRA



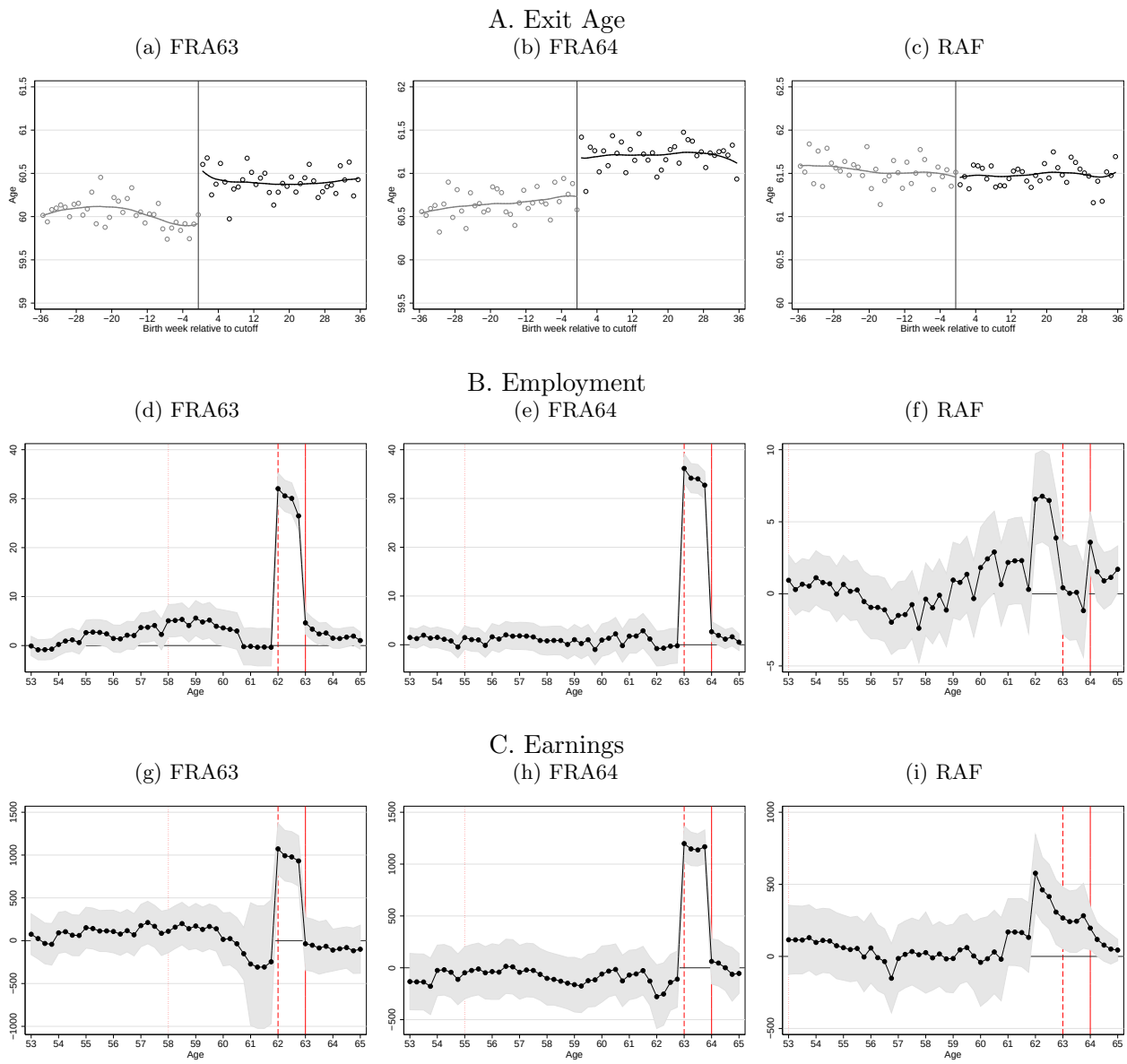

Notes: This Figure shows the proportion of women claiming before the FRA, claiming at or after the FRA, and claiming a disability insurance pension, for all women born between 1936 and 1949.
Source: Own calculations, based on SSSD.

### 7.3 Labor Supply Effects

We document the effects of increasing the FRA, or re-instating actuarial fairness, in graphs that show the labor force exit age by month of birth (Figure 12A). Increasing the FRA from 62 to 63 years affects women's decision to leave the labor force. To deal with considerable noise, we focus on changes in the age bracket 60 to 66 years, setting exit ages below 60 years to 60 years, and exit ages above 66 years to 66 years. Women who were born in 1938 and eligible for a full pension at age 62 (solid line) leave the labor force at age 61.5 years. In contrast, women who were born in 1939 and subject to the new FRA at age 63 years leave the labor force at age 61.8 years. Women born early in 1939 delay labor force exit by about 0.5 years compared to women born late in 1938. Increasing the FRA from 63 to 64 years, FRA64, also raises the labor force exit age. Women born before the birth date cutoff, January 1, 1942, leave the labor force at 62, whereas women born just after the cutoff date work for about 0.4 more years. Re-instating actuarial fairness, the RAF step

of the reform, does not affect labor force exit.

