Ageing Europe – An Application of National Transfer Accounts for Explaining and Projecting Trends in Public Finances

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Spousal Retirement: a Regression Discontinuity Study

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Abstract

Retirement policies are individually designed but the majority of older people live as couples. We estimate the effects of a French pension reform on spouses' employment decisions. We use labor-force survey data, pooled over different years, on fifty thousand French couples and apply a regression discontinuity framework, also controlling for couple's unobserved heterogeneity. We conclude that the reform immediately reduced both spouses' retirement probability but also increased the probability of being unemployed for the husband and a "housewife" for the wife. The wife's retirement probability also drops by 1 to 4 percentage points if the husband is hit by the reform, and vice-versa. Instrumenting spousal retirement with legal retirement age, own retirement probability rises by 2 to 5 percentage points upon spousal retirement. We conclude that social security laws may actually impede spouses (who are often apart in age) to retire together.

Keywords

Ageing, Retirement, Policy Evaluation

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1. Introduction

Increasing individual working lives to counter population ageing and public pension deficits is currently of great interest to policy makers. Most OECD countries have implemented policies to make individuals work longer, and in particular many have increased the legal retirement age. France was a pioneer in this area. The reform we analyze here was voted on by the government in the summer of 1993. In France like most other countries, retirement laws and pension benefits are individually designed (Gruber, Jonathan and David Wise, 2005), while the vast majority of older people live as couples and very likely plan their retirement together (Michael Hurd, 1990; David Blau, 1998; Mark An, Bent Jesper Christensen and Nabanita Datta Gupta (2004), Bo Honoré and Aureo de Paula, 2014).[1]

Leisure complementarities are generally considered as one of the main drivers of 'joint retirement', the fact that spouses retire often within a year from each other (Maria Casanova, 2010; Pierre-Carl Michaud and Frederic Vermeulen, 2011). Recent work though has highlighted asymmetries in the timing of spouses' retirement (Robert Pollak, 2013; Alan Gustman and Thomas Steinmeier, 2009). The current evidence on the co-movements in older spouses' employment due to policy changes (in either retirement or health or social security rules) is also conflicting (Michael Baker, 2002; Courtney Coile, 2004; Donna Gilleskie and David M. Blau, 2006; Kanika Kapur and Jeannette Rogowski, 2007; James Banks, Richard Blundell, and Maria Casanova, 2010; Francois Gerard and Lena Nekby, 2012; Jonathan Cribb, Carl Emmerson and Gemma Tetlow, 2014; Rafael Lalive and Stefan Staubli, 2014).

These studies focused on dual-earners, thus often ignoring other non-employment outcomes, and paid little attention to the fact that age differences may actually drive spousal responses.

[1] Wilbert Van der Klaauw and Kenneth Wolpin (2008) also provide structural models of household retirement.

Age differences may not be exogenous to household decision-making (Pierre-Andre Chiappori, Sonia Oreffice and Climent Quintana Domeque, 2012; Hans Bloemen and Elena Stancanelli, 2015). The current paper addresses these issues and also represents the first attempt to open the black box of spouses' retirement strategies in France, as the earlier literature focused on the individual retirement decision.[2]

As is the case in the U.S. the majority of couples in France are dual-earners, and most married women work full-time. The labour-force participation rates of French women and men aged 45 to 54 have been slightly above those of their American counterparts (Francine Blau and Lawrence Kahn, 2013), since, respectively, the 1990s and the 2000's (see Figure 1). There are no spousal pension benefits and public retirement (defined-benefit) pensions are the rule in France. Only a tiny minority of workers receive an employer-provided pension (6% according to Lans Bovenberg, 2011) in addition to their public pension. Replacement rates of pension benefits to previous earnings vary between 50% and 80% depending on the sector of employment and the time of retirement -knowing though that at least 30 per cent of the workers earn the minimum wage in France and older persons are overrepresented among the poor. Periods of inactivity (maternity leave, sickness, and unemployment) are all fully insured with pension rights. Health insurance (which often appears as a concern in the earlier literature as it affects older spouses' employment behavior) is universally public in France. Retirement is an "absorbing" state: only 1% or less of older spouses report positive hours after having retired from work. Therefore, it is possible to neatly identify the effect of

[2] Jean-Olivier Hairault, Francois Langot and Thepthida Sopraseuth (2010) model the employment effect of the distance to legal retirement age in France, in a theoretical job-search framework, to conclude that increasing legal retirement age is likely to increase the employment rates of older workers. Luc Behagel, Didier Blanchet and Muriel Roger (2014) provide a comprehensive picture of individual retirement patterns in France. Beatrice Sedillot (2002) provides descriptive evidence of interactions in spouses' retirement decisions in France.

retirement policy changes on the retirement decision of husbands and wives, as there are a priori no other confounding factors.

The retirement policy that we analyze here required individuals born in 1934 or later to contribute three extra months to the social security fund, for each year of birth after 1933, up to a maximum of ten extra quarters, in order to retire with “maximum” pension benefits. We exploit information on own and spouse’s date of birth to apply a sharp regression-discontinuity design of the effect of the reform on own and spousal retirement. As husbands are on average twenty-four months older than wives, we can estimate both the direct and indirect (via the spouse) effects of the reform. Regarding anticipations, the reform was voted on in the summer of 1993 and implemented in January 1994, which leaves little scope for individuals to react before its coming into force. We conclude that spouses affected by the reform postpone their retirement significantly: the immediate probability of retirement dropped by about 2 percentage points for the husband and by about 4 percentage points for the wife. However, the reform also increased the probability of husband’s unemployment (by less than a percentage point), and that of being a “housewife” for the wife (by about 3 percentage points). The significance of the indirect effect of the reform on the spouse’s decision to retire is weak: the own retirement probability drops by at most 4 percentage points when the spouse is affected by the reform. We also conclude that the husband’s retirement probability increases by about 5 percentage points upon the wife’s retirement (instrumented with legal retirement age) while the wife’s increases by about 2 percentage points upon retirement of the husband. In contrast, the estimated jump in own retirement probability at age 60 is 32 to 35 percentage points for the husband and 25 to 27 percentage points for the wife. Combing the social security laws on eligibility to maximum pension benefits (changed by the 1993 reform) with the legal retirement age to instrument each spouse's retirement, we obtain similar estimates: spousal retirement increases own retirement by about 1 to 3 percentage points against a jump in own retirement by 30 to 40 percentage points at own treatment. We conclude that due to the age difference between the husband and the wife, social security laws may hinder spouses' preferences for joint retirement.

The structure of this paper is as follows. The next section describes the empirical approach. The institutional background is presented in Section 3. The data are detailed in Section 4. The graphical analysis and the results of estimation are then discussed in Sections 5 and 6, respectively. The last section draws some conclusions.

2. The method

The reform we consider here affected individuals born in 1934. The reform was voted on in July 1993 and implemented in January 1994. We exploit this natural experiment, as individuals born just before or just after 1934 are likely to be very similar in every other respect so that we can isolate the effect of this reform on their retirement decisions.

Using a Regression Discontinuity (RD) approach has a number of advantages over the differences-in-differences models (Guido Imbens and Thomas Lemieux, 2007; Wilbert Van der Klaauw, 2008; David Lee and Thomas Lemieux, 2010) that have been widely used in most empirical work on the effects of public policies on spouses' retirement strategies.[3] Essentially, as individuals who are close to the discontinuity cut-off (here, being born in 1934) on the opposite sides of this cut-off are likely to be very similar, a regression discontinuity is very close to an experimental design. On the other hand, the drawback is that

[3] Erich Battistin, Agar Brugiavini, Enrico Rettore and Guglielmo Weber (2009) were the first to apply a RD design to study the effect of household head's retirement on household consumption.

we can only estimate the immediate effect of the reform for those close to the treatment group, like with most regression discontinuity studies. In particular, we can here apply a regression discontinuity as there are no other policies that specifically affected individuals born in 1934. Regarding anticipations (David Lee and Thomas Lemieux, 2010, while birthdate (or age) certainly cannot be manipulated, individuals do know their age (and their birthday) and could therefore behave differently before the introduction of the reform, which would invalidate the natural experiment design. However, since the policy was announced and voted on only 6 months before its introduction, this seems unlikely. We use the McCrary approach to test for the continuity of the running variable.

We denote by O the outcome variable: this encompasses retirement, *R*, as well as other non-employment states, such as unemployment, U, or being a full-time housewife, HW. The treatment is given by the 1993 policy reform, which affected individuals born in 1934 who were treated as from January 1994. Our goal is to estimate the average impact of the treatment on spouses' outcomes:

1) $\gamma = E[O_{(1)} - O_{(0)}]$

We assume that any difference in outcomes is due to the treatment, knowing that we may only observe O for the same spouse j either before (0) or after (1) the treatment. Assuming the continuity of E[O] on either side of the cut-off, and defining the running variable, M, as the number of months elapsed before or after the treatment, the RD estimator γ_{RD} can be rewritten as:

2) $\gamma_{RD} = \lim^{-}_{M\to 0} E[\, O_{j(1)} \mid M_j=0] - \lim^{+}_{M\to 0} E[O_{j(0)} \mid M_j=0]$

which can be approximated (*Hahn,* Jinyong; Petra *Todd*; Wilbert *Van der Klaauw, 2001;* Imbens, Guido and Thomas Lemieux, 2007) by taking the difference of the mean outcomes of the respondents born in the months close to (before and after) the treatment (the cutoff point of being born in January 1934). Assuming a linear regression model for the outcome, we can also write:

3) $O_j = \gamma_{RD}\, T_j + \lambda\, f(M_j)\, T_j + \beta\, f(M_j)\, (1-T_j) + u_j$

Where T is the (which equals one for individuals born in January 1934 and later months, and zero for those born in the months before January 1934), $f(M_J)$ is a linear polynomial function of the distance in months from being born in January 1934, interacted with the treatment dummy T to allow for different effects on either side of the cutoff. We estimate γ_{RD} using a fully non-parametric approach (specifying local polynomials with a triangular kernel, as in Austin Nichols, 2014), as well as linear regression models. We use the same bandwidth for both models. We apply the procedure as in Sebastian Calonico, Matias D. Cattaneo and Rocio Titiunik (2014) to determine the optimal bandwidth, which produces an optimal bandwidth of 48 months for the RD impact of the reform on the wife's retirement probability and a slightly different figure (36 or 41) for the other RD specifications; we opt to present results using the same bandwidth for all the RD specifications. The results are in general robust to using different bandwidths -noting that setting a smaller bandwidth leads to dropping from the estimation sample couples in which the age difference between the husband and the wife is larger (i.e. couples with age difference that is more than the twice the bandwidth automatically drop from the estimation sample). We separately estimate each spouse's response to both own treatment and spousal treatment ("cross-effects" or "spillovers" or "indirect" effects). To account for the rotating sample structure (where most couples are observed more than once, and up to three times over the sample period) we cluster the errors at the couple level. In addition, to control for couple-specific characteristics, including notably the age difference between the spouses, we also estimate a variant of these models allowing for couple random effects. We also experiment with allowing for multiple treatments[4] by considering two cutoffs: one for the husband's been born in 1934 or later and the other for the wife's been born in 1934 or later. Then, the bandwidth is such as to include couples in which both the husband and the wife were born within 48 months from January 1934.

