

# The Effects of a Retirement Age Reform on Couples' Labor Supply Decisions \*

Edith Sand, Bank of Israel

Shirlee Lichtman-Sadot, Ben-Gurion University of the Negev

May 2019

## Abstract

This paper estimates the effects of a reform that deferred the retirement age in Israel on spouses' labor supply. We utilize a detailed administrative dataset to study the implications of the reform, which raised both men's and women's ages of retirement benefits concurrently, in order to estimate spouses' retirement decisions and to understand their interdependencies. We find that own retirement age deferral increases own labor supply for both genders. However, spillover effects of one spouse's retirement age deferral on the other spouse's retirement behavior differ by gender. For men, labor supply does not depend on their wife's retirement age deferral. For women, however, postponing their husband's retirement age increases their labor supply if their own retirement age is not increased, but does not further increase their labor supply if own retirement age is already postponed.

---

\* We thank Israel's Central Bureau of Statistics for allowing restricted access to individuals' data in the CBS research lab.

## 1. Introduction

Pension reform has been prioritized on the agenda of many governments for more than a decade. Due to population aging and declining fertility rates, the main actuarial challenge that countries face is how to ensure that pension systems are financially sustainable, and at the same time provide adequate income upon retirement for their citizens. In order to reach this goal, many countries have launched significant pension reforms, including raising retirement ages, changing the way entitlements are calculated, and other measures to introduce sufficient savings in their pension systems.

To understand the labor force consequences of such policy changes, a considerable number of studies have tried to detect and causally identify the effects of changes in different pension system traits on labor supply and retirement decisions. Various changes in pension systems were explored, for example, changes in social security benefits, increases in the threshold as well as the subsequent gradual abolishment of earnings tests, changes in disability pension, increases in the age at which early retirement (ERA) and full retirement (FRA) first become available, and changes in the provision of occupational pension programs (see Hernæs 2013 for a literature review).

Most of these research studies on pension reform's implications are individually designed.<sup>1</sup> However, since the majority of households are not a collection of single people, and in most households both spouses participate in the labor market, retirement decisions are likely to be coordinated among spouses.<sup>2</sup> Indeed, earlier papers have found that couples tend to coordinate their retirement decisions (Hurd 1990, Blau 1998, Zweimüller, et al. 1996, Gustman & Steinmeier 2000, and Coile, 2004). However, these patterns of retirement's timing coordination among spouses can result from spouses' age differences, gender differences in life expectancy and other confounding effects, without capturing whether one spouse's retirement decision causally affects the other spouse's decision. Research considering spillover effects of one spouse's changes in pension system attributes to the other spouse's retirement decision is

---

<sup>1</sup> Most research (Mastrobuoni 2009; Staubli and Zweimüller 2013; Hanel and Riphahn 2012; Atalay and Barrett 2015; Danzer 2013; Vestad 2013; in Israel, see Bank of Israel Reports 2010 and 2014 and Avioz and Kimhi 2018) focused on the effects of reforms on the individuals directly targeted by the program changes, neglecting potential spillover effects on spouses of those affected.

<sup>2</sup> For example, the labor force participation rates of men and women aged 60–64 in the U.S. in 2016 were 62 percent and 50.1 percent, respectively (Employment Projections program, U.S. Bureau of Labor Statistics, 2018). The respective LFP for OECD countries on average were 71.4 and 55.3 percent, respectively, for men and women aged 55–64 (OECD.Stat 2019).

somewhat limited, and there are even fewer papers that analyze the effects of changes in pension system attributes affecting both genders on couples' joint retirement decisions.

This paper studies the implications of a pension reform that raised both men's and women's ages for retirement benefits concurrently in Israel as of 2004, as a natural experiment in order to understand the interdependencies in spouses' causal retirement decisions. In December 2003, the Israeli government approved a reform to defer the age of retirement benefits. The reform was to be gradually implemented beginning in March 2004 and through mid-2009 for both men and women. For men, the retirement age was increased from 65 to 67, while for women the increase was from 60 to 62. Every few months, the age of retirement was raised for men and women by four months. The main implications of raising the retirement age were reflected in the deferral of the age of eligibility for employment-related pensions (second pillar), as well as the old age allowance that is dependent on a means test (first pillar).

Our research design exploits the effect of raising both men's and women's age for retirement benefits in a double regression discontinuity design model, enabling us to define treatment and control groups according to each spouse's dates of birth. Importantly, we allow the reform to affect each spouse directly, indirectly, and we also allow an interaction effect, indicating that both spouses experienced the reform. We conduct this analysis for men and women separately. That is, we test how the husband's (wife's) probability of working is affected by raising his (her) own retirement age and how it is affected by raising their spouse's retirement age which might, in turn, also depend on his (her) own retirement age deferral.

The results in almost all the regressions indicate that the estimated effect of one's own increase in retirement age has the largest positive effect on individual labor supply. For men, the estimated effect is slightly greater than for women and does not depend on the change in their wife's retirement age. In contrast, for women, we find that the effect of raising their own retirement age increases their labor supply, raising their husbands' retirement age also increases

their labor supply if their own retirement age is not increased, but does not further increase their labor supply if their retirement age is also postponed.

As theoretical models suggest, both income and leisure complementarity considerations might explain these results.<sup>3</sup> Husbands' retirement age deferral effects on their wives' employment might be driven by the leisure complementarity channel, because raising their husbands' retirement age decreases their joint leisure time which might, in turn, increase their willingness to continue working. However, it might be also driven by income effect considerations, as raising their husbands' retirement age, which increases households' income, might decrease their probability of working. Since a husband's retirement age deferral increases his wife's probability of working (i.e., husbands' spillover effects are positive), the income channel might be weaker. However, this effect depends on the retirement age deferral status of their wives. If a wife's retirement age is postponed, deferring her husband's retirement age as well will not further increase her labor supply.

We show that when the interaction between both spouses' retirement age deferrals' effects is not taken into account, one would expect the effect sizes of each separate spouse retirement age deferrals on women's employment rate to be lower by almost half, and the joint effect size of both spouses' retirement age deferrals to be similar. Understanding the interdependencies of spouses' retirement age deferrals is therefore necessary for designing better retirement age reform policies and correctly evaluating the consequences of postponing spouses' retirement ages.

Our double regression discontinuity strategy relies on comparing employment rates of couples with the same age structure, before and after the reform was implemented. In order to validate our main identification strategy and show that our results are not derived by years of birth differences in control versus treatment groups, we conduct several robustness checks. First, we show that the characteristics of couples with the same age structure in the control and treatment groups are similar by running a series of balancing tests. Second, adding couples' year of birth interaction fixed effects to the baseline specification reveals that our results are not sensitive to

---

<sup>3</sup> Most theoretical models characterize spouse's retirement decisions in a family decision making framework that incorporates both the fact that one spouse's valuation of leisure time depends on the other spouse's retirement, and the fact that the budget constraint is determined at the household level (see for example, Hurd, 1990 and Blau, 1998). Alternative ways of modeling interactions of spouses are bargaining models which can be either cooperative (see Vermeulen, 2002, and Michaud and Vermeulen, 2011) or noncooperative (see Gustman and Steinmeier 2000, 2004), where spouses' retirement decisions are interdependent not only due to complementarity and wealth effects but also because of changes in the relative bargaining power between spouses.

that inclusion, since it changes our estimated effects only marginally. Third, part of our sample consists of individuals with unknown month of birth, for whom retirement benefits were given as if they were born at the middle of their year of birth. This feature enables us to examine whether the effect of retirement age deferral is different among individuals with and without an exact month of birth. Indeed, we find that the effect of retirement age deferral does not depend on an individual's exact date of birth. Finally, we are able to compare our double regression discontinuity strategy's results to that of a double difference-in-difference empirical strategy. Using another empirical strategy enables us to validate our baseline results and show that our results do not depend on the estimation strategy employed. In addition, it enables us to perform a placebo analysis and reject the option that our results could be replicated under a similar setting regardless of the reform's implementation.