Figure 12: Wealth Shocks Cause Labor Market Responses




Notes: This figure reports the average labor force exit age (A), employment (B), and quarterly earnings (C). Leftmost vertical line indicates when women heard first about the reform. The two remaining lines highlight the old FRA, and the new FRA. Points refer to RDD estimates adopting the specification in 6.

Source: Own calculations, SSSD.

When, in their life cycle, do women work more? Figure 12B reports RDD effects on employment, between age 53 and age 65, at quarterly frequency. Women affected by the FRA63 worked about at the same rate before age 57. From age 57 there is a small, but significant increase in the

employment rate that would be consistent with forward looking extension of work to accommodate an anticipated wealth shock. But the bulk of the response is between age 62 and 63 when women in the old system left the labor market, and women in the new system staid on to recoup part of the loss in wealth. The employment rate remains somewhat higher after age 63 due to women who work beyond the FRA delaying exit by one year as well. Women affected by the FRA64 show a very similar employment pattern as women affected by FRA64, expect for the anticipated employment response. Women affected by RAF work significantly more between age 62 and 63, when the price of early retirement was doubled. The employment response to RAF is about six times smaller than the corresponding response to FRA.

From the point of view of the individual, the additional earnings, due to more work, are central. Figure 12C shows effects on quarterly earnings, from age 53 to age 65. Increases in the FRA by one year add about 1000 CHF per quarter to the earnings of affected women, or about 4000 CHF. The additional earnings are about 25% of the wealth shock remaining after claiming adjustment. Earnings profiles are not affected before the FRA, suggesting that women do not adjust employment patterns in a way to affect earnings, even before reaching the old FRA. RAF employment responses increase earnings significantly, by about 250 CHF per quarter, on average, adding about 1000 CHF to life time earnings.[9]

### 7.4 RDD Estimates

Table 3 presents an overview of the effects of FRA increases, and the change in the price of early retirement on the wealth shock (A), before accommodation, benefit claiming (B), and labor supply (C).[10] Increases in the FRA considerably lower social security wealth, FRA63 by about 16,000 CHF (or 3.3%), and FRA64 by about 19,000 CHF (or 4.1%). RAF also lowers social security wealth, by about 15,000 CHF (3.2%). Effects on social security wealth are robust to the choice of bandwidth for FRA63 and RAF, and somewhat sensitive to bandwidth for FRA64.

These wealth shocks trigger considerably delays in pension claiming, by 0.6 years for FRA63 and FRA64, and by 0.4 years for RAF (Table 3B). The reform delayed the average age of pension

[9] We have also explored how the 1997 reform affected flows into UI, and DI, and find statistically significant but economically small effects.

[10] 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.

Table 3: Labor Supply and Claiming Effects

| | FRA63 | | FRA64 | | RAF | |
|---|---|---|---|---|---|---|
| | linear | quadratic | linear | quadratic | linear | quadratic |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| A. Wealth Shock | | | | | | |
| SSW, no adj. | -16,485*** | -16,147*** | -25,596*** | -18,917*** | -16,098*** | -15,607*** |
| | (6,157) | (2,834) | (5,470) | (2,444) | (4,751) | (2,190) |
| B. Benefit claiming | | | | | | |
| Claiming age (years) | 0.682*** | 0.6*** | 0.588*** | 0.562*** | 0.323*** | 0.391*** |
| | (0.089) | (0.042) | (0.098) | (0.044) | (0.093) | (0.042) |
| SSW, observed | -14,419** | -14,314*** | -21,051*** | -14,113*** | -2,041 | -334 |
| | (5,953) | (2,738) | (5,460) | (2,444) | (4,851) | (2,232) |
| C. Retiring from work | | | | | | |
| Exit age (years) | 0.57*** | 0.475*** | 0.408*** | 0.471*** | 0.033 | -0.032 |
| | (0.139) | (0.063) | (0.134) | (0.062) | (0.121) | (0.055) |
| Bandwidth (weeks) | 12 | 12 | 12 | 12 | 12 | 12 |
| Obs | 14,581 | 14,581 | 16,224 | 16,224 | 19,937 | 19,937 |

Notes: This table reports RDD estimates of the effects of FRA63, FRA64, and RAF, adopting a 12 weeks bandwidth.
Source: Own calculations, SSSD.

claiming by about 1.6 years, an almost one for one delay in pension claiming. Changes to claiming moderate the shock to social security wealth by about 1,600 CHF, 10% of the FRA63 shock, or 4,000 CHF, or 20% of the FRA64 shock. Observed social security wealth is not affected by RAF. The RAF claiming response therefore exactly offset the initial RAF wealth shock.

FRA wealth shocks lead to substantial delay in labor market exit (Table 3C). FRA63 increases work by about 0.5 years, and FRA64 adds about 0.45 years. Women respond to the uninsured part of the wealth shock by working longer. In contrast, RAF does not trigger a significant labor market response, consistent with our earlier finding that claiming adjustments suffice in dealing with the RAF wealth shock.