Finally, we focus specifically on the legal retirement age of 60 at which most French workers retire with "maximum" pension benefits to set up a "fuzzy" regression discontinuity design of the effect of spousal retirement (instrumented by being aged 60 or more) on own retirement. This allows for the fact that the retirement probability increases by more than zero but less than one at the legal retirement age of 60. As the legal retirement age can be anticipated, individuals may react in advance of their (spouse) reaching legal retirement age. However, both spouses are bound by the legal retirement age. Not only we do not uncover any evidence of anticipation effects, we also find only a small effect of spousal retirement on own retirement. There are no other policy measures that affect individuals upon reaching age 60 in France. Under this set up, the spouse j being aged 60 on the day of the survey interview is the 'cut-off' for the treatment of spouse i, S_i, with Age equal to the age of spouse j minus 60 (which is equal to zero at the cut-off, as is standard). Given the continuity of the running variable (the age of spouse j, which we measure in months and fractions of months), the FRD estimator can be rewritten as:

[4] The state of the arts for multiple regression discontinuity applications is still evolving as accounted in Matias Cattaneo, Luke Keel, Rocio Titiunik and Gonzalo Vazquez-Bare (2014).

$$13)\ \gamma FRD = \frac{\lim^{-}_{Age_j \to 0}\ E[\,O_{i(1)} \mid Age_j=0] - \lim^{+}_{Age_j \to 0}\ E[\,O_{i(0)} \mid Age_j=0]}{\lim^{-}_{Age_j \to 0}\ E[\,R_{j(1)} \mid Age_j=0] - \lim^{+}_{Age_j \to 0}\ E[\,R_{j(0)} \mid Age_j=0]}$$

We can then use a local polynomial approach to estimate γFRD or a two-stage least square (2SLS) approach -which is equivalent to a fuzzy RD design (Jinyong Hahn, Petra Todd and Wilbert van der Klaauw, 2001) - and write each spouse's outcome, O_i (or R_i, Ui, HWi) as a function of the other spouse's retirement probability, R_j, instrumented with a dummy, S_j, which takes the value of one when spouse j has reached age 60 (720 months or 21 840 days) of age- and zero otherwise, as follows:

$$15)\ O_i = a^i + R_j\,\iota^i + (1 - S_j)*Age_j\,\mu^i + S_j*Age_j\,\check{n}^i + \upsilon_i$$

$$16)\ R_j = a^{rj} + S_j\gamma^{rj} + (1 - S_j)\,Age_j\,\mu^{rj} + S_j\,Age_j\,\check{n}^{rj} + \nu^{rj}$$

where Greek letters denote the parameters to be estimated, Age_j is a linear polynomial in age of the spouse *j* (normalized by subtracting 60), and we also allow for interactions between *S*, the age cut-off dummy, and the age polynomial, as is normal (Joshua Angrist and Jorn-Steffen Pischke (2009, page 261). The empirical strategy here can also be seen as an instrumental-variable approach. The literature typically recommends wider bandwidths in fuzzy regression discontinuity designs than in the case of sharp regression discontinuity. We control for couple fixed effects (or, alternatively, random effects). Again, we check the robustness of our conclusions to allowing for multiple treatment of each spouse by running a linear regression model of own retirement with two cut-offs for both spouses' being aged 60 and above (Table 5).

Finally, we combine the two requirements of being aged 60 and having paid enough social security contributions to be able to retire with "maximum pension benefits", to define the treatment. To do so we construct a measure of each spouse's "potential" pension contribution records. The details are given when reporting the results of estimation of this specification, at the end of Section 6.

3. Institutional Background

Most workers in France retire by the time they are aged 60: age 60 is the 'effective' retirement age according to recent OECD estimates (OECD, 2014). This is unsurprising as 60 is the legal age at which most workers in France can retire with "maximum" pension benefits. In 2010, this legal retirement age threshold was raised from 60 to 62, but with effect only in 2018. The age 60 threshold thus still currently applies, and we do see a large increase in both spouses' retirement probability at age 60 (the top panel in Figure 6). Particular sectoral agreements enable some workers to retire before 60, with "early" retirement often being at age 55, but these apply to only a minority of workers (we find no jump in retirement at age 55 for either the husband or the wife: see the top panel of Figure A in the Appendix). By age 65, the law also requires most workers to retire if they have not yet done so.[5] We can therefore think of the French retirement system as a two legal retirement-ages system, with a first threshold at 60 and a second at 65, although in practice the vast majority of workers retire long before 65 (there is no jump in retirement at 65 for the husband: see the bottom panel in Figure A in the Appendix). This likely reflects that pension benefits do not increase any further with employment after age 60 when individuals have sufficient years of social-security contributions.

5 The 2010 reform also raised this age 65 threshold with effect as from 2018.

According to recent estimates, about 79 per cent of French retirees claim only a public (first pillar) pension, while 6 per cent also receive an occupational (employer-provided) pension and 18 per cent also have a private pension. The corresponding American figures are, respectively, 45, 13 and 42 per cent (Lans Bovenberg, 2011). The replacement rates of pension benefits with respect to past earnings are quite generous, and vary roughly between 50 per cent and 80 per cent or more. Pension benefits are a function of past earnings with a maximum level that depends on workers' social-security records and varies according to the year of birth (since the 1993 reform) and the sector of employment. For example, a private-sector worker born in 1943 who entered the labor market at age twenty would have to work until 60 to retire with maximum pension benefits – knowing that this pension benefit (adjusted for inflation) would be received every month from retirement until death.

The key to understanding the retirement mechanism in France is that pension benefits do not rise if individuals continue to work once they have worked long enough to receive maximum pension benefits: the private-sector worker in our example would receive the same monthly pension benefit retiring at 60, 61 or even later. Retiring at the legal retirement age of 65 is interesting for workers that have interrupted careers (often the case for married women) or that entered labor the labor very late (like doctors) as those retiring at age 65 become eligible for maximum pension benefits regardless of the length of their contribution period.[6] For example, if the private worker of our example only started working at age 30, s/he would be able to retire with maximum pension benefits at age 65; while the drop in pension income for retiring earlier than 65 would be substantial (the replacement rate would drop by 15 to 20

[6] These rules are undergoing a reform nowadays.

percentage points if s/he retired at age 60). Indeed, we find a jump into retirement at age 65 for some of the wives but not for the husbands (bottom panel in Figure A in the Appendix).

The 1993 retirement reform, which was voted on in the summer of 1993 and came into force in January 1994, increased the length of the maximum contribution period required to retire with maximum pension benefits for workers born in 1934 or afterwards. The number of extra contribution months varied according to the distance between the birth date and the "cutoff" point of being born in 1934. While those born in 1934 needed an extra three months of work history, those born in 1935 needed six more months, and those born in 1943 or later 30 extra months. Treatment intensity is thus proportional to the distance from the cutoff. In line with the discussion above, not contributing these additional months would entail an income penalty, as workers retiring earlier would not be able to receive the maximum level of pension benefits (the replacement rate of pension benefits to past earnings would drop accordingly). The rules for the calculation of maximum pension benefits were also made tighter, introducing a longer reference period for the earnings which would serve as the reference earnings to calculate pension benefits – by lengthening the reference period, less weight is given to the highest earnings, which are often earned late in the career. Therefore, the reform provided incentives for individuals to retire later. Because breaks in employment not insured with pension contributions are often chosen by the individual, using the actual contribution period as the running variable (instead of the individual birthday) did not appeal to us (besides, this measure is not available in the LFS) but we experiment with constructing a measure of "potential" contributions and interact it with the legal retirement age (see Section 6, last subsection).

Older individuals entering unemployment were exempt from actively searching for work (due to the so-called "dispense de recherche d'emploi' Law), while their unemployment benefits were not digressive (remained at the same level until retirement and did not fall), regardless of unemployment duration. In addition, employers (by the so-called "contribution Delalande" Law) faced a substantial financial penalty for laying off older workers. We check for discontinuities in unemployment patterns at age 55 and 3 months, which is the critical age for benefiting from these favourable unemployment terms (Antoine Bommier, Thierry Magnac and Muriel Roger, 2003), to conclude for no significant move into unemployment around this critical age (Figure B in the Appendix).[7] Therefore, we consider unemployment among the outcomes of our empirical model.

4. The data

Our analysis data come from the French Labour Force Surveys (LFS). We chose this sample for a number of reasons. First, administrative social security data in France are only available at the individual level to date; while the census data are cross-sectional. The 1990-2002 LFS surveys are annual with one-third of the sample exiting each year and being replaced by new members (three-year rotating panel). These surveys are very comparable over time, as they use the same questionnaire, data-collection method (personal interviews at the respondent's home) and sample design. The response rate was almost 90%. This LFS series was broken though in 2003 to comply with Eurostat requirements. The newer LFS series (from 2003) relies on quarterly surveys, mostly carried out by telephone; and the questionnaire and sample design differ from the earlier 1990-2002 surveys. In addition, another reform regarding the

[7] Antoine Bommier, Thierry Magnac and Muriel Roger, (2003) appeal to differences-in-differences to suggest negligible transitions into unemployment in response to these reforms.

duration of pension contributions took place in 2003, exactly at the time of the LFS series break. We thus analyze a sample of couples in 1990-2002 LFS data as follows:

- Individuals were matched to their partner if any and single people were dropped from the sample.[8]
- Multi-couple households were dropped.
- Records from different survey years were then pooled together.

This produced a sample of 588 654 couples, including cohabiting couples (who are, however, only a very small minority among older spouses: our results are robust their exclusion). The sample size in the empirical analysis varies according to whether we focus on the "husband" being born in 1934 as the cut-off or the "wife" being born in 1934 (we call the male partner the "husband" and the female partner the "wife" regardless of marital or cohabiting status) or whether we concentrate on the legal retirement age and set the cut-off at the husband (or the wife) having reached the legal retirement age of 60. The sample size is over 50,000 couples in all empirical specifications when setting an (optimal) bandwidth of 48 months, either for the distance in months from being born in 1934, or the distance in months from being aged 60, and for either spouse. We can carry out panel analysis on a sample of over 30,000 couples that are observed at least twice and at most three times, over the sample period. Attrition does not seem to be a major problem as only 5% of the sample is not re-interviewed at least a second time. Some of this attrition could possibly be associated with the couple changing address upon (joint) retirement (as the survey does not follow households that move), but the McCrary test performs well, suggesting that this is not a systematic problem (Figure 2).

[8] In this survey, it is not possible to distinguish same-sex couples from singles sharing housing, as same sex individuals are automatically coded as singles.

The LFS collects month and year of birth together with the day, month and year of the interview. We can therefore construct a continuous measure of month and year of birth and the distance in months from being born in January 1934. We also construct a continuous measure of age (in months and fraction of months) at the day of the interview. The retirement status is subjectively assessed by the individual and measured on the interview date. In particular, the individual reports whether his/her main economic status was employment, unemployment, full-time education, military service, retirement, being a housewife or other inactive. We distinguish retirement, unemployment and being a "housewife" as outcome variables (few men report being full-time home-makers).

We do not control for other explanatory variable in the empirical analysis, but check that other variables do not change discontinuously for individuals born in 1934 (or aged 60), as is customary in RD analysis. These variables (Table A in the Appendix) include completed years of education, the local unemployment rate, the number of children.

5. Graphical analysis

A number of insights into the validity of the empirical design and the effects of the treatment can be obtained by simply plotting the data (Guido Imbens and Thomas Lemieux, 2007; Wilbert Van der Klaauw, 2008; David Lee and Thomas Lemieux, 2010). First, as is customary, we show that the running variable (distance in months from being born in 1934 or from age 60) is continuous at the cut-off (Figure 2). Were people able to manipulate their birthday (or their age) in anticipation of the policy, we may find a discontinuity in the running variable at the cut-off point, which would invalidate the RD approach (Justin McCrary, 2008). Age and birthday are very precisely measured in developed countries such as France. However, some worry that individuals may, for example, drop out of the survey at retirement. Figures 2 suggest that this is not the case and that the running variable is continuous at the cut-off.