Our research expands upon prior literature on couples and retirement and specifically assesses how couples react to increases in each other's retirement ages. Our research is most closely related to several recent papers, which study spillover effects of pension reforms among spouses, while carefully addressing the causal effect of the reforms. Baker (2002) studies the introduction in 1975 of Spouse's Allowance to the Canadian Income Security system on the retirement behavior of couples. He used an empirical strategy that compared changes in retirement behavior of males and females who became eligible for the Spouse's Allowance to that of their counterparts of the same age, who due to the age of their spouse did not qualify for an allowance, and finds significant spillover effects for men. Cribb, et al. (2013) examine an increase in women's ERA in the UK and find, using a difference-in-differences approach, significant positive spillover effects on their husband's labor supply. Using a similar methodology, Selin (2012) uses a recent Swedish pension reform to study the effect of a wife's retirement incentive on the husband's retirement behavior, but finds no spillover effect, while Atalay and Barrett (2017) who analyze an increase in the eligibility age for pension benefits for women in Australia, find an increase in participation of men married to women in the affected cohorts.

As most reforms raised women's retirement age in order to equate it to that of men's, the majority of the papers studied neither the effect of a husband's retirement age on the wife's retirement behavior nor the effects of both spouses' retirement age deferrals. Three papers are more closely related to our research since they study the effects of retirement age deferrals of both spouses on each other's labor supply. Johnsen and Vaage (2017) study labor supply

spillovers within households as a result of an early retirement reform in Norway. The reform, which was partially implemented and involved only some firms, enabled the use of a difference-in-differences model, comparing spousal employment before and after the workers reach the ERA for both treated and control workers. They found that workers eligible for early retirement reduce their employment rates compared to non-eligible workers. Moreover, they found that cross effects of male workers reduce their wife's employment, but no cross effects were found on husbands' employment. Additionally, Lalive & Parrota (2017) and Stancanelli (2017) both examine how labor force participation changes, according to LF survey data, as a function of both individual FRA and one's spouse's FRA in similar settings in Switzerland and France, respectively. Both papers use a double RDD approach with the distance in months between the relevant policy threshold and the birth month as the running variable, and study the effect of reforms that increased the number of quarters required to contribute in order to be eligible for maximum retirement benefits based on birth years. While the former paper finds that women are more strongly affected by their partners' pension eligibility, the latter reaches the opposite conclusion.

Our main contribution beyond the prior literature is in studying the effects of spouses' retirement age deferrals on their retirement decisions and their interdependencies using a detailed dataset that enables us to carefully address the causality of the effects. We find that the spillover effect of one spouse's change in retirement age on the other spouse's labor supply, emphasized in the literature, might be canceled out if both spouses' retirement ages are deferred. This contribution to previous papers was feasible in our setting due to two features. First, most recent reforms changed the retirement age of women in order to equalize both gender retirement ages. This made it impossible to examine, in most countries, spillover effects of a husband's retirement age deferral on his wife's labor force supply. Second, we use a large panel of couples' administrative data instead of Labor Force Survey data, which enables us to detect, using a double regression discontinuity strategy, the effect of the pension reform specifically on the age cohorts affected by it. In addition, we are able to test the effect of the reform not only on employment rates, but also on several additional labor market outcomes, such as annual salary and the probability of keeping the same job throughout the year, and

study heterogeneous effects of the reform over several dimensions, such as couples' ages, education levels and prior employment status.

The rest of the paper is organized as follows. Section 2 presents the institutional background, Section 3 describes the data, Section 4 discusses the identification strategy and Section 5 reports the results. Section 6 offers a summary and some conclusions.

## **2. Institutional Setting**

Israel's retirement income system is based on a universal social security allowance (first pillar) and on individual savings in pension funds (second pillar).<sup>4</sup>

The old-age social security allowance (the first pillar) is the basic amount paid by the state to retirees at retirement age. This pillar's aim is to guarantee a basic income for the elderly population. The allowance is paid to every insured person<sup>5</sup> who has reached the absolute eligibility age.<sup>6</sup> At the age of conditional eligibility, it is paid on condition that the insured person passes an income test. The conditions for receiving the old-age allowance are not very exclusive and close to 90 percent of those eligible for the old-age allowance receive it already at the age of conditional eligibility. The conditions depend on total income (not including pension benefits) and are reduced if total income crosses a certain threshold, so that most individuals are eligible for some old-age allowance, even if only partial. The minimum old-age allowance (the basic pension) ranged around 15.5 percent of the average wage, with additions for years worked, delay in receiving the allowance and pending additions, according to the individual's eligibility.<sup>7</sup>

The second pension pillar is pension savings that depend on employment and the wages of working-age employees, and its aim is to ensure that workers will be able to maintain their standard of living after retirement. Until 1995, Israelis' retirement savings were concentrated

---

<sup>4</sup> For a detailed description of Israel's retirement income system, see Brender 2009.

<sup>5</sup> The insured population includes all Israelis who have lived in Israel for a certain period of time prior to retirement age. New immigrants who arrive in Israel after retirement age receive an old-age allowance, but not based on the National Insurance Law.

<sup>6</sup> The age of absolute eligibility for men is 70. The age of absolute eligibility for women was 65 in 2004 and the state is raising it gradually to 70 (by 2020).

<sup>7</sup> The basic old-age allowance had reached about NIS 1,500 in 2013 (about USD 430), with fluctuations from this rate of about 3–4 percent from the economic stability reform of 1985, which automatically updated it in accordance with increases in the standard of living.

in occupational pension funds that offered defined-benefit schemes. Employees in the public sector and in large organizations were offered similar benefits in employer-funded programs with no direct employee contribution. Individuals could also enjoy tax benefits for depositing a portion of their uncovered salaries into private savings accounts—provided that the amounts were not withdrawn for at least 15 years from the date the account was opened.<sup>8</sup> At 2007 approximately 60 percent of the population was covered by the pension-savings pillar.