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 A.1 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 A.2). Reform

Table 4: Household Considerations

| | FRA63 | | FRA64 | | RAF | |
|---|---|---|---|---|---|---|
| | linear | quadratic | linear | quadratic | linear | quadratic |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| A. Single or Age Balanced | | | | | | |
| Exit age (years) | 0.337* | 0.443*** | 0.398** | 0.464*** | 0.087 | 0.085 |
| | (0.187) | (0.086) | (0.178) | (0.081) | (0.16) | (0.073) |
| Claiming age (years) | 0.632*** | 0.548*** | 0.582*** | 0.578*** | 0.445*** | 0.457*** |
| | (0.135) | (0.063) | (0.141) | (0.063) | (0.131) | (0.059) |
| Obs | 7968 | 32487 | 9220 | 37903 | 11372 | 45970 |
| B. Husband's response | | | | | | |
| Exit age (years) | -0.115 | 0.09 | 0.021 | 0.091 | 0.095 | -0.003 |
| | (0.165) | (0.075) | (0.159) | (0.072) | (0.153) | (0.071) |
| Claiming age (years) | -0.038 | -0.034 | -0.086 | -0.008 | -0.087 | -0.158*** |
| | (0.11) | (0.05) | (0.11) | (0.049) | (0.132) | (0.061) |
| Bandwidth (weeks) | 12 | 12 | 12 | 12 | 12 | 12 |
| Obs | 7,885 | 7,885 | 9,106 | 9,106 | 11,104 | 11,104 |

Notes: This table reports RDD estimates of the effects of FRA63, FRA64, and RAF, adopting a 12 weeks bandwidth.
Source: Own calculations, SSSD.

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 A.3(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 A.3(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 4A). Results for this sample are virtually identical to main results (Table 3). Abolishing the supplementary pension does not appear to affect labor supply and claiming decisions.

We also assess to what extent spouses react to their partner's wealth shock (Table 4B). Partners

do 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, RAF, decided to claim benefits somewhat earlier, by about one month. We speculate that RAF, 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.[11]

We have explored how different sub-groups react to pension wealth shocks. Table 5 shows pension claiming adjustments, by subgroups, both adopting a linear specification, the baseline, and a quadratic specification, a sensitivity analysis. Women living without a partner delay pension claiming less than married women in response to increases in the FRA. But the response to increases in the ER price, RAF, is the same. Foreign women respond to increases in the FRA similar to Swiss women, but not at all to increases in the early claiming price, perhaps because foreign women do not claim benefits early. Regions of Switzerland where Romance languages are spoken, Latin region, respond similar to increases in the FRA, but only the Swiss German region responds to increases in the ER price. Women working in the private sector respond to reform elements similar to women working in the public sector, except for the FRA64 change inducing public sector women to delay claiming benefits more strongly than private sector women. Claiming responses do not differ much by earnings levels. A substantial difference exists between women who die by age 74 and women who live beyond that age. Women who die by age 74 are not responsive to changes in the incentives to claim benefits early, or late, claiming benefits at the earliest possibility.

How do women's labor market responses differ? Table 6 shows responses by sub-groups, grouped identically to claiming results in our earlier table. Single and married women respond to FRA wealth shocks about the same in the initial shock, FRA63, but single women respond much less in the second FRA shock, raising the FRA to 64 years. Foreign and Swiss again respond very similar in the FRA63 change, but foreign women respond about half as strong as the Swiss in the FRA64 step. Regions of Switzerland were also differentially affected. Women in the Swiss German speaking areas respond to pension wealth shock by working about two thirds of a year more. Women in the Romance speaking regions of Switzerland do not respond significantly, and the

[11] 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.

Table 5: Heterogeneity in Claiming Age

| | FRA63 | | FRA64 | | RAF | |
|---|---|---|---|---|---|---|
| | linear | quadratic | linear | quadratic | linear | quadratic |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Full sample | 0.697*** | 0.719*** | 0.692*** | 0.722*** | 0.383*** | 0.413*** |
| | (0.087) | (0.129) | (0.096) | (0.141) | (0.09) | (0.131) |
| Singles | 0.503*** | 0.58** | 0.641*** | 0.662** | 0.359** | 0.38 |
| | (0.176) | (0.263) | (0.182) | (0.265) | (0.164) | (0.237) |
| Married | 0.802*** | 0.78*** | 0.731*** | 0.769*** | 0.391*** | 0.435*** |
| | (0.079) | (0.115) | (0.098) | (0.145) | (0.1) | (0.147) |
| Swiss citizens | 0.707*** | 0.71*** | 0.712*** | 0.68*** | 0.488*** | 0.521*** |
| | (0.075) | (0.111) | (0.09) | (0.134) | (0.086) | (0.123) |
| Foreign citizens | 0.701*** | 0.904** | 0.764** | 1.1** | 0.045 | 0.218 |
| | (0.261) | (0.379) | (0.318) | (0.455) | (0.303) | (0.438) |
| German region | 0.792*** | 0.861*** | 0.698*** | 0.724*** | 0.493*** | 0.502*** |
| | (0.086) | (0.129) | (0.102) | (0.152) | (0.103) | (0.15) |
| Latin region | 0.643*** | 0.652*** | 0.746*** | 0.657** | 0.22 | 0.312 |
| | (0.158) | (0.229) | (0.201) | (0.296) | (0.178) | (0.256) |
| Private sector | 0.696*** | 0.748*** | 0.636*** | 0.673*** | 0.389*** | 0.368** |
| | (0.098) | (0.146) | (0.107) | (0.157) | (0.099) | (0.144) |
| Public sector | 0.683*** | 0.578** | 0.996*** | 1.01*** | 0.351 | 0.664** |
| | (0.179) | (0.266) | (0.215) | (0.321) | (0.219) | (0.309) |
| Avg. earnings below median | 0.658*** | 0.708*** | 0.898*** | 0.912*** | 0.406*** | 0.528*** |
| | (0.109) | (0.159) | (0.121) | (0.175) | (0.113) | (0.165) |
| Avg. earnings above median | 0.737*** | 0.721*** | 0.432*** | 0.466** | 0.351** | 0.298 |
| | (0.133) | (0.201) | (0.152) | (0.226) | (0.139) | (0.2) |
| Dies before age 74 | 0.265 | 0.322 | 0.437 | 0.868 | -0.102 | -0.139 |
| | (0.411) | (0.605) | (0.478) | (0.698) | (0.54) | (0.776) |
| Dies after age 74 | 0.764*** | 0.805*** | 0.757*** | 0.73*** | 0.38*** | 0.417*** |
| | (0.071) | (0.105) | (0.085) | (0.127) | (0.081) | (0.117) |