As is often done in the empirical RD literature, we plot the raw means of the outcome variable (grouped by bins of two months) together with the kernel triangular estimates (using the same bandwidth as in the empirical model) and the 5% confidence intervals around these estimates against the running variable. We plot each spouse's retirement probability after the 1993 reform as a function of own (left panel in Figure 3) and spousal birthday (right panel in Figure 3). To understand these graphs, it is important to keep in mind that spouses born to the left of the cut-off point (the vertical line at zero, which corresponds to being born on January 1934) are older while those born to the right are younger. After the reform, the husband's and the wife's retirement probability falls significantly, as expected. We find no significant indirect effects: the retirement probability of the husband (wife) is a smooth function of the birth date of the wife (husband).

Next, we run a "placebo" test in which we apply the same RD strategy but fictitiously assume that generations born in 1932 and later were affected by a reform implemented in1992 (Figure 4).[9] The graphs show no significant drop in the retirement probability at the 1932 cut-off for either the husband or the wife. The placebo test thus validates our RD design: the effects we see in Figure 3 are not driven by a spurious combination of birth years and policy years.

As far as other non-employment outcomes go, the husband's unemployment probability rises after the 1993 reform. The probability that the wife reports being a housewife also increases

[9] We drop from the estimation sample couples that answered the survey in 1994 and later years.

significantly (see Figure 5). It then appears that the reform discouraged married women's employment, and perhaps led them to describe themselves as "housewives" rather than unemployed. We conclude that the 1993 reform induced individuals to postpone retirement, but also pushed some spouses into inactivity states other than retirement.

Focusing on the legal retirement age, Figure 6 traces out the retirement probability of spouses as a function of own and spousal age. The jump in own retirement probability on reaching the legal retirement age 60 (the top panel of Figure 6) is over zero and under one (as it should be in a fuzzy RD) and very sizable for both the husband and the wife. We also find a small rise in the wife's retirement probability when the husband is aged 60 or over (the bottom right graph in Figure 6) but no visible effect of the wife's being aged 60 on the husband's retirement probability (the bottom left graph). Therefore, whether we exploit the 1993 policy reform or the legal retirement age, we find little immediate effect of spouse's retirement on own retirement. However, spouses are often thought to retire within a year of each other (Maria Casanova, 2010). We therefore split the sample by the age difference between the spouses and focus on spouses whose ages differ by at most one year. Figure 7 shows the husband's retirement probability as a function of the wife's age (left graph) and the wife's retirement probability as a function of the husband's age (right graph) for these couples. The retirement probability of the wife now jumps up immediately and significantly as the husband turns 60. There is also a significant rise in the retirement probability of the husband, as the wife turns 60. This suggests that age differences between spouses significantly affect the probability of cross-retirement, although we should underline that age differences between spouses may not be exogenous to household decisions. To control for this we use couple fixed effects in the linear regression models.

We last check graphically that 60 is the only age cutoff that we should consider. We estimate (by means of a local polynomial method, applying a triangular kernel distribution and an optimal bandwidth of 48 months) the jump in the retirement probability of each spouse at:

- the legal retirement age of 60 (the top panel of Figure 6);
- the legal retirement age of 65 (the bottom panel in Figure A in the Appendix);
- age 55 (the top panel in Figure A in the Appendix), at which people typically enter sector-specific early-retirement schemes;
- the age of 55 years and 3 months (Figure B in the Appendix), starting at which the unemployed are exempt from making any active search effort and receive non-regressive unemployment benefits until retirement (Bommier, Magnac, Roger, 2003).

We saw that the retirement probability of each spouse jumps up for spouses aged 60 and above (Figure 6), with estimates of over 0.30 for the husband and over 0.25 for the wife (next Section). This difference reflects the fact that many married women have interrupted work histories with uninsured periods out of work,[10] so that by the time they reach age 60, they do not have sufficient social-security contributions to be able to retire with maximum pension benefits; they then opt to work some additional years to retire with the maximum pension. For the other age cut-offs considered (see the bullet list above), we find no significant increases in the retirement probabilities of either spouse, except for the age 65 cut-off at which there is a small jump into retirement for the wife (but not for the husband). This reflects the fact that married women have more often interrupted work history than married men, and thus, some of them retire at the legal retirement age of 65, at which they can receive maximum pension benefits (see Section 4). As we focus on spillover effects and the husband

[10] They may have quit work, for example, to take care of children or their elderly parents (Kristian Bolin, Bjorn Lindgren and Petter Lundborg, 2008).

is older than the wife in most couples (over two years older on average), we do not include in our model the spike in the wife's retirement probability when she is 65 (by then her husband will be on average 67 and over and will already be retired). The optimal bandwidth for the discontinuity in retirement at legal retirement age 60 is 48 months (Section 3).

6. Estimation Results

We estimate the effect of the 1993 retirement reform on spousal retirement and other non-employment outcomes by applying a sharp RD design, using both a local polynomial estimator and a linear regression model (Section 3) with the same (optimal) bandwidth. We also estimate the effect of spousal retirement (instrumented by the spouse's being aged 60, legal retirement age) on own retirement under a fuzzy RD design, by means of a local polynomial estimator and an instrumental variable model (Section 3). Next, we combine the laws for entitlement to maximum pension benefits (changed by the 1993 reform) with the legal retirement age. In all the models the standard errors are clustered at the couple level (or we include couple random or fixed effects). A number of robustness checks are carried out, which include varying the bandwidth, dropping spouses born in January 1934, or selecting only couples in which the age difference between the husband and the wife is at most twelve months.

Sharp RD design: estimates of the direct effects of the 1993 policy reform

The reform significantly reduced both spouses' retirement probability. The drop in the retirement probability is about 0.02 (or two percentage points) for the husband and 0.04 (or four percentage points) for the wife. When estimating a linear model with couple random effects, the estimates are slightly larger for the wife and double the size for the husband, for whom the retirement probability now drops by 0.04. For the generations born shortly before the reform (from July to December 1933), mean retirement was 0.86 for the husband and 0.53 for the wife (about 26% of the wives are housewives). Therefore, although the reform worked as expected inducing spouses to retire later, the size of effect was relatively small.[11] The two approaches, local polynomials using a triangular kernel estimator and linear regression model, lead to comparable results that are also robust to varying the bandwidth or dropping spouses born in January 1934 (Table1).

We next estimate the effect of the reform on spouses' probability to exit into non-employment states other than retirement (columns 4, 5, and 6 of Table 1). We find that the husband's unemployment probability increases significantly (Column 4 of Table 1), although the size of the effect is very small at 0.01 in the model with couple random effects (which is larger than the estimates obtained not accounting for random effects). The husband's unemployment probability just before the cut-off (for generations born between July and December 1933) is 0.011. As the older unemployed were dispensed from actively searching for a job, the reform may have reinforced the unemployment trap for them. Alternatively, it could be that employers dismissed these workers[12] as the (possibly psychic) costs of employing older workers longer perhaps outweighed the penalty incurred for dismissing them. We have used some extra questions on the reasons for entering inactivity to investigate these issues, using the reasons for being inactive (dismissal, quit, taking care of family, or health problems) as the outcome variable, but given the small sample sizes here nothing was significant.

[11] Earlier studies of the effect of the reform using an incremental differences-in-differences strategy also found very small reform effects on the individual retirement probability (Antoine Bozio, 2008).
[12] The existing literature suggests that employers may discriminate against older workers (Joanna Lahey, 2008).

Regarding wife's unemployment, the estimated coefficient on the 1993 reform is positive but statistically significant only for the model with couple random effects (and also for the local polynomial model with a larger bandwidth of 96 months). The RD estimate is 0.007 (the last row of column 5 in Table 1). We cannot exclude that some married women (or the interviewers surveying them) report being a "housewife" rather than unemployed, even if they receive unemployment benefits. We find a significant increase in the probability of being a housewife following the 1993 reform. The estimated coefficient is statistically significant and of similar size across specifications (the last column of Table 1). The effect is not large, however, amounting to about 0.03 (or 3 percentage points) –knowing that about 26% of the wives born between July and December 1933 were housewives.

Sharp RD design: estimates of the indirect effects of the 1993 policy reform

We now consider the indirect effects of the 1993 reform and estimate the wife's outcomes as a function of the husband's birthdate and vice-versa. The cut-off point is here whether the spouse was born in 1934. The estimates of the indirect effect of the reform on spousal retirement are negative but not significant statistically (Columns 1 and 2 of Table 2). If the husband postpones retirement, than the wife will also have an incentive to do so, and vice-versa. This explains the negative coefficients on the cross-effects. The insignificance of these indirect effects is unsurprising given that the direct effects are small in size.

Regarding the other non-employment outcomes, the husband's unemployment probability does not react to his wife being affected by the reform. However, the wife's unemployment probability does respond significantly to the husband being affected by the reform, with the estimated RD coefficient being close to 0.01 and statistically significant under all empirical specifications (Column 5 of Table 2). The spillover effect on the wife being a housewife is also positive but only statistically significant at the ten per cent level, and only in the models with couple random effects or a smaller bandwidth of 24 months. The size of the effect is quite small at about 0.02 to 0.03. We saw above that the husband's own unemployment probability also rose significantly due to the reform, which may indicate spillover effects from husband's to wife's unemployment. Entering unemployment (while waiting to retire with maximum pension benefits) may also perhaps be seen as a way of enjoying leisure complementarities on the retirement of one's spouse, although unemployment benefits are conditional on involuntarily losing one's job, so this option would be costly in terms of foregone income.

To check that we are not confounding the direct and indirect effect of the reform, we also re-estimated similar RD models allowing for multiple discontinuities (Matias Cattaneo, Luke Keel, Rocio Titunik and Gonzalo Vazquez-Bare, 2015), specifying a discontinuity for the husband being born in January 1934 or later and an additional discontinuity for the wife being born in January 1934 or later. We therefore now explicitly allow spouses to be treated twice, once when they are hit by the reform (the direct effect) and then when their spouse is hit (the indirect effect). Under this set-up, we allow for the same bandwidth in both spouses' birth dates, and select couples in which both spouses were born within 48 months from January 1934. The estimated own effects are similar to those when estimating the two discontinuities separately and some of the cross retirement effects become now statistically significant (though only at the ten per cent statistical significance level), suggesting that spousal retirement affects own retirement by one to four percentage points (Table 3). The cross-unemployment effect for the wife becomes instead not significant statistically.

Sharp RD design: a placebo of the 1993 policy reform

To check the validity of our RD analysis, we replicate (for the sample years between 1990 and 1993) a similar set up for spouses born in 1932 and later years (up to 1933), assuming fictitiously that a similar reform appeared in 1992. Figure 4 shows no direct or indirect effect of this fictitious reform on spouses' outcomes (for the sake of brevity we do not show these estimation results, which are available from the author).

Fuzzy RD design (or IV): the indirect effects of spousal retirement on own retirement

We further investigate spouses' retirement strategies by exploiting the large discontinuity in retirement at the legal retirement age of 60 (see top panel of Figure 6). Regarding anticipations, although age and retirement can be anticipated, the legal retirement age constraints are binding so that spouses cannot anticipate retirement. In addition, the graphs in Figure 6 show no evidence of anticipation. We also find only small indirect effect of spousal retirement on own retirement (the bottom panel in Figure 6). The age difference between spouses may not be exogenous to spousal decision making, an issue which has been neglected in most of the literature on spouses' retirement to date. We pick this up by estimating, for each specification, a model including couple fixed effects.