The government has carried out a series of reforms in both pillars over the past two decades, with the aim of covering its actuarial deficits and the projected growth of its budgetary expenditure. These reforms focused on the transition from defined benefit pension insurances to defined contribution schemes where the insurance was based on the accumulation of funds in accordance with deposits and returns during the pension savings period (defined contribution), and on covering the actuarial deficits in the old pension funds. The transition from defined benefit plans to pension plans based on the accumulation of savings took place in two main steps. The first step was taken in 1995, when the government ended the ability of new savers to join the old pension (defined benefit) funds and required that new, defined contribution, pension funds be established in their place. The second step was taken starting in 1999, when new public sector employees were no longer eligible to participate in the employer-funded pension scheme, and were placed in the new pension funds. In order to deal with the actuarial deficit suffered by most of the old pension funds, the government formulated an arrangement that included a reduction in the benefits of members, an increase in monthly deposits by active members, and an injection of funds by the government.<sup>9</sup>

As part of this fiscal consolidation program, in December 2003, the Israeli government approved a reform to defer the age of retirement benefits. The change was implemented gradually between 2004 and 2009. Every few months, the age of retirement was raised for men and women by four months: for men from 65 to 67 and for women from 60 to 62. The increase was reflected in the deferral of the age of eligibility for employment-related pensions (second

---

<sup>8</sup> Government support for pension saving took two forms: tax allowances at the times of deposit and withdrawal and preferential yields for the deposited amounts.

<sup>9</sup> At the beginning of 2008, the government took an additional step in the pension area: it adopted a national compulsory pension accord covering all the employees.



pillar),<sup>10</sup> as well as the old age allowance that is dependent on a means test (first pillar).<sup>11</sup> We exploit this reform to address how individuals' retirement age and their spouses' retirement age affects their labor force supply.

### **3. Data**

We make use of restricted data from Israel's Central Bureau of Statistics (CBS). We begin with the 1995 Israeli census sample for the full questionnaire (20% of population), focusing on the Jewish population born between 1931 and 1974.<sup>12</sup> Each individual record contains information on the following variables: own and spouse's demographic variables (ethnicity based on parents' country of birth, years of education, type of higher education [secular versus religious], number of children, year of immigration to Israel, year and month of birth), labor force participation characteristics in 1995 (full/partial/unemployment, salaried employee or self-employed worker), individual's and household's income from 1995 (wage income, allowances and pension payments and income from other sources).

We match this sample of individuals with their spouses in 2001, 2007 and 2014 according to the population registries from 2001, 2007, and 2014. For each individual, the population registries provide their spouse as of that year, number of children, spouse's and children's place and date of birth (year and month), an indicator for immigrating from Israel (year and month of immigration) and an indicator for passing away (year and month of death).

We then match, for each individual in our sample, several additional variables from the Israel Tax Authority data for every year during 2001–14, also provided by the Central Bureau of Statistics. The tax data provides the labor force participation information of each individual,

---

<sup>10</sup> Defined benefit pension funds allow retirement before the official pension age (i.e., age for early retirement) but at the cost of a reduction in the payment rate (the new funds are in any case based on previously defined contributions). This age for early retirement was 58 for women and 60 for men (the age of early retirement for women has been gradually raised in 2010 to 60, for women born after January 1952).

<sup>11</sup> In addition, the law also deferred the age at which employers can terminate, for any reason, the employment of the relevant workers and restricted the possibility of continuing to employ them in the public sector from 65 to 67.

<sup>12</sup> We concentrate on the Jewish population for two main reasons: first, because of the low labor force participation rates among female Arabs (the LFP was lower than 15 percent among Arab women aged 55–64). Second, because parts of the Arab population are characterized by a high percentage of polygamy (for example, about 30% of Arab Beduin families are estimated to be polygamist, Abuhazira 2010).

based on taxable income from work. This information includes annual salaries, monthly employment status, the two main employment positions<sup>13</sup> and number of employers.

Our final dataset is at the monthly level. We focus on individuals who were married at least according to one of the population registries (2001, 2007 or 2014). For each couple we have the demographic information of each spouse, individual's and household's incomes from the 1995 census for those who completed the full questionnaire, and each spouse's labor force participation information during the years 2001–14.

#### **4. Estimation Strategy**

Our main estimation strategy is a double regression discontinuity design for both genders, which enables us to identify the effects on an individual's employment rate of own eligibility change, spouse's eligibility change, and an interaction effect, indicating that both spouses experienced eligibility changes. This estimation strategy assumes that by comparing couples with a similar age structure, within a sufficiently narrowly defined set of birth cohorts (i.e., within two years before and after the birth cohort for which the law was implemented), the probability of each spouse in a specific month to be assigned to treatment versus control groups is as good as random, so that their characteristics are not correlated with the outcomes of interest. Thus, the differences between spouses' probability of working in a specific month among those assigned to control versus treatment groups result solely from the effect of the change in legislation.

To do so, we construct treatment and control groups for both genders in the following manner. We restrict the sample to older spouses in the age interval for which the official age of retirement was deferred, i.e., women aged 60 and 61 and men aged 65 and 66, two years before and after the implementation of the reform. The implementation of the reform was gradual, i.e., the age of retirement was raised for men and women by four months, six times between 2004 and 2009. Therefore, we define six age groups for men and women, according to their different retirement ages. Each group is divided into a treatment group and a control group, according to individuals' date of birth. The treatment groups include individuals who were affected by the legislation—that is, all the individuals, at these ages, whose date of birth is later than the threshold date for which the new retirement age went into effect. The control groups included

---

<sup>13</sup> If an employee had more than two employment positions, the two with the highest annual salary were used.

all individuals, at these ages, born earlier than that date. For example, the retirement age was raised at first in March 2004 by four months (from age 60 to 60 and four months) for women born after March 1944. Therefore, the first group of women consists of those aged 60 to age 60 and four months. The treatment group for this age group consists of those born up to two years after the threshold date for which the new retirement age went into effect (March 1944), while the control group for this group consists of those born in the two years before that date. Table 1 defines the exact dates of the gradual deferral of the retirement ages and the definition of each treatment and control group for each one of the six cohorts, for men and women, respectively. Figure 1 presents a graphical description of these groups.

The main analysis consists of two datasets, one for men and their wives and the other for women and their husbands, at a monthly level. In each dataset the individual and his/her spouse belong at least in one month to either one of the defined treatment or control groups. These two datasets overlap to a large extent, with small difference reflecting changes in the marital status of part of the couples. Table 2 presents the characteristics of individuals belonging either to treatment or control groups at the individual level, for men and women.<sup>14</sup> Overall the characteristics of individuals in the control group resemble those in the treatment group, for both men and women. Individuals in the treatment group seem to have higher education and a higher percentage were employed in the past. Since the data consist of couples, the characteristics of men (women) are similar to the characteristics of husbands (wives) in the sample (the small difference might reflect changes in the marital status of part of the couples).

In order to examine whether the assignments of individuals and their spouses in a specific month, controlling for their ages, to the control versus treatment groups are as good as random, we run a series of balancing tests. Each regression includes one of 16 individual and spouse characteristics as a dependent variable and the probability of being assigned to the treatment group in a specific month as the explanatory variable. In addition, each regression controls for year fixed effects and the ages of the spouses (at a monthly level). Individuals' and their spouses' characteristics are: both spouses' education levels, ethnicities (four ethnicity groups according to place of birth of each spouse), number of children, dummy for studying in a religious school, dummy for new immigrant (for both spouses), and household income and

---

<sup>14</sup> We note that since each of these two datasets is defined at a monthly level, control and treatment groups partly consist of same individuals in different timing. Appendix Table A1 presents the number of observations (at a monthly level and individual level) of couples belonging to treatment versus control groups (without counting cases where the same individual belongs to both treatment and control groups).

employment status in 1995. Table 3 presents the results of these balancing tests for the assignment of individuals in a specific month to the treatment group. Except for two cases, none of the estimated effects in the table are significantly different from zero, indicating that the characteristics of individuals and their spouses in a specific month that were assigned to the control group are similar to the characteristics of individuals and their spouses that were assigned to the treatment group, when comparing couples with the same age structure.