Notes:

point estimate is about one fifth of one year. Women in the private sector respond to both FRA63 and FRA64 to about the same extent. Women in the public sector respond very strongly, almost one for one, to FRA63 and not significantly to FRA64. Labor supply responses for women with below median earnings are somewhat stronger than labor supply responses for women with above median earnings, consistent with the lower replacement rate for high earning women. Labor supply responses to FRA63 of women who are dead by 74, and women who are not are quantitatively similar, even though results are not significant for the group of women dead by 74. Responses to

FRA64 are quantitatively smaller, and still insignificant, for the group of women dead by 74.

Table 6: Heterogeneity in Exit Age

| | FRA63 | | FRA64 | | RAF | |
|---|---|---|---|---|---|---|
| | (1) linear | (2) quadratic | (3) linear | (4) quadratic | (5) linear | (6) quadratic |
| Full sample | 0.623*** | 0.686*** | 0.446*** | 0.575*** | -0.003 | -0.147 |
| | (0.136) | (0.199) | (0.132) | (0.191) | (0.12) | (0.176) |
| Single | 0.583*** | 0.662** | 0.245 | 0.435 | 0.048 | 0.189 |
| | (0.222) | (0.325) | (0.208) | (0.298) | (0.19) | (0.273) |
| Married | 0.653*** | 0.705*** | 0.592*** | 0.685*** | -0.035 | -0.384* |
| | (0.173) | (0.25) | (0.171) | (0.249) | (0.156) | (0.23) |
| Swiss citizens | 0.536*** | 0.638*** | 0.551*** | 0.65*** | 0.001 | -0.194 |
| | (0.144) | (0.21) | (0.134) | (0.195) | (0.122) | (0.178) |
| Foreign citizens | 0.968*** | 1.068** | 0.233 | 0.528 | 0.242 | 0.529 |
| | (0.307) | (0.439) | (0.355) | (0.509) | (0.345) | (0.501) |
| German region | 0.656*** | 0.759*** | 0.681*** | 0.843*** | 0.007 | -0.147 |
| | (0.154) | (0.224) | (0.15) | (0.217) | (0.139) | (0.204) |
| Latin region | 0.431 | 0.453 | 0.067 | 0.155 | -0.297 | -0.316 |
| | (0.277) | (0.404) | (0.259) | (0.377) | (0.232) | (0.335) |
| Private sector | 0.582*** | 0.627*** | 0.424*** | 0.593*** | -0.054 | -0.231 |
| | (0.147) | (0.214) | (0.139) | (0.201) | (0.124) | (0.182) |
| Public sector | 0.952*** | 0.95** | 0.349 | 0.238 | 0.162 | 0.104 |
| | (0.325) | (0.476) | (0.343) | (0.502) | (0.341) | (0.496) |
| Avg. earnings below median | 0.719*** | 0.881*** | 0.471** | 0.682** | -0.202 | -0.451* |
| | (0.186) | (0.267) | (0.188) | (0.27) | (0.17) | (0.251) |
| Avg. earnings above median | 0.538*** | 0.489* | 0.441** | 0.482* | 0.194 | 0.135 |
| | (0.199) | (0.292) | (0.189) | (0.275) | (0.17) | (0.246) |
| Dies before age 74 | 0.616 | 0.664 | -0.097 | -0.149 | -0.127 | 0.217 |
| | (0.424) | (0.618) | (0.497) | (0.735) | (0.522) | (0.753) |
| Dies after age 74 | 0.631*** | 0.716*** | 0.534*** | 0.667*** | -0.022 | -0.197 |
| | (0.14) | (0.202) | (0.132) | (0.191) | (0.12) | (0.175) |

Notes: This table reports RDD estimates of the effects of FRA63, FRA64, and RAF, adopting a 3 months bandwidth, and a 12 months bandwidth. Full sample repeats our main analysis. Then we present results from sample splits by gender, nationality, language region, sector, average earnings, and death before, or after age 74.
Source: Own calculations, SSSD.