We first note that the first-stage estimates are very significant, and indicate a large jump in own retirement probability for each spouse at age 60 and above. In particular, the husband's retirement probability increases by 0.32 in the local polynomial estimator and 0.34 in the linear regression model; the analogous figures for the wife are 0.25 and 0.27 respectively. These smaller estimates for the wife reflect that married women tend to have more interrupted work careers and thus need to work to a later age to be able to retire with maximum pension benefits. We now also find a significant and positive, although small, effect of own retirement on spousal retirement: the husband's retirement probability rises by 0.05 to 0.06 (5 to 6 percentage points) when the wife retires, with analogous figures for the wife of 0.02 to 0.03 (2 to 3 percentage points) – although the latter estimate is statistically insignificant in the local polynomial regressions. These cross-effects (although significant and positive, as predicted in the literature) are not very large. This is unsurprising as the age difference in the average couple is over two years and retirement schemes are individually designed with no spousal benefits but legal retirement ages. French administrative surveys of retirees reveal that 78% of retirees say that family considerations had no impact at all on their decision to retire, while 49% say that having reached the age at which they can retire with maximum pension benefits was a very important reason to retire (multiple answers were possible: see Appendix Table B).

Heterogeneous effects due to the age difference between spouses

To capture response differences by spousal age gaps, we split the sample into three groups of "unions":

_couples in which the age difference between the husband and wife is at most one year (Columns 4 and 5 of Table 4), regardless of which spouse is older;

_couples in which the wife is over a year older than the husband (Column 6 of Table 4), which is the case in under 20% of the older couples;

_couples in which the husband is over a year older than the wife (Columns 7 of Table 4), which is the vast majority of older couples.

We find that couples that are close in age retire together (Columns 4 and 5 of Table 4), although these estimates confound the effect of own and spousal age, given that both spouses will turn 60 at a similar date. When looking at couples in which the husband is over a year older than the wife, husband's retirement is found to significantly reduce the probability that the wife retires at around the same time, although this effect is small in size at about 0.07 to 0.08. For the opposite case of the husband being over a year younger than the wife, the estimates of the effect of wife's retirement on husband's retirement are also negative but never statistically significant. We should also note that the age difference may also induce the older spouse to postpone retirement, something which we have not checked here, as in our data most of the older spouses have already retired by the time the younger spouse turns 60.

Table 5 shows the estimates of linear regression models in which each spouses' retirement probability varies as a function of whether either spouse is aged 60 or more, thus allowing for multiple cut-offs. The bandwidth is set accordingly and includes couples in which both spouses are aged within 48 months from age 60 –for all the couples and splitting the sample according to the age difference between spouses (as we did in Table 4). The estimates show that the jump in own retirement at own age 60 is robust to controlling for the spouse's being (also) aged 60, but many of the cross-effects are not significant (although they are all positive). In particular, controlling for the own jump into retirement at age 60 in addition to the discontinuity in own retirement when the spouse is aged 60, makes the size of the latter estimate much smaller also for couples that are of similar age, within at most a year of age difference (Columns 4 and 5 of Table 5). We find that for this group the husband's retirement probability increases by about four percentage points when the wife is aged 60 and above; while the wife's retirement probability increases by about 3 to 5 percentage points when the husband is aged 60, although controlling for couple's fixed effects the latter effect is not statistically significant. The findings of small and often insignificant cross-effects are in line with our conclusions that the 1993 reform had only small and weakly significant (at best) spillover effects on the spouse of individuals affected by the reform (Tables 2 and 3).

Intensive margin of labor supply: market-hour outcomes

Retirement is an absorbing state in France, with very few people continuing to work past retirement, at least in the period we consider: only 1.3% of the husbands and 0.6% of the wives report positive hours after having retired from work.[13] Therefore, it is difficult to pin down the effect of retirement on own hours. We also find no indirect effect of the 1993 reform on the spouse's hours of work (if the husband is affected by the reform, the wife hours of work do not vary significantly, and vice-versa), and small effects of spousal retirement (instrumented with the spouse's being aged 60 and above) on own hours of work. The hours of work of the husband drop by about 1.8 hours per week when the wife retires while the hours of work of the wife drop by about 1.3 hours per week when the husband retires, but these estimates are statistically significant only when controlling for couple's fixed effects. Restricting the sample to husbands with positive working hours though (keeping in mind that the selection may not be exogenous here), we find no significant effect of the wife's retirement on his hours, though the estimate remains negative and equal to slightly less than an hour (0.8). In contrast, restricting the sample to wives with positive working hours (for illustrative purposes only, as the selection may not be exogenous), we find a positive and significant effect of his retirement on her hours, equal to about an hour per week, when controlling for couple's fixed effects (and using a 48 months bandwidth for the husband's

[13] Precisely, 572 husbands report positive hours out of the 43679 that have retired from work in our sample of 74942 husbands aged within 48 months from age 60 (the estimation sample in Column 3 of Table 4) and 159 wives report positive hours out of the 25357 that have retired from work in our sample of 71612 wives aged within 48 months from age 60 (the estimation sample in Column 2 of Table 4).

being aged 60). There seem to be considerable heterogeneity in hours responses but the overall conclusion is that hours responses are not very important either at the extensive (see earlier results on spousal retirement outcomes) or the intensive margin (the results that we have summarized here and that are available from the author).

Interacting legal retirement age and maximum pension benefit laws

As we have seen, since the 1993 reform, workers born in 1934 and later years had to work more quarters to be able to retire with maximum pension benefits, which led both spouses to postpone retirement. We have also established that each spouse's retirement probability increases dramatically at the legal retirement age of 60. However, we find little spillover effects of the 1993 reform on the spouses of individuals affected by the reform. In line with this, we also conclude that spousal retirement (instrumented with the spouse's being aged 60 or more) has only a small effect on own retirement. We now construct a measure of the "potential" social security contribution period of each spouse, based on the education level, [14] (assuming that individuals entered the labor market as soon as they completed education), the year of birth and the laws on compulsory schooling years.[15] Next, we calculate for each spouse the "optimal" social security contributions required for them to be able to retire with maximum pension benefits, which is a function of their birth year since the 1993 reform (abstracting from any variation due to the sector of employment and taking the private sector

[14] School was compulsory until age 14 until 1959, when a reform extended compulsory schooling to age 16 for children that were at least six years old as from January 1959.

[15] Until 2004, women were credited some additional social security contributions (one extra year of pension rights) for each child, conditional on being employed around the time the child was born. This was on top of the pension rights accrued during the maternity leave period. However, the LFS only ask about children still leaving at home but by the time parents retire children have often left the parental home.

as the reference here).[16] Subtracting the potential social security contributions (measured in months at the date of the survey) from the optimal contributions (required for receiving maximum pension benefits), we obtain a measure of the "potential"[17] distance in months from the moment at which each spouse is able to retire with maximum pension benefits. The treatment is then defined as having enough social security contributions to be able to retire with maximum pension benefits. However, we need to account also for the existence of legal retirement ages, and thus, we interact the social security treatment dummy (equal to one for spouses that have already reached the month at which they can potentially retire with maximum pension benefits, and to zero otherwise) with the dummy for being aged 60 and above. The running variable is obtained by interacting the distance in months from being aged 60 with the distance in months from the optimal contributions.

We then estimate Fuzzy RD models of the effect of spousal retirement (instrumented with the spouses' being aged at least 60 and having attained the optimal contribution record) on own retirement. To allow for the fact that spouses are "treated" twice because of the own and the spousal treatment, we also estimate linear regression models of each spouse's retirement as a function of both spouses' being aged 60 and having attained the optimal contribution record. The results of estimation corroborate our conclusions of small cross-effects of own retirement on spousal retirement (Table 6). In particular, the estimates obtained are very similar to those obtained considering only the effect of the 1993 reform on both spouses' retirement (Table 3) or using the legal retirement age of 60 to instrument own and spousal retirement (Table 5). Each spouse's retirement probability increases by 0.01 to 0.03 (one to three percentage

[16] Not only spouses may change sector of employment over their life course, but also the sector of employment is chosen, and thus not exogenous. Therefore, we do not make any attempt to control here for the spouses' sector of employment.
[17] We use the term potential to emphasize that we do not use the actual social security contributions, which are not observed and also likely endogenous here.

points), when the other spouse is treated – but the jump in own retirement is about 0.30 to 0.40 upon own treatment.

7. Conclusions

Population ageing and increasing budgetary pressure have led most OECD countries to introduce policies to extend individual working lives. Over two-thirds of older individuals live as couples and it is therefore of great importance for policy purposes to understand the retirement strategies of married workers. Our work is novel in a number of respects. The employment rates of older married women in France are very high (above those of their American counterparts), which makes it possible to estimate the effects of a retirement-policy reform on both spouses. The earlier literature considers the employment decisions of dual-earners –thus ignoring other non-employment outcomes- and relates to North-American, British and North-European, countries, in which private-pension schemes and spousal pension benefits are widespread. Like other Central European or Mediterranean countries, around 80 per cent of French retirees receive only first pillar (public) pension benefits, which are individually designed and there are no spousal pension benefits in France. We pay special attention to the age difference between the husband and the wife which may not be exogenous to the timing of spouses' retirement decision.

We here exploit a pioneering 1993 retirement reform, providing incentives for workers to postpone retirement, to identify the direct and indirect effects of the reform on spouses' retirement and other non-employment outcomes. We also make use of the discontinuity in retirement at the legal retirement age to gain additional insights into spouses' joint retirement patterns. Last, we combine the two treatments and interact the social security law on maximum pension benefits (reformed in 1993) with the legal retirement age. We estimate both local polynomial models using triangular kernel estimators and linear regression models with linear polynomials in the forcing variable (and their interaction with the cut-off). These models are estimated with (rotating) panel data on over 50 000 French couples, and we control for individual unobserved heterogeneity (or cluster the standard errors at the couple's level).

We conclude that due to the 1993 policy reform, own probability of retirement fell immediately by about 2 percentage points for the husband and about 4 percentage points for the wife, but the reform also increased the husband's unemployment probability (by under one percentage point), and that of being a "housewife" for the wife (by about 3 percentage points). The indirect effects of the reform are small: own retirement probability drops by one or two percentage points at most when the spouse is impacted. This may reflect the only small effects of the reform on own retirement. We therefore also exploit the discontinuity in own retirement probability at age 60 (which is the legal retirement age for most workers in France) and apply a fuzzy regression discontinuity approach (which can also be seen as an instrumental-variable approach). We find that the husband's retirement probability increases by few percentage points upon the wife's retirement (instrumented with legal retirement age) and vice-versa for the wife. In contrast, the estimated jump in own retirement probability at age 60 is 32 to 35 percentage points for the husband and 25 to 27 percentage points for the wife. Combing the social security laws on eligibility to maximum pension benefits (changed by the 1993 reform) with the legal retirement age to instrument each spouse's retirement, we obtain similar estimates: spousal retirement increases own retirement by about 1 to 3 percentage points but the jump in own retirement at own treatment is equal to over 30 percentage points for both spouses.

Given the social security laws and legal retirement ages, spouses' joint retirement patterns appear to be essentially driven by the age difference between spouses. Because many OECD countries have increased legal retirement ages and many older people live as couples, this study is globally relevant. Many OECD countries provide spouses with the option to file income taxes jointly or separately but social security laws are not yet flexible enough to allow dual-earner (and possibly, dual-career) spouses to time their retirement "together", if they wished so.