We exploit the fact that given the couple's ages, the assignment of each spouse to control and treatment groups in a given month is as good as random, to analyze the effect on employment of individual's change in retirement age, his/her spouse's change in retirement age, and whether the effect is different if both have experienced changes in their retirement ages. We note that the gradual implementation of the law also enables us to detect the effect of retirement age deferral from other changes that took place throughout this period by including year fixed effects to the regression.<sup>15</sup>

Specifically, we consider the following benchmark double regression discontinuity estimation strategy, separately for men and women:

$$(1) y_{ijt} = \alpha + \alpha_1 T_{it} + \alpha_2 T_{jt} + \alpha_3 T_{it} * T_{jt} + \beta_1 A_{it} + \beta_2 A_{jt} + \gamma_t + \delta X_{ij} + \varepsilon_{ijt}$$

where  $y_{ijt}$  is the probability of working of individual  $i$  (with spouse  $j$ ) in month  $t$ ;  $T_{it}$  is a dummy variable that equals one if individual  $i$  in period  $t$  belongs to the treatment group;  $T_{jt}$  is a dummy variable that equals one if his/her spouse  $j$  in period  $t$  belongs to the treatment group. The baseline specification includes year ( $\gamma_t$ ) fixed effects and individual's ( $A_{it}$ ) and his/her spouse's ( $A_{jt}$ ) ages (at a monthly level). We further include individual and spouse characteristics ( $X_{ij}$ ).  $\varepsilon_{ijt}$  is an error term clustered within the couples' years of birth interaction.

This specification enables the individual's employment probability to be affected by his/her own retirement age deferral ( $\alpha_1$ ); his/her spouse's retirement age deferral ( $\alpha_2$ ); and allows the effect of his/her own retirement age deferral to be differentially affected based on his/her spouse's retirement age status ( $\alpha_3$ ). This coefficient estimates by how much an individual's employment probability is affected by his or her own retirement age deferral when spouse's retirement age was deferred, compared to a case when it was not. Moreover, we will compare

---

<sup>15</sup> We note that this estimation strategy might underestimate the effect of the reform due to the control group consisting of individuals who may have been also affected to some extent by the reform. For example, the probability of working among women aged 61 might increase as a result of deferring her retirement age from 60 to 61.

the effects on employment of men and women from this model to two additional models: the first is the most simplified version, where spouse's effect is not incorporated and does not affect own employment rate, and the second is the case where both spouses' retirement age deferrals are incorporated, but their interaction is not.

## **5. Results**

The main findings are presented in Table 4. The table presents the effects on an individual's probability of working in response to own retirement age deferral, to spouse's retirement age deferral and to its interaction, separately for men and women. The table presents the coefficient estimated in Equation 1, according to four different specifications. The first specification includes only year fixed effects, the second specification includes the ages of the couples as well (at a monthly level); and the third specification, which is our baseline specification, includes additional couples' characteristics. The fourth specification includes an additional control: the interaction between the couples' years of birth fixed effects.

The table presents the estimated effects of the model specified in Equation 1. Columns 1-3 present the estimates of own retirement age deferral (column 1), spouse's retirement age deferral (column 2) and its interaction effect (column 3) for men, based on the four specifications, and columns 4-6 present the respective estimates for women. In the first specification, which includes only year fixed effects, the estimated effects of own retirement age deferral on the probability of working are positive and significant for both women and men, the estimates of spouse retirement age deferral are also positive but statistically different from zero only for women, and the estimates of the interaction terms are negative but again statistically significant only for women. These results do not change dramatically when couples' ages are added to the regression (second row), though the estimated coefficients decrease slightly in all regressions. Adding spouses' characteristics leaves the estimates almost unchanged. The fourth specification, with couples' years of birth fixed effects, slightly decreases the estimates of men, while slightly increasing those of women.<sup>16</sup>

Interestingly, the estimated effects of men's own retirement age deferral on their probability of working are higher than that of women's in both the baseline specification (0.084, SE=0.013

---

<sup>16</sup> Appendix Table A2 presents results from a specification similar to the last specification of Table 4, but includes both spouses' years of birth fixed effects instead of the interaction between the spouses' years of birth fixed effects. The results are similar for men, while for women the estimated effects are slightly lower (the interaction term is only marginally significant).

versus 0.56, SE=0.011) and the couples' years of birth fixed effects specification (0.067, SE=0.026 versus 0.06, SE=0.016). Moreover, while men's employment status does not depend on spouse's retirement age deferral, women's probability of working does depend on that of their husbands. The estimated effects of husbands' retirement age deferral and the interaction term are statistically significant only for women (0.027, SE=0.01 and -0.019, SE=0.011 according to the baseline specification and 0.046, SE=0.016 and -0.048, SE=0.022 according to the couple's years of birth fixed effects specification). Thus, husbands' retirement age deferral has a positive effect on women's employment rate according to both specifications. But deferring both spouses' retirement age does not significantly increase women's employment rate relative to the case where only her own retirement age is postponed (0.064, SE=0.014 compared to 0.056, SE=0.011, according to the baseline specification, where the p-value of the difference is 0.417) and 0.06, SE=0.016 compared to 0.058, SE=0.027, according to the couples' years of birth fixed effects specification, where the p-value of the difference is 0.61).

To illustrate the magnitude of the effects of the estimates, we simulate the changes of retirement age deferral of both spouses on women's and men's employment rates. The employment rates in the pre-reform period (year 2003/2004) for men aged 60 to 62 and women aged 65 to 67 were 29 percent and 33 percent, respectively. Increasing own retirement age raises the employment rate of men by 7 or 8 percentage points depending on the specification, from 29 percent to 36 or 37, regardless of their spouses' retirement age deferral. For women, the size of the effect of own retirement age on employment rates depends on their spouse's retirement age deferral. Their employment rate increases from 33 percent to 39 percent due to only her own retirement age deferral; it increases from 33 percent to 36 percent due to only their spouses' retirement age deferral (or to 38 percent according to the couples' year of birth fixed effects specification). However, there is no added benefit from both spouses experiencing an increase in retirement age relative to the case where only women are experiencing it (their employment rate increases also from 33 percent to 39 percent).

This result may be surprising at first, since there is considerable descriptive statistics evidence on coordination of retirement decisions among spouses. Theoretical models, however, stress spillover effects of one spouse's retirement age deferral to the other spouse's probability of working and its possible contradicting channels: the leisure complementarity channel predicts that raising a spouse's retirement age would decrease his/her leisure time which in turn would increase the willingness of the other spouse to continue working if spouses' leisure is

complementary. In contrast, the income channel predicts the opposite effect. It forecasts that raising a spouse's retirement age would increase this spouse's probability of working and increase the household's income, thereby reducing the need for the other spouse to continue working as well. Our result implies that, for women, both channels might be in effect, though the leisure complementarity channel might be stronger. This results from the positive and significant spillover effects of husbands' retirement age deferral on their wives' probability of working, though this effect is present only when their own retirement age is not postponed. If their own retirement age is postponed, there is a small and positive spillover effect of husbands' retirement age deferral but it is not statistically significant (according to the baseline specification, and no spillover effect according to the couples' years of birth fixed effects specification), implying that there exists an upper threshold above which women will not increase their employment rates further due to the retirement age reform.