How did the reform affect the government's social insurance budget? Table 7 shows effects on benefits and contributions, both for OASI and unemployment insurance (UI).[12] We report the

[12]The reform also affects income tax receipts, not shown in the table. Our estimates are a lower bound for the effect on the budget.

Table 7: Fiscal effects

| | FRA63 | | FRA64 | | RAF | |
|---|---|---|---|---|---|---|
| | (1) linear | (2) quadratic | (3) linear | (4) quadratic | (5) linear | (6) quadratic |
| *A. Effects on OASI* | | | | | | |
| Benefits (A) | -15,013*** | -13,784*** | -25,619*** | -18,881*** | -5,818*** | -5,962*** |
| | (5,379) | (2,471) | (4,818) | (2,181) | (1,029) | (466) |
| Contributions (B) | 4,375** | 5,050*** | 4,238** | 4,969*** | 1,422 | 1,139 |
| | (1,949) | (685) | (1,675) | (876) | (1,440) | (701) |
| *B. Effects on UI* | | | | | | |
| Benefits (C) | -289 | -93 | 531 | 539** | -280 | -5 |
| | (559) | (268) | (533) | (243) | (560) | (253) |
| Contributions (D) | 296 | 260*** | 93 | 292*** | 235 | 102 |
| | (209) | (74) | (167) | (84) | (160) | (74) |
| *C. Net Effects* | | | | | | |
| Expenditures (A+C-B-D) | -19973*** | -19,187*** | -29,419*** | -23,602*** | -7,754*** | -7,207*** |
| | (5,530) | (2,422) | (4,736) | (2,191) | (1,868) | (884) |
| Bandwidth (weeks) | 12 | 12 | 12 | 12 | 12 | 12 |
| Obs | 7,885 | 7,885 | 9,106 | 9,106 | 11,104 | 11,104 |

Notes: This table reports RDD estimates on the present discounted value of benefits and contributions to the old age and survivors' insurance (OASI), and unemployment insurance (UI). We assume a discount rate of 2.5% per year, and discount to the FRA, 63 years in FRA63, and 64 years for both FRA64 and RAF.
Source: Own calculations, SSSD.

present discounted value of benefits and contribution, discounted to the FRA for a women with average life expectancy. Increasing the FRA to 63 reduces social security benefits, by about 15'000 CHF in present discounted value terms, or by about 3%, and FRA63 raises contributions by about 4500 CHF in present value terms, raised on the extra work triggered by the reform. Unemployment benefits do not increase, but contributions to the unemployment insurance fund do, again levied on the extra work triggered by the reform. On net, increasing the FRA lowers the present discounted cost of one women by 20'000 CHF. FRA64 has a somewhat stronger effect, reducing the net cost by at least 24'000 CHF. In contrast, doubling the price of early retirement, RAF, reduces social security benefits by about 6'000 CHF, and raises social security contributions and unemployment insurance somewhat, even though effects are not statistically significant.

Taken together, the reform decreased the cost of one claimant by about 50'000 CHF, or a

bit more than 10% of the cost of one claimant. Interestingly, increases in the FRA generated about 75% of the savings, despite offering early retirement at a fairly low price. This is because an FRA increase, removing an entire year of pension payments, triggers a strong reduction in pension benefits that cannot be accommodated through claiming adjustments. Women reacted to the increases in the FRA by delaying pension claiming, contributing additional savings in benefit payments. The RAF step, abolishing early retirement at a low price, contributes 25% to the savings, reducing early claiming. RAF would have contributed more, if more women had found it in their interest to claim benefits earlier.

# 8 Conclusion

We study how a two year increases in the full retirement age (FRA) affects labor supply, pension claiming, and retirement income. We identify the causal impact of changes in the FRA in the context of a large pension reform in Switzerland that became effective in 1997. This reform increased the FRA for women from 62 to 64 in two one-year increments. The reform offered early claiming, at age 62, initially at the price of reducing social security benefits by 3.4% per every year of early claiming, then doubling the early claiming price to 6.8%. These changes affected women at the sharp cohort cutoffs, 1939, 1942, and 1948. The sharp discontinuities in the FRA by birth date allow us to analyze the impact of sizeable pension wealth shocks on labor supply, and the sizeable changes in the price of early claiming inform on how women trade off future income with current income.

We find that the FRA has a strong effect on the labor supply behavior of affected women. A one year increase in the FRA delays labor market exit by 7 to 8 months and increases the claiming age of retirement benefits by about 5 to 6 months. Most of the adjustment in labor supply takes place in the year women reach the pre-reform FRA (age 62 for the first and age 63 for the second FRA increase). Labor force participation also increases in the year before the pre-reform FRA and in the year of the new FRA, suggesting that labor market exit does not adapt immediately. Re-instating actuarial fairness (RAF) does not affect labor supply exit but delays pension claiming by 4 months.

We also study whether an increase in the FRA affects social security wealth. Pension claiming

responses to increases in the FRA manage to reduce the initial wealth shock by about 10 to 20%, leaving a significant part of the wealth shock unbuffered. Earnings increases due to delayed labor market exit cover an additional 35% of the wealth shock, leaving about 50% of the wealth shock unaccommodated. The sizeable increase of the early claiming price does not affect social security wealth, as women fully adjust pension claiming to undo the effects of the reform.