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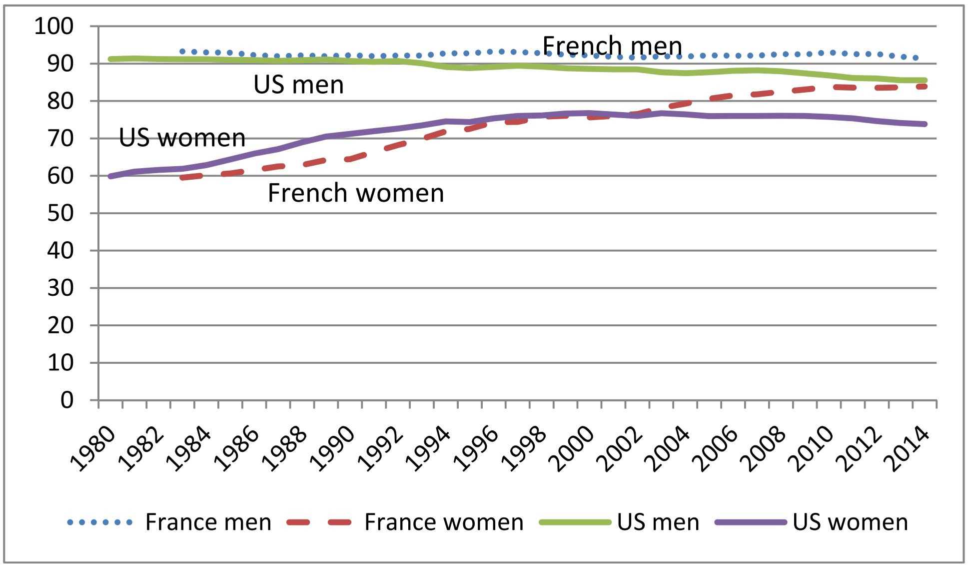
Figure 1. Labor-Force Participation Rates of Men and Women Aged 45 to 54.



Source: OECD Statistics Online.

Figure 2. McCrary Graphs of the discontinuity in the running variable at the cut-off.

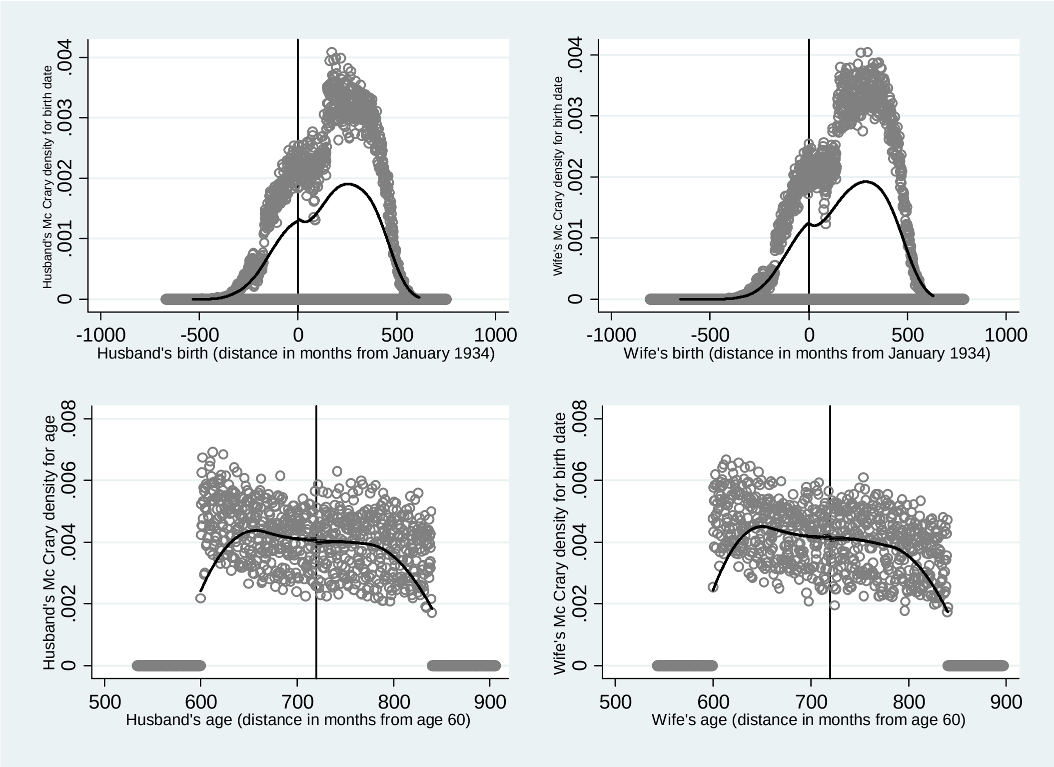
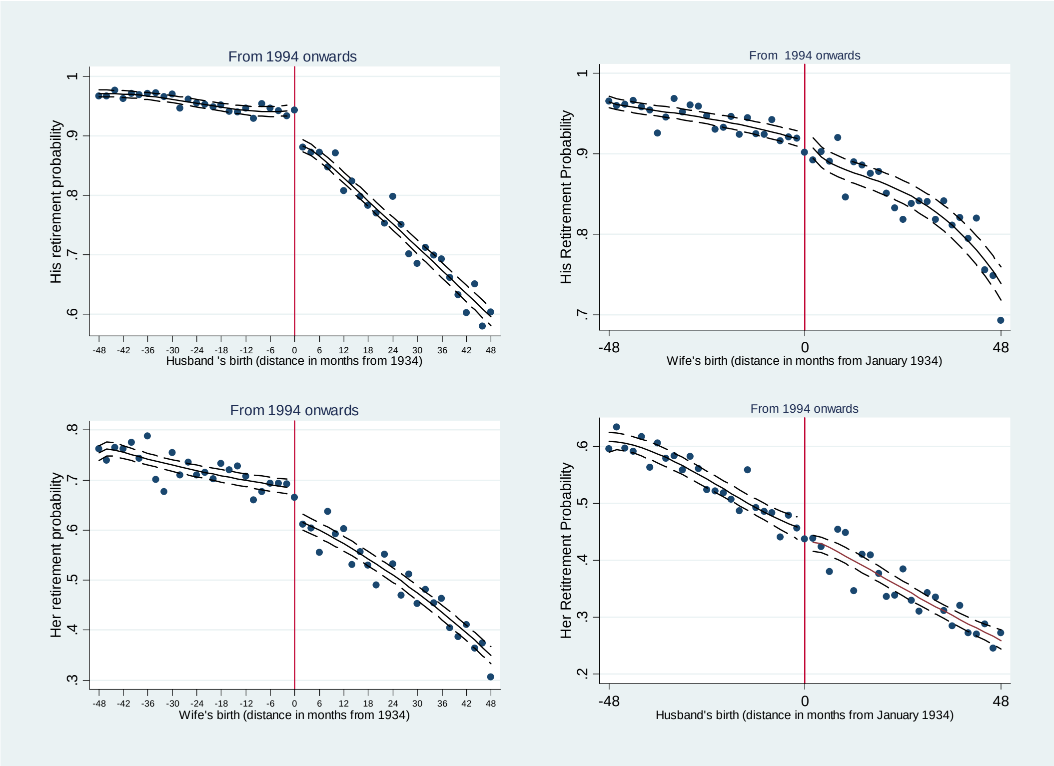
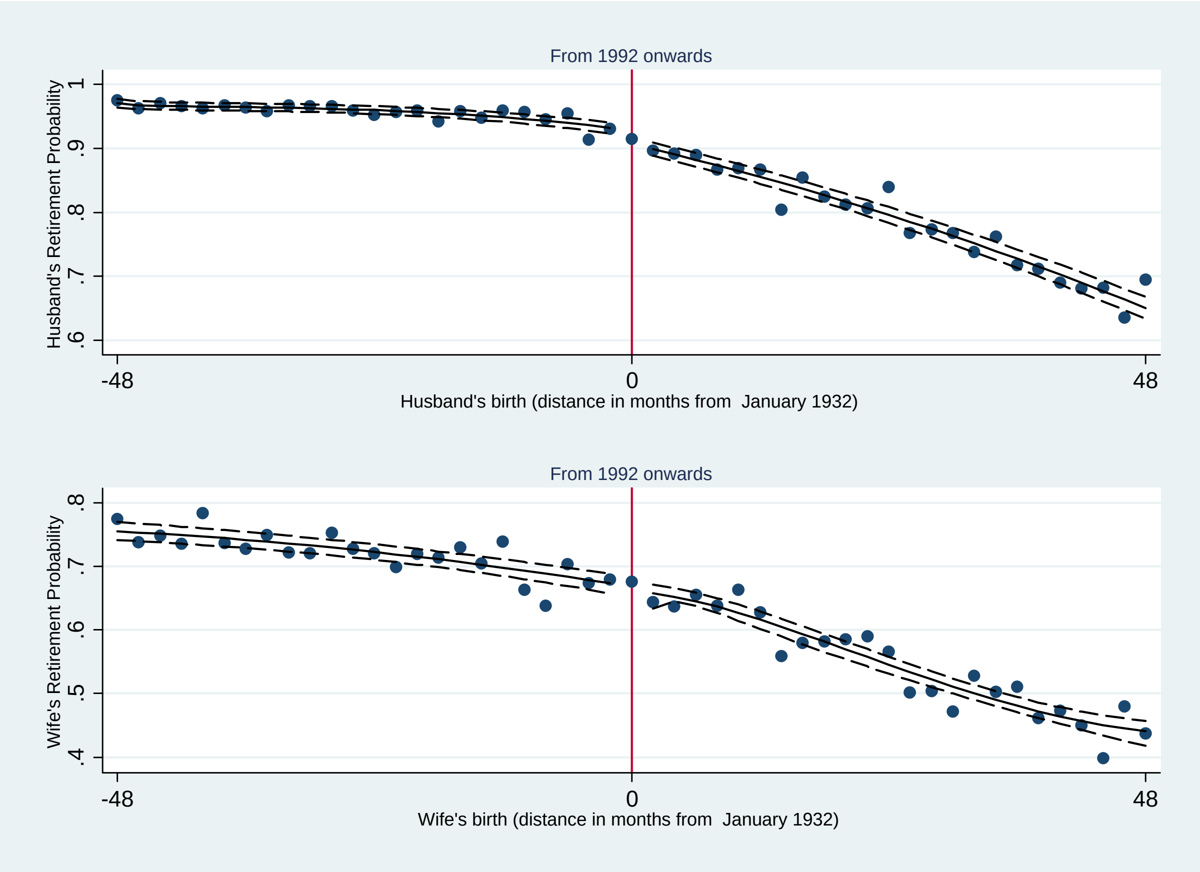