To the best of our knowledge, we are the first to explore possible interactions between both spouses' retirement age deferrals. Other papers examine either how individuals are affected by own retirement age deferral or by their spouse's own retirement age deferral, and a few examine both but do not include the interaction term. In order to stress the importance of including this interaction term as well as the implication of the overall effect of a spouse's retirement age deferral on the other spouse's employment rate, we compare our results to two simplified versions of our model: a version where the interaction term is not incorporated in the model, i.e., assuming that the effect of own retirement age deferral on own employment is the same regardless of spouses' retirement age deferral; and another version where no spouses' effects are incorporated at all. These results are presented in Table 5. This table presents the same main specifications presented in Table 4 (baseline and couples' years of birth fixed effect specifications). Columns 1 and 4 present estimates of a version where only retirement age deferral is included, for men and women respectively. Columns 2–3 and 5–6 present similar estimates of a version where own and spouse retirement age deferrals are both included, but without the interaction term, again for men and women, respectively.<sup>17</sup>

Comparing the estimates of the different versions of the model reveals that the estimated effects of own retirement age deferral do not change by much when including spouse's retirement age deferral, according to both baseline and couples' years of birth fixed effect specifications (the effect of own retirement age deferral are: 0.082, SE=0.014 and 0.074, SE=0.021 for men and

---

<sup>17</sup> The version without spouse's effects includes as controls only individual's age and year of birth fixed effects. Standard errors are also clustered within an individual's year of birth.

0.046, SE=0.011 and 0.033, SE=0.014 for women in Table 5, versus 0.084, SE=0.013 and 0.067, SE=0.026 for men and 0.056, SE=0.011 and 0.06, SE=0.016 for women in Table 4, respectively). This is also true when comparing own and spouse's estimates of men from this table (columns 2 and 3) to the respective estimates in Table 4 (columns 1 and 2).

For women, however, not including the interaction term lowers by almost half the separate effects of each of the spouses' retirement age deferrals on women's employment rate (own deferral increases it by about 4.6 or 3.3 compared to 6.3 or 5.5 percentage points, and husband's deferral increases it by about 1.7 or 2.2 compared to 2.7 or 4.6 percentage points, according to the baseline or couples' year of birth fixed effects specification respectively), while the joint effect of both spouses' retirement age deferrals remains with similar effect size (it increases women's employment rate by about 6.3 or 5.5 compared to 6.4 or 5.8 percentage points). Thus, if the interaction term is not taken into account, one would underestimate the expected effect sizes of deferring the retirement age of each spouse. Understanding the interdependencies of spouses' retirement age deferrals is therefore necessary for designing better retirement age reform policies and correct evaluate the consequences of postponing spouses' retirement ages.

The size of the effect of own retirement age deferral is somewhat similar to the literature, though it is hard to compare since the features of each reform are different. For example, Atalay and Barrettt (2012) find an approximately 8 percentage points increase in the participation of Australian women due to the increase in their eligibility age for pension benefits from 60 to 65. Cribb, et al. (2013) find that women's employment rates at age 60 increased by 7.3 percentage points when the pension age in the UK was increased to 61. Other studies find stronger effects: Selin (2017) finds a relative decrease of nearly 20 percentage points in the retirement probability of Swedish wives aged 63 as a result of a delay in pension benefits reform, whereas Johnsen and Vaage (2017) find that Norwegian workers of both genders who are eligible for early retirement reduce their employment rates by about 35 percent compared to non-eligible workers. There is also variation in spillover effects, though most studies find higher positive spillover effects of retirement age deferral on wives' employment when both men's and women's retirement ages are postponed (see Lalive and Parrotta, 2017, and Johnsen and Vaage, 2017).

*Does the increase in employment rates result from year of birth differences between treatment and control groups?*



The empirical strategy relies on the comparison of couples' employment rates, controlling for their ages, before and after the reform was implemented. Although analyzing the control versus the treatment groups' characteristics of these couples stresses their similarity, it can still be claimed that the fact that the control group consists of individuals born in earlier years may affect the results, as their employment rates might be lower regardless of the implementation of the reform. We address this concern in several ways.

First, the fact that the inclusion of couples' year of birth interaction fixed effects to the regression (Table 4, column 4) changes the results only to a small extent and leaves the results significantly different from zero suggests that the dependency of the results to birth cohort differences between treatment and control groups is not substantial. Moreover, it also implies that our findings cannot result from within couples' birth cohort differences between those assign to treatment and control groups. As noted, the estimated effects of own retirement age deferral remain similar and statistically significant for both men and women (0.084, SE=0.013 versus 0.067, SE=0.026 for men and 0.056, SE=0.011 versus 0.06, SE=0.016 for women, according to the baseline versus couples' years of birth fixed effects specifications, respectively), while the effect of spouses' retirement age deferral and the interaction term increase to some extent, though continue to be insignificantly different from zero for men and significantly different from zero for women (spouses' estimated effect are 0.027, SE=0.01 versus 0.046, SE=0.016 and the interaction terms are -0.019, SE=0.011 versus -0.048, SE=0.022, according to the baseline versus couples' years of birth fixed effects specifications respectively).

In order to gain further insights into the dependency of our results on the differences in birth years in control versus treatment groups, we take into account an additional feature of our dataset. For around one quarter of individuals in our sample the exact month of birth does not exist (though the year of birth is given), due to unknown month of birth or inadequate registry by the Population and Immigration Authority.<sup>18</sup> Pension benefits are given to those individuals based on a fixed date (i.e., April 1<sup>st</sup>). For the purpose of this analysis, in addition to assigning April 1<sup>st</sup> as their date of birth as in the main analysis, we split the two samples for men and women into two, one consisting of individuals with an adequate birth registry and the other with individuals without it, in order to check the similarity of the retirement age deferral

---

<sup>18</sup> The sample includes mostly older individuals who immigrated to Israel before or after the founding of the State of Israel (according to the summary statics presented in Table 2, only about 3 percent were born in Israel).

estimated effects based on these two samples. Table 6, columns 1–2 and 3–4 provide evidence of this issue by presenting the estimated effects of own retirement age deferral based on the two stratified subsamples, for both men and women respectively.<sup>19</sup> The regressions include the effect of own retirement age deferral, controlling for individuals' age and other characteristics and year of birth fixed effect. The differences between the estimated effects of own retirement age deferral according to both subsamples are not statistically different from zero, for both men and women. Moreover, the estimated effect for men based on analyzing the subsample of exact birth date individuals is lower than the estimated effect in the second subsample (0.063, SE=0.015 and 0.074, SE=0.025 respectively), while the opposite is true for women (0.048, SE=0.002 and 0.035, SE=0.018 respectively). This provides further evidence that the effect of retirement age deferral does not depend on the exact date of birth of individuals.