Pension reforms act on two key margins, the timing of labor market exit, and the timing of benefit claiming. By carefully changing incentives to delay labor market exit, and benefit claiming, the menu of reforms we study can shed new light on the distribution of the costs of delaying work exit, and the costs of delayed claiming, driving the two key margins.

## References


Behaghel, L. and Blau, D. M. (2012). Framing social security reform: Behavioral responses to changes in the full retirement age. *American Economic Journal: Economic Policy*, **4**(4), 41–67.

Blau, D. M. and Goodstein, R. M. (2010). Can social security explain trends in labor force participation of older men in the united states? *Journal of Human Resources*, **45**(2), 328–363.

Bütler, M. and Teppa, F. (2007). The choice between an annuity and a lump-sum: Results from swiss pension funds. *Journal of Public Economics*, **91**, 1944–1966.

Coe, N. B. and Zamarro, G. (2011). Retirement effects on health in europe. *Journal of health economics*, **30**(1), 77–86.

Coile, C. C. and Gruber, J. (2007). Future social security entitlements and the retirement decision. *The Review of Economics and Statistics*, **89**(2), 234–246.

Cribb, J., Emmerson, C., and Tetlow, G. (2013). Incentives, shocks or signals: labour supply effects of increasing the female state pension age in the UK. IFS Working Papers W13/03, Institute for Fiscal Studies.

Duggan, M., Singleton, P., and Song, J. (2007). Aching to retire? the rise in the full retirement age and its impact on the social security disability rolls. *Journal of Public Economics*, **91**(7-8), 1327–1350.

Gelber, A., Isen, A., and Song, J. (2016). The effect of pension income on elderly earnings: Evidence from social security and full population data. Working paper, UC Berkeley.

Gruber, J. and Wise, D. A., editors (1999). *Social Security and Retirement around the World*. University of Chicago Press.

Hanel, B. and Riphahn, R. T. (2012). The timing of retirement  New evidence from Swiss female workers. *Labour Economics*, **19**(5), 718–728.

Hernaes, E., Markussen, S., Piggott, J., and Vestad, O. L. (2013). Does retirement age impact mortality? *Journal of health economics*, **32**(3), 586–598.

Krueger, A. B. and Pischke, J.-S. (1992). The effect of social security on labor supply: A cohort analysis of the notch generation. *Journal of Labor Economics*, **10**, 412–437.

Kuhn, A., Wuellrich, J.-P., and Zweimüller, J. (2010). Fatal attraction? access to early retirement and mortality. Working Paper 499, Institute for Empirical Research in Economics, University of Zurich.

Lee, D. S. and Lemieux, T. (2010). Regression discontinuity designs in economics. *Journal of Economic Literature*, **48**(2), 281–355.

Manoli, D. and Weber, A. (forthcoming). Nonparametric evidence on the effects of financial incentives on retirement decisions. *American Econom.*

Mastrobuoni, G. (2009). Labor supply effects of the recent social security benefit cuts: Empirical estimates using cohort discontinuities. *Journal of Public Economics*, **93**, 1224–1233.

OECD (2011a). *Health at a Glance 2011*. Organisation for Economic Cooperation and Development.

OECD (2011b). *Pensions at a Glance 2011*. Organisation for Economic Cooperation and Development.

Senti, C. (2011). Pensionierte als arbeitnehmende: Ein arbeits- und sozialversicherungsrechtlicher sonderfall mit stolperstricken. Presentation, University of St. Gallen.

Song, J. and Manchester, J. (2007). Have people delayed claiming retirement benefits? responses to changes in social security rules. *Social Security Bulletin*, **67**(2), 1–23.

Staubli, S. and Zweimüller, J. (2013). Does raising the early retirement age increase employment of older workers? *Journal of Public Economics*, **108**(C), 17–32.

# Appendix

Table A.1 in the Appendix shows RD estimates of a regression with the dependent variable being the number of individuals in a bin for different bandwidth.

Table A.1: Testing smoothness of number of individuals

| | FRA 63 | | FRA 64 | | RAF | |
|---|---|---|---|---|---|---|
| | linear | quadratic | linear | quadratic | linear | quadratic |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Number of individuals | -17 | -22 | 26 | 40 | 34 | 9 |
| | (13) | (19) | (22) | (29) | (21) | (29) |
| Bandwidth (weeks) | 12 | 12 | 12 | 12 | 12 | 12 |
| Obs. | 24 | 24 | 24 | 24 | 24 | 24 |