Figure 3. Husband's and Wife's Retirement Probability after the 1993 Reform



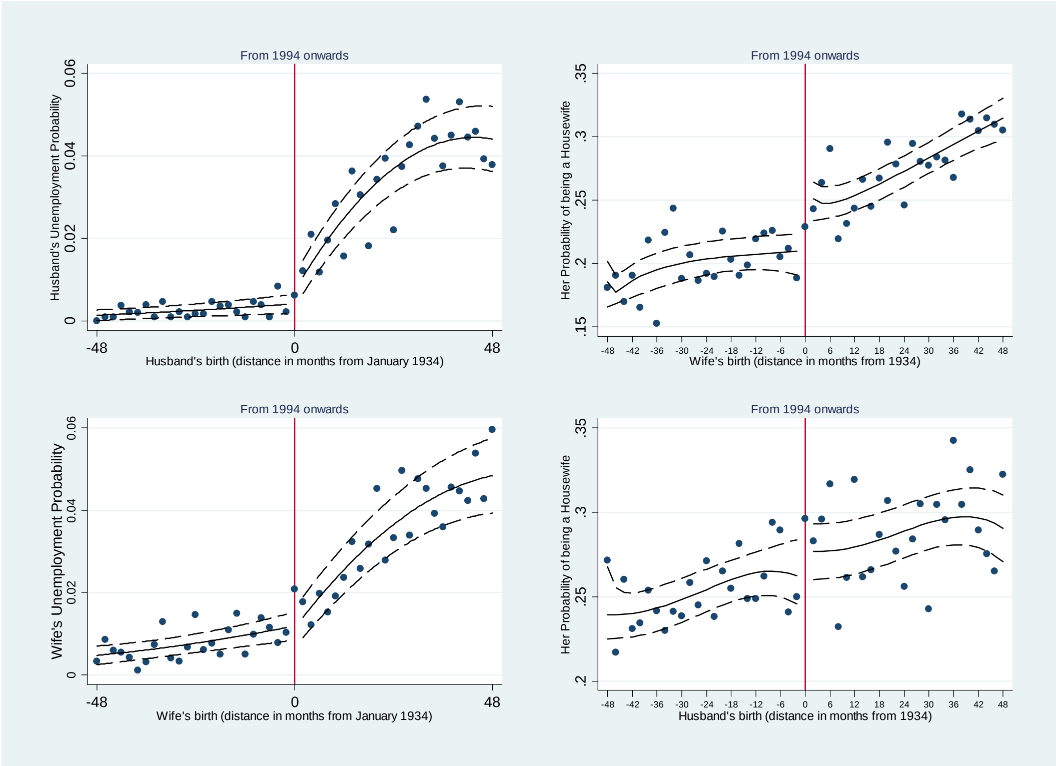
Note: The graphs show the retirement probability of the husband (top panel) and the wife (bottom panel) by own month of birth (left panel) and by spouse's month of birth (right panel), respectively, after the 1993 reform. The birth month of "zero" corresponds to January 1934: individuals born in 1934 and later were hit by the retirement reform in 1994. The observations are grouped by bins of two months. The dots are the raw means of the outcome variable (the retirement probability) which is plotted against the running variable (distance in months from being born in January 1934 or spousal distance in months from being born in January 1934, respectively). The solid line is non-parametrically fitted using a triangular kernel with a bandwidth of 48 months. The dotted lines are the 5 percent confidence bounds around the kernel estimates.

Figure 4. Placebo: Husband's and Wife's Retirement Probability after the "1992 fictitious reform"



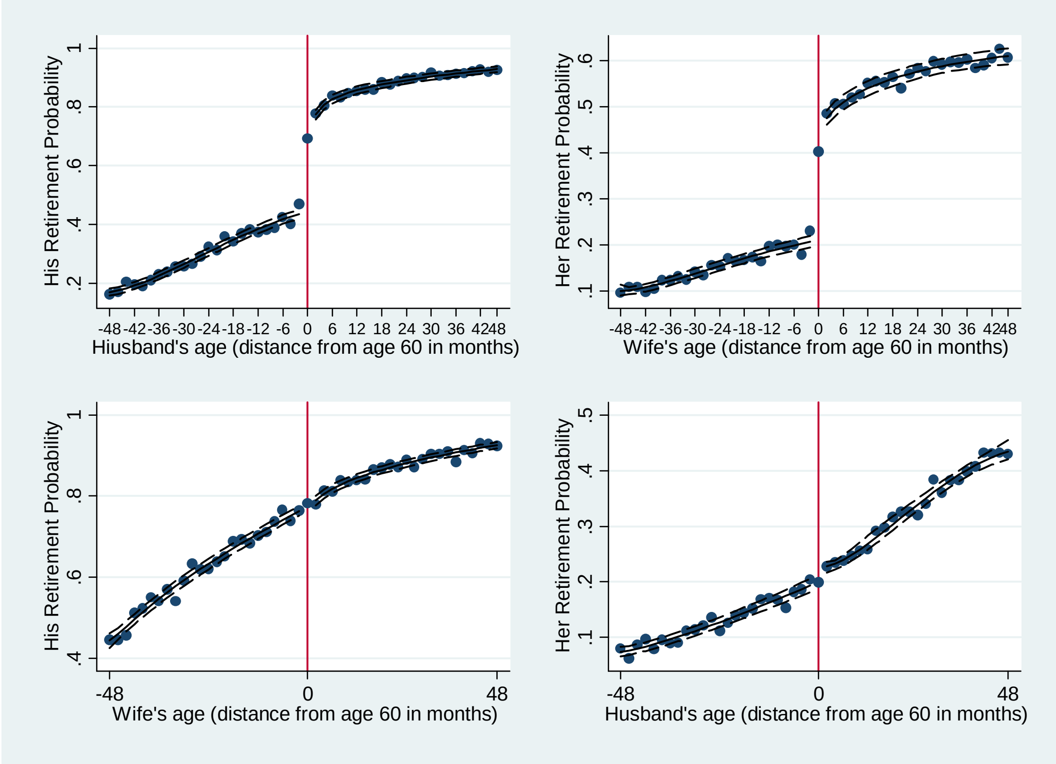
Note: The graphs show the retirement probability of the husband (top panel) and the wife (bottom panel) by own month of birth before and after 1992. There was no reform in 1992; these graphs are a counterfactual of the 1993 reform. The birth month of "zero" corresponds to January 1932. The observations are grouped by bins of two months. The dots are the raw means of the outcome variable (the retirement probability) which is plotted against the running variable (distance in months from being born in January 1932). The solid line is non-parametrically fitted using a triangular kernel with a bandwidth of 48 months. The dotted lines are the 5 percent confidence bounds around the kernel estimates.

Figure 5: Husband's and Wife's Other non-Employment Outcomes after the 1993 Reform.



Note: The graphs show the unemployment probability of, respectively, the husband (top left panel) and the wife (bottom left panel) by own month of birth as well as the probability that the wife is a housewife by own month of birth (top right panel) or by husband's month of birth (bottom right panel). The birth month of "zero" corresponds to January 1934: individuals born in 1934 and later were hit by the retirement reform in 1994. The observations are grouped by bins of two months. The dots are the raw means of the outcome variable (the probability of unemployment, or being a housewife, respectively) which is plotted against the running variable (distance in months from being born in January 1934, or spousal distance in months from being born in January 1934, respectively). The solid line is non-parametrically fitted using a triangular kernel with a bandwidth of 48 months. The dotted lines are the 5 percent confidence bounds around the kernel estimates.

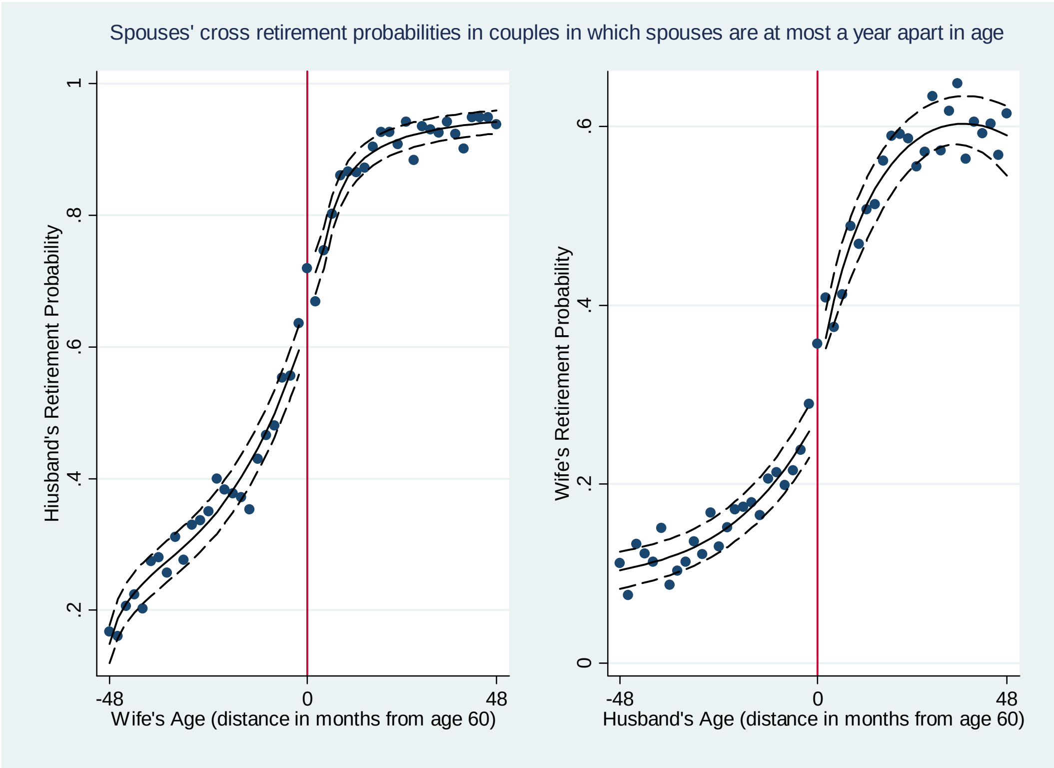
Figure 6. Husband's and Wife's **Own** and **Cross** Retirement Probability at age 60



Note: The graphs show the retirement probability of the husband (top panel) and the wife (bottom panel) by own and spouse's age. The age of "zero" corresponds to being aged 60, which is the legal retirement age for most workers in France (see the discussion in the text). The observations are grouped by bins of two months. The dots are the raw means of the outcome variable (the retirement probability) which is plotted against the running variable (distance in months from being aged 60 when interviewed). Retirement status is measured at the interview date. The solid line is non-parametrically fitted using a triangular kernel with a bandwidth of 48 months. The dotted lines are the 5 percent confidence bounds around the kernel estimates.

Figure 7. Husband's and Wife's **Cross** Retirement Probability at the age 60:

couples in which the age difference between spouses is at most one year.



Note: The graphs show the retirement probability of the husband (left graph) and the wife (right graph) by the spouse's age. The age of "zero" corresponds to being aged 60, which is the legal retirement age for most workers in France (see the discussion in the text). The observations are grouped by bins of two months. The dots are the raw means of the outcome variable (own retirement probability) which is plotted against the running variable (spouses' distance in months from being aged 60 when interviewed). Retirement status is measured at the interview date. The solid line is non-parametrically fitted using a triangular kernel with a bandwidth of 48 months. The dotted lines are the 5 percent confidence bounds around the kernel estimates.

Table 1. Estimation results of the direct effect of the 1993 reform for the spouses (own effects)

Outcome:	**M Retired**	**F Retired**	**M Unemp.**	**F Unemp.**	**F Housewife**
Mean if born in 1933	*0.86*	*0.53*	*0.011*	*0.022*	*0.26*
(st dev. from the mean)	*(0.35)*	*(0.50)*	*(0.10)*	*(0.15)*	*(0.44)*
***Local Polynomial** model* bandwidth ***48 months,** robust standard errors clustered at the couple level*					
Dummy for born ≥ 1934	**-0.0197****	**-0.039****	**0.0066****	**0.003**	**0.027****
(standard error)	(0.007)	(0.013)	(0.002)	(0.003)	(0.011)
Observation number	*51350*	*48284*	*51350*	*48284*	*48284*
***Local Polynomial** model* bandwidth ***24 months**, standard errors clustered at the couple level*					
Dummy for born ≥ 1934	**-0.0169****	**-0.036****	**0.0049***	**0.003**	**0.035****
	(0.009)	(0.0188)	(0.003)	(0.004)	0.016)
***Local Polynomial** model* bandwidth ***96 months**, standard errors clustered at the couple level*					
Dummy for born ≥ 1934	**-0.0145****	**-0.0436****	**0.0092****	**0.006****	**0.029****
	(0.005)	(0.009)	(0.0019)	(0.002)	(0.008)
Linear regression,** linear birth polynomial & interaction with D, standard errors clustered,* bandwidth ***48 m.					
Dummy for born ≥ 1934	**-0.020****	**-0.0329****	**0.0096****	**0.005**	**0.0217****
	(0.007)	(0.012)	(0.0023)	(0.003)	(0.010)
R square	*0.117*	*0.065*	*0.130*	*0.011*	*0.009*
Observation number	*51350*	*48284*	*51350*	*48284*	*48284*
Linear regression,** linear birth polynomial & interaction with D,* ***couple random effects, bandwidth ***48 m.***					
Dummy for born ≥ 1934	**-0.0449****	**-0.049****	**0.0123****	**0.007****	**0.029****
	(0.007)	(0.0117)	(0.0025)	(0.003)	(0.010)
Overall R-squared	*0.116*	*0.065*	*0.016*	*0.011*	*0.012*
Number of observations	*51350*	*48284*	*51350*	*48284*	*48284*
Number of panel observations	*22907*	*21452*	*22907*	*21452*	*21452*

The local linear polynomials are estimated using a non-parametric triangular kernel. The standard errors are adjusted and clustered at the couple level. The linear regression model includes linear polynomials in the distance from birth in 1934 and interaction of the dummy for being born in 1934 and later years with this polynomial. The standard errors in parentheses are robust and are also clustered at the couple level. In the table, ** indicates statistical significance at the 5% level and * at the 10% level.