The fact that including couples' year of birth interaction fixed effects as additional controls only marginally change the estimated effects and they stay statistically significant indicates that our results are not driven by differences between control and treated spouses' years of birth. Moreover, we demonstrate that the effect of the retirement age deferral is similar regardless of its dependency on individuals' exact month of birth cohorts. These two robustness checks provide overall evidence that even though our identification strategy relies on comparing individuals from control and treatment groups who experienced a retirement age deferral based on their years of birth, the effect of this dissimilarity on our results hardly exists. We provide further robustness checks in the last section using a double difference-in-differences estimation strategy.

### *Heterogeneous Effects*

In order to gain further insights into which type of households were more affected by the reform and to learn more about the different mechanisms at place, we explore heterogeneous effects across several dimensions. First, we look at whether the reform affected individuals differently based on their working status ten years before the reform was implemented. We expect the reform to affect more individuals who participated in the labor market in the past, as we examine the effect of the reform on their working status at the time the reform took place. Second, we test whether the reform affected individuals differently based on their salary—again, as reported ten years before the implementation of the reform. In this case, it is not clear

---

<sup>19</sup> The analysis was not performed on the main version of the model that includes spouses' retirement age deferral effect and the interaction term because there are only a few couples in which both spouses have inadequate birth registration.

ex ante which group should be more affected, since the reform decreased the pension paid to low income households mainly through the deferral of old age allowance that is dependent on a means test, but also decreased pension payments to high income households mainly through the deferral of the age of eligibility for employment-related pension. Finally, stratifying the sample based on level of education, which may be more correlated among spouses than past earnings, provides another approximation for earning capability instead of monthly wages. Moreover, it might enable us to explore whether the fact that only wives' employment status is affected by their husbands' retirement age deferral is related to gender preference or to lower attachment of women to the labor market.

Table 7 presents the estimated effects of three stratifications of the sample: Panel A shows the results of the stratification based on whether both spouses were working in 1995 or not, according to the 1995 Israeli census; Panel B presents the stratification of the sample by high versus low individual income in 1995 (higher or lower than the median salary income); and Panel C displays the results of the reform by individuals' level of education (dummy for highly educated=1 if holding a B.A. degree or higher). The estimates are from both the baseline specification and the couples' years of birth fixed effect specification, separately for men and women.

The heterogeneous estimates by couples' working status suggests that, as expected, the effect of the reform on employment rates is largely driven by couples who participated in the labor force ten years before the reform was implemented. Most of estimated effects of retirement age deferral that are statistically significant according to Table 4 are also significant for the working couple sub-sample and are even higher than those of the non-working sub-samples, especially according to the birth year fixed effects specification (according to this specification, the effects of own retirement age deferral, spouse's retirement age deferral, and the interaction term are 0.1, SE=0.02 versus 0.01, SE=0.02; 0.062, SE=0.03 versus 0.025, SE=0.032; and -0.079, SE=0.032 versus -0.01, SE=0.048, respectively, for women; and for men, the respective estimates are 0.077, SE=0.031 versus 0.06, SE=0.042; 0.036, SE=0.016 versus -0.019, SE=0.03; and the interaction terms are not statistically significant.)

The results of the second stratification in Panel B are similar to those in Panel A, when stratifying the sample by income level, though the high-income level subsample is smaller than that of the working couple subsample. Thus, the effects are mostly driven not only by working couples, but by working couples from the top of the income distribution, especially for women

since the estimated effects differences for men are marginal (for example, according to the birth year fixed effects specification, the estimates for own, spouse and interaction term for women are: 0.086, SE=0.037 versus 0.026, SE=0.039; 0.087, SE=0.034 versus -0.006, SE=0.016; and -0.09, SE=0.055 versus 0.015, SE=0.037). The fact that the reform affected mostly high-income individuals might imply, for example, that pension benefits for the low-income earners constitute a lower percentage of total earning compared to alternative transfer benefits when unemployed, or that the demand side is more binding for low-income individuals preventing them from staying in the labor force at older ages.

Panel C presents the estimates based on stratifying the sample by level of education. Since we use a narrow definition of high education—holding a B.A. degree or higher—the sample of individuals with high education constitutes only a small subsample of individuals. Assuming that spouses' levels of education are correlated and reflect stable earning capacity of both spouses to a larger extent than monthly salary, this stratification might help us understanding if husbands' spillover effects on their wife's employment status are driven by gender preference or by lower attachment of women to the labor force. Indeed, we find that for both genders and both specifications the estimated effects of individuals with high education level are statistically significant and statistically higher (except one) than the respective estimates for individuals with a low education level. This suggests that for highly educated individuals where both spouses' earning capacity are high, both genders behave in similar ways, so that the gender asymmetry of the baseline results might be driven by unequal gender attachment to the labor market and not different preferences.

#### *Heterogeneous Age Cohort Effects*

We now test whether the retirement age deferral affected individuals differently according to their age cohorts. Thus, instead of imposing the same treatment effect on all age cohorts as in the analysis so far and referring to the impact of the average treatment of the reform, we now examine non-linear effects. Due to the gradual implementation of the reform, two contradicting types of effects are expected over time. We would expect a gradual assimilation to the reform, with the highest effect toward the end of the period. Yet in contrast, as the reform was gradually implemented affecting older age cohorts at later stages, we would expect that the effect of retirement age deferral on the employment rate to be less effective as an individual becomes older.

Table 8 presents the effects of postponing the retirement age on the different age cohorts of the sample, gradually adding each age cohort one at a time (the different age cohorts are defined in Table 1). Panel A presents the effect of retirement age deferral only on the first two age cohorts (men/women aged 65/60 to 65/60 and 8 months); Panel B presents similarly the effect on the first three age cohorts (men/women aged 65/60 to 66/61); Panel C presents similarly the effect on the first four age cohorts (men/women aged 65/60 to 66/61 and 4 months); and Panel D presents similarly the effect on the first five age cohorts (men/women aged 65/60 to 66/61 and 8 months). The estimated effects are presented for the baseline specification and on a specification that includes, in addition, couples' year of birth interaction fixed effects.

Interestingly, restricting the sample to the first two age cohort groups reveals the highest effect. The effect fades out when adding older age cohorts to the sample. For example, the first row estimated effects according to the baseline specification, which includes a sub-sample of men aged 65 to 65 and 8 months and their wives of age 60 to 60 and 8 months (or women in the same ages and their husbands), reveals that the effect size drops by half or more compared to the estimated effects when including all the individuals in the sample presented in the last rows of the Table 4 (the estimated effects of own retirement age deferral are 0.119 (SE=0.0336) versus 0.084 (SE=0.013) for men and 0.116 (SE=0.035) versus 0.056 (SE=0.011) for women; the respective estimated effects of spouse retirement age deferral are 0.062 (SE=0.026) versus 0.004 (SE=0.011) for men and 0.059 (SE=0.033) versus 0.027 (SE=0.009) for women; and the estimated effects of the interaction term are -0.133 (SE=0.027) versus 0.006 (SE=0.015) for men and -0.082 (SE=0.035) versus -0.019 (SE=0.011) for women). This means that even though individuals were able to assimilate to the new law gradually, later cohorts were less affected by the reform due to the fact that these cohorts were also older, with less probability of working due to their retirement age being postponed. Moreover, for younger cohorts, the estimated effects of own and spouses' retirement age deferrals on individual's employment and its interactions are more similar across genders than for older cohorts.