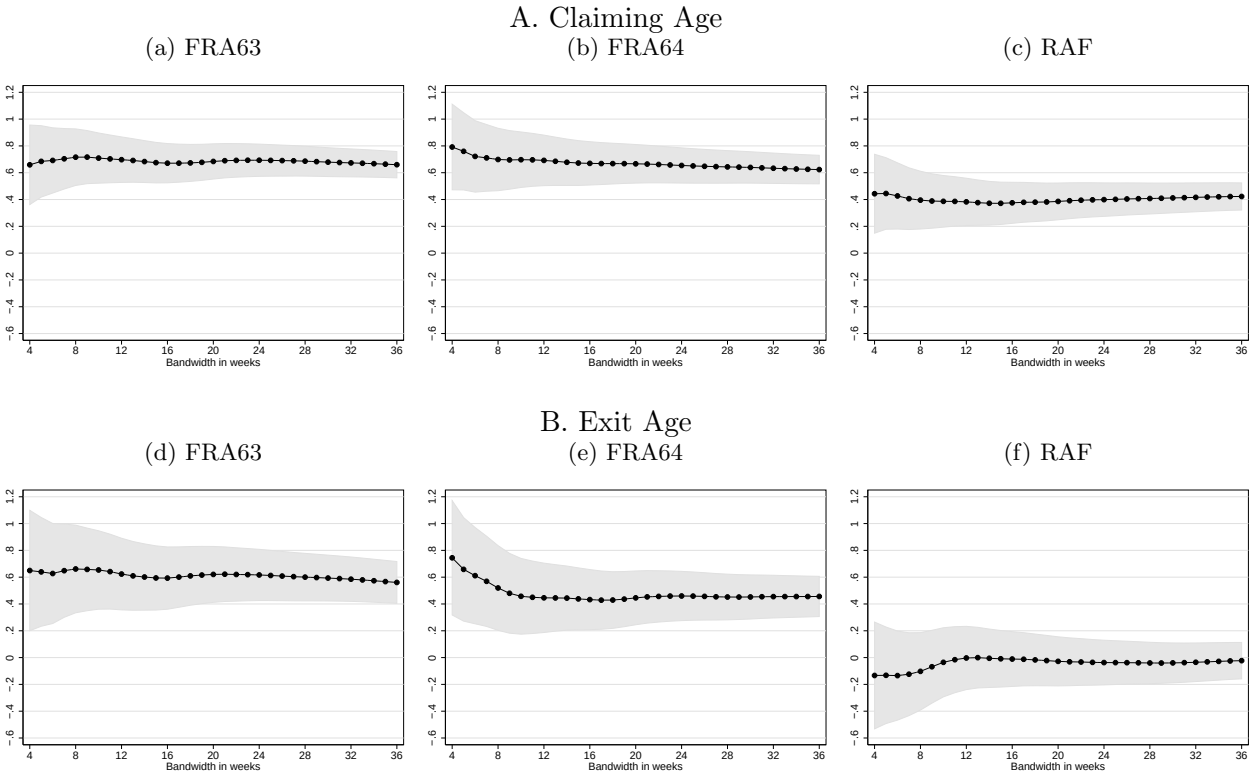
Notes: Table shows results of the McCrary test for balance of the distribution of the weeks of birth at the cohort cut-offs, 1939, 1942, and 1948.
Source: Own calculations, based on SSSD.

Table A.2: Testing smoothness of covariates

| | FRA63 | | FRA64 | | RAF | |
|---|---|---|---|---|---|---|
| | linear | quadratic | linear | quadratic | linear | quadratic |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| % Foreign | 0.6 | 2.4 | 1.8 | 2 | 1.8 | 3.6** |
| | (1.5) | (2.3) | (1.3) | (1.9) | (1.2) | (1.7) |
| % Married | 1.9 | 2.1 | -0.2 | -0.1 | 0.8 | 0.1 |
| | (1.8) | (2.6) | (1.7) | (2.5) | (1.5) | (2.2) |
| Age difference to husband (years) | 0.4 | 0.4 | 0.3 | 0.4 | 0.1 | 0 |
| | (0.3) | (0.4) | (0.2) | (0.4) | (0.2) | (0.3) |
| % Husband born 1933 | 0.3 | -0.4 | -0.4 | -0.4 | 0 | -0.1 |
| | (0.7) | (1) | (0.4) | (0.6) | (0.2) | (0.2) |
| % Husband born 1938 | 0.1 | 0.9 | 0.6 | -0.1 | -0.5* | -0.8* |
| | (0.9) | (1.3) | (0.8) | (1.1) | (0.3) | (0.4) |
| % Spousal benefits | -0.2 | -1.6 | -19.5*** | -18.4*** | 0.6 | 1 |
| | (1.7) | (2.5) | (1.3) | (1.9) | (0.8) | (1.2) |
| % Spousal benefits, age difference<2 | -0.6 | -1.5 | 0.7 | 1.3 | -0.6 | -1.1 |
| | (1.3) | (2) | (1.1) | (1.6) | (0.9) | (1.3) |
| Average annual indexed earnings | -664 | -2,304 | -1,325 | 45 | 100 | 95 |
| (2013 CHF) | (1,103) | (1,643) | (1,094) | (1,587) | (922) | (1,389) |
| Monthly earnings at age 50 | -112 | -87 | -128 | -150 | 192 | 388 |
| (2013 CHF) | (123) | (179) | (118) | (163) | (375) | (615) |
| Months employed until age 50 | -0.8 | -1.1 | 0.3 | 1 | 0.8 | 0.9 |
| | (0.6) | (0.8) | (0.9) | (1.3) | (1.5) | (2.2) |
| Months unemployed until age 50 | 0.1 | 0.1 | 0 | 0 | 0 | -0.3 |
| | (0.1) | (0.1) | (0.1) | (0.1) | (0.2) | (0.3) |
| Months contributing voluntary | 0.1 | 0.1 | -0.2 | -0.3 | 0.2 | 0.1 |
| until age 50 | (0.1) | (0.2) | (0.2) | (0.2) | (0.2) | (0.4) |
| Bandwidth (weeks) | 12 | 12 | 12 | 12 | 12 | 12 |
| Obs | 14,581 | 14,581 | 16,224 | 16,224 | 19,937 | 19,937 |