Table 2. Estimation results of the indirect effect of the 1993 reform for the spouses (cross-effects)

	M Retired	**F Retired**	**M Unemp.**	**F Unemp.**	**F Housewife**
Mean if born 1933	*0.86*	*0.53*	*0.011*	*0.022*	*0.26*
Mean if spouse born 1933	*0.82*	*0.21*	*0.016*	*0.06*	*0.30*
Local Polynomial** model* bandwidth ***48 months, *robust standard errors clustered at the couple level*					
D. Spouse born ≥ 1934	**-0.0010**	**-0.0048**	**0.003**	**0.011****	**0.014**
standard error	(0.008)	(0.014)	(0.002)	(0.005)	(0.013)
Observation number	*48284*	*51350*	*48284*	*51350*	*51350*
Local Polynomial** model* bandwidth ***24 months*, robust standard errors clustered at the couple level*					
D. Spouse born ≥ 1934	**-0.014**	**-0.007**	**0.006***	**0.014****	**0.029***
	(0.011)	(0.0198)	(0.003)	(0.008)	(0.018)
Local Polynomial** model* bandwidth ***96 months*, robust standard errors clustered at the couple level*					
D. Spouse born ≥ 1934	**0.009**	**-0.0118**	**-0.0008**	**0.007****	**0.009**
	(0.006)	(0.0098)	(0.002)	(0.004)	(0.009)
Linear regression, *linear birth polynomial & interaction with D, robust st. err. clustered,* bandwidth ***48 m.***					
D. Spouse born ≥ 1934	**-0.004**	**-0.008**	**0.0009**	**0.009***	**0.012**
	(0.007)	(0.012)	(0.002)	(0.005)	(0.011)
R square	*0.036*	*0.047*	*0.11*	*0.004*	*0.002*
Observation number	*48284*	*51350*	*48284*	*51350*	*51350*
Linear regression, *linear birth polynomial & interac. with D, robust st. err.,* ***couple random effects,*** bandwidth ***48 m.***					
D. Spouse born ≥ 1934	**-0.008**	**-0.015**	**0.001**	**0.010****	**0.018***
	(0.007)	(0.012)	(0.002)	(0.005)	(0.011)
Overall R-squared	*0.036*	*0.047*	*0.003*	*0.004*	*0.002*
Number of observations	*48284*	*51350*	*48284*	*51350*	*51350*
Number of panel observations	*21452*	*22907*	*21452*	*22907*	*22907*

Note: The local linear polynomials are estimated using a non-parametric triangular kernel. The standard errors are adjusted and clustered at the couple level. The linear regression model includes linear polynomials in the distance from birth in 1934 and interaction of the dummy for being born in 1934 and later years with this polynomial. The standard errors are robust and are also clustered at the couple's level. Standard errors appear in arentheses. In the table, ** indicates statistical significance at the 5% level and * indicates statistical significance at the 10% level.

Table3. Estimation results of the direct and indirect effect of the 1993 reform for the spouses.

	M Retired	**F Retired**	**M Unemp.**	**F Unemp.**	**F Housewife**
Mean if born 1933	*0.86*	*0.53*	*0.011*	*0.022*	*0.26*
Mean if spouse born 1933	*0.82*	*0.21*	*0.016*	*0.06*	*0.30*
Linear regression, *linear birth polynomial & interaction with D, robust st. err. clustered,* bandwidth ***48 m. for both spouses' birthday***					
Dummy Husband Born ≥ 1934	**-0.018****	**0.003**	**0.007****	**0.004**	**-0.001**
standard error	(0.009)	(0.016)	(0.003)	(0.005)	(0.014)
Dummy Wife Born ≥ 1934	**-0.012**	**-0.025***	**-0.0002**	**0.002**	**0.017**
standard error	(0.008)	(0.015)	(0.003)	(0.004)	(0.013)
R square	*0.10*	*0.07*	*0.015*	*0.010*	*0.012*
Observation number	*28463*	*28463*	*28463*	*28463*	*28463*
Linear regression, *linear birth polynomial & interac. with D, robust st. err.,* ***couple random effects,*** bandwidth ***48 m. for both spouses***					
Dummy Husband born ≥ 1934	**-0.04****	**0.004**	**0.009****	**0.005**	**0.004**
standard error	(0.009)	(0.015)	(0.003)	(0.005)	(0.014)
Dummy Wife born ≥ 1934	**-0.014***	**-0.039***	**0.0001**	**0.005**	**0.023***
standard error	(0.009)	(0.015)	(0.003)	(0.005)	(0.013)
R square	*0.10*	*0.07*	*0.015*	*0.01*	*0.012*
Observation number	*28463*	*28463*	*28463*	*28463*	*28463*

Note: The linear regression model includes linear polynomials in the distance from birth in 1934 for each spouse and interaction of the dummy for being born in 1934 and later years with this polynomial for each spouse. The standard errors are robust and are also clustered at the couple's level. Standard errors appear in parentheses. In the table, ** indicates statistical significance at the 5% level and * indicates statistical significance at the 10% level.

Table 4. Estimation results of the indirect effect of spouse's retirement on own retirement (2SLS)

	All couples		**Couples at most a year apart in age**		**M more than a year younger**	**F more than a year younger**
	M Retired	**F Retired**	**M Retired**	**F Retired**	**M Retired**	**F Retired**
Mean outcome if M age 59	*0.41*	*0.18*	*0.42*	*0.23*	*0.45*	0.07
Mean outcome if F age 59	*0.74*	*0.20*	*0.52*	*0.20*	*0.19*	0.21
***Local Polynomial** model bandwidth **48 months,** robust standard errors clustered at the couple level*						
Spouse Retired	**0.051****	**0 .016**	**0.77****	**0.42****	**-0.08**	**-0.080****
	(0.023)	(0.018)	(0.079)	*(0.04)*	(0.06)	(0.015)
Denominator						
D. Spouse aged ≥60	*0.25***	*0.32***	*0.23***	0.33**	*0.25***	0.32**
	(0.007)	*(0.007)*	*(0.016)*	*(0.016)*	*(0.018)*	*(0.008)*
2SLS,** linear polynomial in age & interaction with the treatment dummy, standard. errors clustered,* bandwidth ***48 months						
Spouse Retired	**0.051****	**0.035****	0.87**	**0.54****	**-0.04**	**-0.082****
	(0.022)	(0.016)	(0.07)	(0.045)	(0.06)	(0.014)
First stage						
D. Spouse aged ≥60	0.27**	0.34**	0.26**	0.35**	0.26**	0.34**
	(0.006)	(0.006)	(0.01)	(0.015)	(0.02)	(0.008)
2SLS,** linear polynomial in age & interaction with the treatment dummy, **couple random effects, bandwidth ***48 months***						
Spouse Retired	**0.06****	**0.023****	**0.84****	**0.46****	**-0.04**	**-0.078****
	(0.013)	(0.011)	(0.04)	(0.03)	(0.03)	(0.012)
First stage						
D. Spouse aged ≥60	0.27**	0.34**	0.26**	0.342**	0.27**	0.34**
	(0.004)	(0.004)	(0.015)	(0.009)	(0.01)	(0.005)
2SLS,** linear polynomial in age & interaction. with the treatment dummy, **couple fixed effects, bandwidth ***48 months***						
Spouse Retired	**0.06****	**0.024****	**0.82****	**0.43****	**-0.05**	**-0.072****
	(0.014)	(0.012)	(0.05)	(0.03)	(0.04)	(0.013)
First stage						
D. Spouse aged ≥60	0.27**	0.34**	0.25**	0.34**	0.27**	0.34**
	(0.005)	*(0.004)*	(0.01)	(0.001)	(0.01)	(0.005)
Number of observations	*71612*	*74942*	*13721*	*13741*	*11014*	*50277*
Number of panel observations	*35484*	*37542*	*6807*	*6832*	*5572*	*25332*

Note to Table 4. The local linear polynomials are estimated using a non-parametric triangular kernel. The standard errors are adjusted and clustered at the couple's level. The Two Stages Least Square (2SLS) model include linear polynomials in the age (distance in months from age 60 at the date of the interview) and a linear interaction of the dummy for being aged 60 and above with this polynomial in the both the outcome and the first stage equations. The standard errors are robust and are also clustered at the couple level. Standard errors are given in brackets. In the table, ** indicates statistical significance at the 5% level and * indicates statistical significance at the 10% level. Here the bandwidth is set with respect to the spouse whose retirement is been instrumented with s/he being aged 60 and above. That is why the number of observations varies in each column.

Table 5. Estimation results of the direct and indirect effect of spouse's retirement on own retirement (linear regression models)

	All couples		Couples at most a year apart in age		M more than a year younger	F more than a year younger
	M Retired	**F Retired**	**M Retired**	**F Retired**	**M Retired**	**F Retired**
Mean outcome if M age 59	*0.41*	*0.18*	*0.42*	*0.23*	*0.45*	0.07
Mean outcome if F age 59	*0.74*	*0.20*	*0.52*	*0.20*	*0.19*	0.21
Linear regression*, linear polynomial in age & interaction with the treatment dummy standard errors clustered,* bandwidth ***48 m****.*						
Husband aged ≥60	**0.34****	0.010	**0.32****	0.058**	**0.30****	0.009
	(0.009)	(0.008)	**(0.018)**	(0.017)	**(0.016)**	(0.009)
Wife aged ≥60	**0.003**	0.26**	**0.046****	0.23**	**0.020**	0.25**
	(0.007)	(0.009)	**(0.016)**	(0.018)	**(0.016)**	(0.014)
Linear regression, *linear polynomial in age & interaction with the treatment dummy,* ***couple random effects,*** bandwidth ***48 m.***						
Husband aged ≥60	**0.34****	0.005	**0.32****	0.032**	**0.30****	0.009
	(0.005)	(0.006)	**(0.012)**	(0.013)	**(0.017)**	(0.009)
Wife aged ≥60	**0.009**	0.26**	**0.042****	0.24**	**0.020**	0.25**
	(0.005)	(0.006)	**(0.012)**	(0.013)	**(0.017)**	(0.009)
Linear regression, *linear polynomial in age & interaction with the treatment dummy,* ***couple fixed effects,*** bandwidth ***48 m.***						
Husband aged ≥60	**0.34****	0.03	**032****	0.019	**0.31****	0.010
	(0.006)	(0.007)	**(0.13)**	(0.013)	**(0.019)**	(0.010)
Wife aged ≥60	**0.01***	0.27**	**0.039****	0.24**	**0.027**	0.25**
	(0.006)	*(0.007)*	**(0.013)**	(0.013)	**(0.018)**	(0.011)
Number of observations	*40223*	*40223*	*12835*	*12835*	*6211*	*21177*
Number of panel observations	*21595*	*21595*	*6440*	*6440*	*3222*	*11839*

Note: The model includes linear polynomials in the age (distance in months from age 60 at the date of the interview) for each spouse and a linear interaction of the dummy for being aged 60 and above with this polynomial for each spouse. The standard errors are adjusted and clustered at the couple level. Standard errors are given in brackets. In the table, ** indicates statistical significance at the 5% level and * indicates statistical significance at the 10% level. Here the bandwidth is set with respect to both spouses' being aged 60 or above.