#### *A Difference-in-Differences Estimation Strategy*

We now employ a double difference-in-differences (DID) analysis that evaluates different age groups and genders before and after the reform and varies their treatment status based on their own birthdate and their spouse's birthdate. We use this empirical strategy for several reasons: first, it enables us to test the effect of the reform on additional labor market variables defined annually; second, the double difference-in-differences specification makes it possible to

examine anticipation effects of the reform on younger cohorts; and finally, it enables us to carry out two additional robustness checks in order to validate our identifying assumptions.

In the baseline double difference-in-differences (DID) analysis, we estimate the effect of the reform by comparing the changes in labor force outcomes before and after the implementation of the reform of spouses affected by the reform, belonging to the treatment group (i.e., men aged 63–66 and women aged 58–61), to those not affected by the reform, belonging to the control group (i.e., men aged 67–70 and women aged 62–65).

Within this framework, we estimate the change in own and spouses' retirement age deferral effects and their interaction on several labor force characteristics: the mean number of working months in a year, annual salary of all individuals, annual salary of workers and the probability of keeping the same job within a given year. Since these variables (except the probability of working in a certain month that we aggregate within a year) are given annually, our dataset is at the individual by-year level. Separate regressions are estimated for men and women.

The double difference-in-differences estimation strategy assumes that the control group is a valid counterfactual to the treatment group in order to estimate the effect of the reform, if both groups have similar pre-reform trends in our four outcomes.<sup>20</sup> In Appendix Table A6, we report the estimated linear time trends of both control and treatment groups and whether they are statistically different from zero. All regressions include couples' characteristics, and are estimated separately for men (columns 1–4) and women (columns 5–8). All the differences between the two groups' pre-reform time trends for the years 2001–04 are small and insignificant for each of the four outcomes.

To compare husbands' labor force variables at age 63–70 (/wives at age 58–65) between a period before the reform (i.e., 2003–04) and a period after the reform (i.e., 2009–10), we

---

<sup>20</sup> Appendix Table A3 presents the number of observations (at a yearly level and individual level) of couples belonging to treatment versus control groups before and after the reform period (without counting cases where the same individual belongs to both treatment and control groups). Appendix Table A4 reports the summary statistics of control and treatment groups in the pre-reform period. The two control and treatment groups have similar characteristics, although they consist of couples with different birth year cohorts.

consider the following double difference-in-differences specification, separately for men and women:

$$2) \quad y_{ijt} = \alpha_0 + \alpha_1 T_{it} + \alpha_2 T_{jt} + \alpha_3 T_{it} * T_{jt} + \alpha_4 R_t + \alpha_5 R_t * T_{it} + \alpha_6 R_t * T_{jt} + \alpha_7 T_{it} * T_{jt} * R_t + \rho X_{ij} + \varepsilon_{ijt}$$

The indicator variable  $T_{it}$  is equal to one if individual  $i$  in year  $t$  belongs to the treatment group, i.e., men aged 63–66 and women aged 58–61; and the indicator variable  $T_{jt}$  is equal to one if his/her spouse  $j$  in year  $t$  belongs to the treatment group. We interact each of these variables with the  $R_t$  indicator variable which equals one for the period after the reform (i.e., 2009–10). In order to estimate the effect of either being individually treated or having a treated spouse, we obtain two of our coefficients of interest:  $\alpha_5$  and  $\alpha_6$ . We also interact the  $R_t$  indicator with the interaction between  $T_{it}$  and  $T_{jt}$  and obtain our third coefficient of interest:  $\alpha_7$ , the added effect in case of joint retirement age deferral changes. The couples' characteristics are denoted by  $X_{ij}$  (the characteristics are the same as in Equation 1). The error term  $\varepsilon_{ijt}$  is clustered at the couple's birth years interaction.

The results of the estimation of Equation 2 are presented in Table 9. The estimated effects of own and spouse retirement age deferral interactions with post-reform dummy variable ( $\alpha_5$  and  $\alpha_6$ , respectively) and its interaction ( $\alpha_7$ ) are presented in columns 1, 2 and 3 for men, and in columns 4, 5 and 6 for women, respectively. Panel A presents the estimated effects on the mean number of working months in a year; Panel B presents similar estimated effects on annual salary of all individuals (the salary of those who did not work was set to zero); Panel C presents similar estimated effects on annual salary of workers; and Panel D presents similar estimated effects on the probability of keeping the same job all year.

Overall, the estimated effects of retirement age deferral variables interacted with the post-reform dummy on all four outcomes in Table 9 have similar signs as the estimated effects reported in Table 4, but are less statistically significant. This might result from the fact that while the double regression discontinuity strategy estimates the effects of the reform specifically on the cohorts directly affected by it, the double difference-in-differences estimation strategy captures its effects on a wider range of age cohorts, including younger

ones.<sup>21</sup> The estimated effects of own retirement age deferral's interaction with the post-reform dummy are all positive and statistically significant for men (the estimated effects of own retirement age deferrals on the mean yearly working months for men is: 0.093, SE=0.021; on annual salary of all individuals: 31,375, SE=5,256; on annual salary of workers: 14,823, SE=6,620; and on the probability of keeping the same job: 0.036, SE=0.01). For women, the estimated effects of own and spouse's retirement age deferrals interacted with the post-reform dummy and the interaction term of both spouses' retirement age deferrals interacted with the post-reform dummy follow a pattern similar to that in Table 4, but only a few of them are statistically significant.

We simulated the effect size of postponing the retirement age on men's mean working months per year, from 5.14 to 6.18 months per year. Interestingly, for men, the annual salary of all individuals increased from NIS 64,300 to NIS 95,600; the annual salary of workers also increased from NIS 97,300 to NIS 112,100, which might indicate that it also influences the amount of hours worked (moving from partial jobs to full time jobs); and the probability of keeping the same job among those who continued working increased from 93 percent to 96.6 percent as a result of postponing their retirement age. For women, annual salary of all individuals increased to a smaller extent but it does not depend solely on own retirement age deferral. Women's annual salary increased from approximately NIS 36,000 to NIS 45,000, whether only their retirement age was postponed; only their spouses' retirement age was postponed; or both spouses' retirement ages were postponed.

The double difference-in-differences specification enables us to examine anticipation effects of the reform on younger cohorts. Appendix Table A9 replicates the analysis presented in Table 9, for younger cohorts treated groups: men aged 61–64 and women aged 56–59.<sup>22</sup> A female planning to retire at age 57 when the retirement age was 60 (or her husband's retirement age was 65) may postpone her retirement to age 60 following an increase in her own retirement age (or her husband's retirement age). Evaluating females solely at ages 58–61 will thus not capture the effects of the reform on younger cohorts. Indeed, Appendix Table A10 reports that the

---

<sup>21</sup> We note that as in the previous double regression discontinuity estimation strategy, the effect of the reform might be underestimated due to the control group consisting of individuals who may have been also affected to some extent by the reform.