Notes: This Table reports the RDD estimate for a number of covariates, testing for smoothness of the mean of these covariates at the cohort cut-offs 1939, 1942, and 1948. Estimates adopt a linear and quadratic specification for functions $f_0()$ and $f_1()$, see section 6.
Source: Own calculations, based on SSSD.

Figure A.1: Sensitivity to Changes in Bandwidth




Notes: Figure shows the RDD estimates, by varying the bandwidth from 4 to 36 weeks. Optimal bandwidth is 12 weeks.

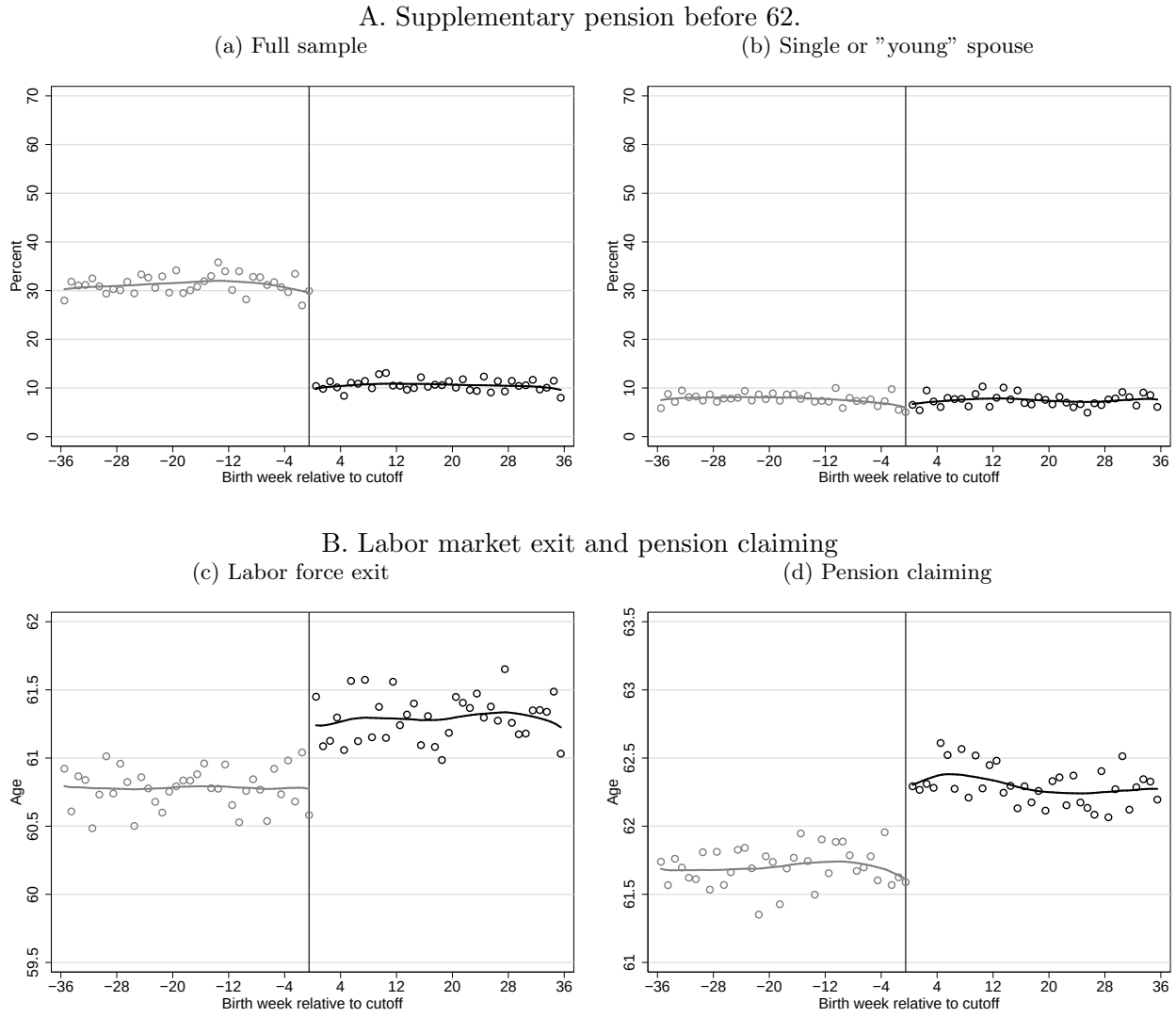
Source: Own calculations, based on SSSD.

Figure A.2: Placebo RDD Estimates


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 A.3: Sensitivity of FRA64 Results




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.