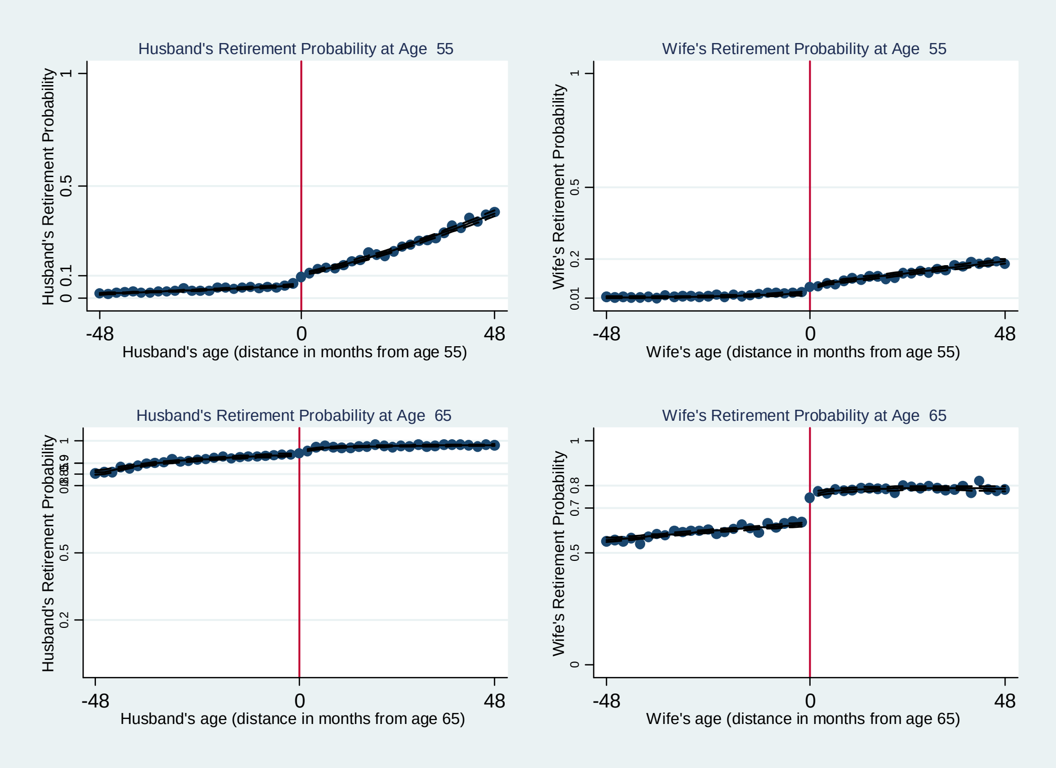
Table 6. Combining the legal retirement age and the social security rules for "maximum" benefits

	M Retired	**F Retired**
Mean outcome if M age 59	*0.41*	*0.18*
Mean outcome if F age 59	*0.74*	*0.20*
Linear regression, linear polynomial & interaction with treatment, standard. errors clustered, bandwidth 48 months from age 60 both spouses		
Husband aged ≥60 & potential contribution ≥ "optimal" level	0.49**	**0.019****
	(0.007)	**(0.007)**
Wife aged ≥60 & potential contribution ≥ "optimal" level	**0.018****	0.31**
	(0.007)	(0.008)
Linear regression ,linear polynomial & interaction. with treatment, ***couple random effects,*** *bandwidth 48 months from age 60 both spouses*		
Husband aged ≥60 & potential contribution ≥ "optimal" level	0.44**	**0.015****
	(0.005)	**(0.005)**
Wife aged ≥60 & potential contribution ≥ "optimal" level	**0.025****	0.30**
	(0.005)	(0.006)
Linear regression ,linear polynomial & interaction. with treatment, ***couple fixed effects,*** *bandwidth 48 months from age 60 both spouses*		
Husband aged ≥60 & potential contribution ≥ "optimal" level	0.37**	**0.030****
	(0.006)	**(0.007)**
Wife aged ≥60 & potential contribution ≥ "optimal" level	**0.028****	0.29**
	(0.006)	(0.007)
Number of observations	*38266*	*38266*
Number of panel observations	*21232*	*21232*
Fuzzy RD (2SLS) Linear regressions, linear polynomial & interaction. with treatment, ***couple fixed effects,*** *bandwidth 48 months from age 60*		
Spouse's Retired	**0.15****	**0.12****
First stage	**(0.014)**	**(0.011)**
Spouse's aged ≥60 & potential contribution ≥ "optimal" level	0.30**	0.38**
	(0.005)	*(0.005)*
Number of observations	*69238*	*72481*
Number of panel observations	*35142*	*37177*

Note to Table 6: The models include linear polynomials in the age (distance in months from age 60 at the date of the interview) interacted with the distance in months from the optimal social security contribution record and a linear interaction of this polynomial with the treatment dummy (which is equal to the interaction of the dummy for being aged 60 and above with the dummy for having contributed at least enough social security contributions to be able to retire with 'maximum' pension benefits. Standard errors are given in brackets. In the table, ** indicates statistical significance at the 5% level and * indicates statistical significance at the 10% level. For the Fuzzy RD (which is equivalent to 2SLS) the bandwidth is set with respect to the age of the spouse whose retirement is been instrumented while in the other models the bandwidth is set with respect to both spouses' age.

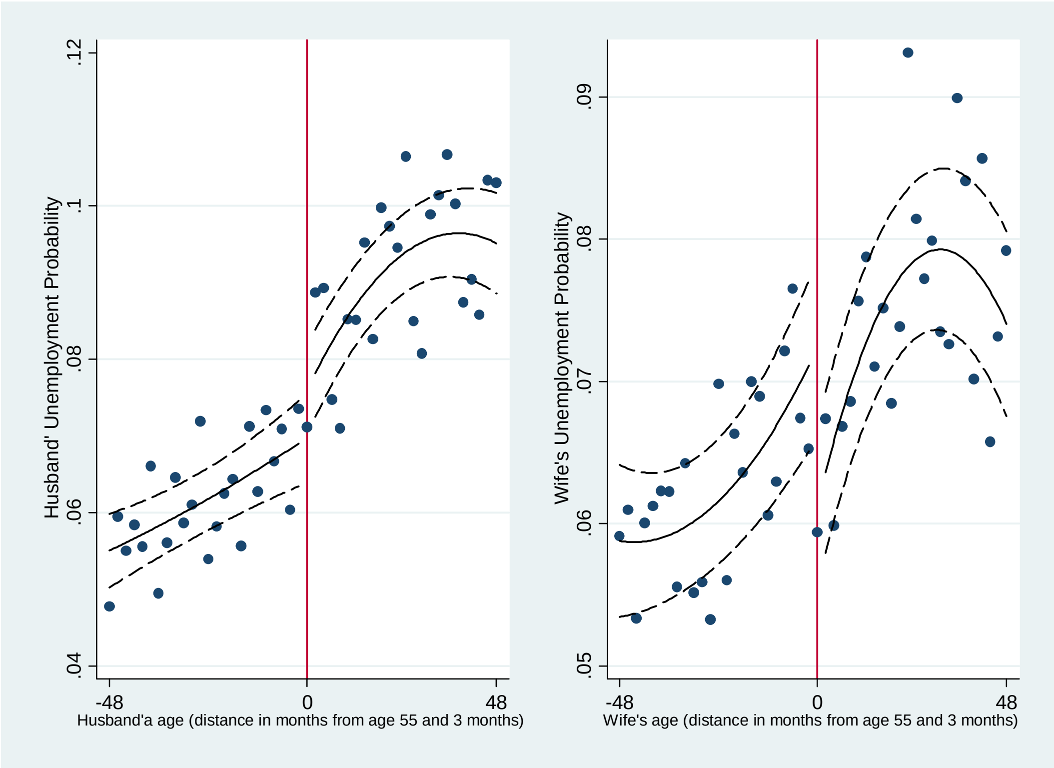
Appendix

Figure A. Husband's and Wife's **Own** Retirement Probability at other legal (early-)retirement ages



Note: The graphs show the retirement probability of the husband (left panel) and the wife (right panel) by own age. The age of "zero" corresponds, respectively, to the early retirement age of 55 (top panel) and to the legal retirement age of 65 (bottom panel). While 60 is the legal retirement age for most workers in France, 55 is the typical age at which special early-retirement programs may apply and 65 is the legal retirement age by which most workers are obliged to retire if they have not yet done so. The observations are grouped by bins of two months. The dots are the raw means of the outcome variable (the retirement probability) which is plotted against the running variable (distance in months from being aged, respectively, 55 or 65, when interviewed). Retirement status is also measured at the interview date. The solid line is non-parametrically fitted using a triangular kernel with a bandwidth of 48 months. The dotted lines are the 5 percent confidence bounds around the kernel estimates. Very few spouses retire at the early retirement age of 55: there is no discontinuity in retirement probabilities at age 55 for either husband or wife. By age 65, most husbands have already retired: there is no jump into retirement at age 65 for the husband. In contrast, although the average wife will have retired at age 60, we also observe a noticeable jump into retirement at age 65, at least for some of the wives.

Figure B. Husband's and Wife's Unemployment Probability at age 55 and 3 months



Note: The graphs show the unemployment probability of the husband (left graph) and the wife (right graph) by own age. The age of "zero" corresponds to the age of 55 and 3 months, at which individuals who are unemployed are dispensed from actively searching from work and their unemployment benefits are no longer regressive, so that they can make a smooth transition into retirement if needed. The observations are grouped by bins of two months. The dots are the raw means of the outcome variable (the unemployment probability) which is plotted against the running variable (distance in months from being aged 55 and 3 months when interviewed). The unemployment status is also measured at the interview date. The solid line is non-parametrically fitted using a triangular kernel with a bandwidth of 48 months. The dotted lines are the 5 percent confidence bounds around the kernel estimates.

Table A. Descriptives statistics of the sample of couples with both spouses aged 50 to 70.

Available from the author

Table B. Reasons to retire (multiple answers are possible): %

	Very Important	Important	Minor reason	Not at all relevant
Retirement Rights reasons				
You can still continue to work or take up a new job	11	11	9	69
You turned 60 years of age	37	14	5	44
You reached the age at which you could retire with the highest possible retirement pension.	49	22	5	24
Job related reasons				
You were dismissed or forced to retire	9	3	2	86
Your employer or colleagues were pushing you to retire one way or other	12	8	6	73
You were unhappy with the job conditions	12	9	7	72
You had health problems that hindered your work capacities	15	8	6	71
You had had enough of your job	23	17	10	50
Personal and Family reasons				
You had family obligations	7	7	4	81
Your spouse was also retiring or had already retired	12	6	3	78
You had other personal projects	7	12	8	72
You wanted to take advantage of being retired as long as possible	47	21	7	26

Note: Each row sums up to 100%. The sample is a representative sample of French retirees who entered retirement from employment. The respondent could indicate multiple reasons.

Source: Enquête Motivations de départ à la retraite 2010, CNAV-COR-DARES-DGT-DREES-DSS.