<sup>22</sup> Appendix Table A6 and Appendix Table A7 present the number of observations and the summary statistics of couples' characteristics in control and treatment pre-reform groups. Appendix Table A8 replicates also the pre-reform trend analysis for these younger cohorts. Similar to the conclusions derived for older cohorts, we find that the treatment and control groups have in almost all cases the same pre-reform time trends in all four outcomes.



estimated effect of the reform on younger cohorts has similar patterns as for the older cohorts (Table 9) though most of the sizes of the effects are marginally lower (for example, for men, the sizes of the effect of own retirement age deferral on all four outcomes for younger cohorts are: 0.059, SE=0.016, 28,477, SE=5,311, 9,539, SE=6,690 and 0.0212, SE=0.01, respectively, and for older cohorts the sizes of the effects are: 0.0865, SE=0.021, 31,375, SE=5,948, 14,823, SE=6,620 and 0.0365, SE=0.01, respectively).

We note that we can utilize this additional estimation strategy to test whether the same results on spouses' employment rates are obtained using two different estimation strategies with different underlying assumptions. The double regression discontinuity design assumes that by comparing couples with a similar age structure, within a sufficiently narrowly defined set of birth cohorts, the differences between spouses' probability of working in a specific month among those assigned to control versus treatment groups results solely from the effect of the change in legislation. In contrast, the double difference-in-differences estimation strategy assumes that comparing treatment to control groups' differences in spouses' mean working months per year before and after the reform results solely from the effect of the reform, if their pre-reform trends are similar.

Indeed, comparing the sizes of the effects on the monthly probability of working according to the double regression discontinuity approach (Table 4, baseline specification) to the mean yearly working months according to the baseline double difference-in-differences approach (Table 9, Panel A) reveals that the coefficients are of similar magnitude. Simulating the effect size of postponing the retirement age increases men's probability of working from 0.287 to 0.371 percent, meaning by 8.4 percentage points based on the double regression discontinuity approach (baseline specification). The magnitude of these effects is similar, although the first refers to the average effect of the reform during its implementation period (2004-2009), while the later refers to the overall effect of the reform, i.e. the change in the probability of working in 2009/10 compared to 2003/4. According to the double difference-in-differences approach, it increases men's mean working months per year by almost one month, meaning men's probability of working rise by 8.65 percentage points.<sup>23</sup> The same calculations for women also yield similar sizes of the effects, but the estimates of the double difference-in-differences approach are not statistically significant (the respective estimated effects of own retirement age deferral according to both tables are 5.6 versus 3 percentage points; the estimated effects of

---

<sup>23</sup> We note that this calculation assumes that the monthly probabilities of working are independent.

spouse retirement age deferral are 2.7 versus 1.23 percentage points; and the estimated effects of the interaction term are -1.9 versus -2.1 percentage points).

As an additional robustness check to further test the validity of the double difference-in-differences estimation strategy's assumption, we carry out a placebo analysis. We replicate the analysis presented in Table 9 for couples before the reform was implemented. Our treatment and control groups include, as before, four age cohorts each: our treatment group includes men aged 63–66 and women aged 58–61, and our control group includes men aged 67–70 and women aged 62–65. However, now the “pre-reform” and “post-reform” periods both cover years before the reform actually took place. This placebo analysis tests whether the results of our baseline double difference-in-difference estimation can be derived solely from control versus treatment groups' labor market outcomes differences over time due to their different age cohorts, regardless of the reform's implementation. The estimates of this placebo analysis, presented in Appendix Table A10, reveal that the two groups' labor market outcome differences between two periods before the reform was implemented are indeed not statistically different from each other.

To conclude, using the double difference-in-differences estimation strategy we showed that the reform affected not only spouses' employment rates but also their annual salaries and job stability. In addition, this estimation strategy enabled us to test the anticipation effects of the reform also on younger cohorts, revealing that they were also affected by the reform, though to a lesser extent. Moreover, we used this estimation strategy for two additional robustness checks. We showed that the double regression discontinuity and double difference-in-differences identification strategies yield overall similar patterns and are of comparable effect sizes when analyzing the work status case, providing additional evidence that our results capture the causal effect of the reform and do not depend on the identification strategy utilized. We also perform a placebo test in order to reject the alternative interpretation that our results could be derived only by control versus treatment groups' age differences regardless of the reform's implementation

## **6. Conclusion**

Looking forward, the challenge of balancing sustainability of social security systems and providing an adequate income in retirement will become more pronounced in many countries around the world. Since most couples nearing retirement age are dual-earners, it is important

to understand the implication of pension reforms at a household level. In this paper, we analyze couples' joint retirement decisions as a result of their retirement age deferrals.

In December 2003, the Israeli government approved a reform to defer the age of retirement benefits for both men and women. The reform, which was gradually implemented over five years, was reflected in the deferral of the age of eligibility for employment-related pensions (the second pillar of retirement savings), as well as for the old age allowance that is dependent on a means test (the first pillar of saving for retirement). Using a detailed database, this setup enables us to detect the labor supply effects of own and spouse's retirement age deferrals of both genders and their interactions.

For identification, we use a double regression discontinuity design and rely on comparison of employment rates of couples with the same age structure, before and after the reform was implemented. We conduct several robustness checks to validate our main identification strategy, such as adding couples' year of birth interaction fixed effects to the baseline specification; and replicating the main results using a difference-in-differences estimation strategy with other identifying assumptions.

We find that increasing own retirement age raises the employment rate of men by 7 to 8 percentage points. For women, the effect size of own retirement age on employment rates depends on their husband's retirement age deferral. Their employment rate increases by about 6 percentage points due to only their own retirement age deferral, and it increases by 3 to 5 percentage points due to only their husband's retirement age deferral. However, deferring both spouses' retirement ages will not further increase women's labor supply relative to the case where only their own retirement age is postponed.

We show that when the interaction between both spouses' retirement age deferrals' effects is not taken into account, one would expect the effect sizes of each separate spouse retirement age deferrals on women's employment rate to be lower by almost half, and the joint effect size of both spouses' retirement age deferrals to be similar. Understanding the interdependencies of spouses' retirement age deferrals is therefore necessary for designing better retirement age reform policies and correct evaluate the consequences of postponing spouses' retirement ages.

Furthermore, we also analyze heterogenous effects of the reform over several dimensions, such as individuals' ages, education levels and prior employment status. We find that the effect of the reform is stronger among younger, more highly paid and more educated individuals.

Moreover, we show that the reform affects in similar ways not only spouses' probability of working, but also several additional labor market outcomes, such as annual salary and the probability of keeping the same job throughout the year.

## **7. References list:**

- Abuhazira, Y. S. (2010). "The Bedouin Population in Israel Population Register Compared with Population Estimation as Basis of Demographic Indexes", Central Bureau of Statistics Working Paper No.50.
- Avioz, R. and A. Kimhi (2018). "The Effects of Increasing the Formal Retirement Age on Labor Supply: Gender and Family Considerations". Draft.
- Bank of Israel Report (2010). "The Effect of the Change in Retirement Age Legislation on the Labor market Participation of 50 Years Old Individuals." Chapter 5, 171-175.
- Bank of Israel Report (2014). "Raising the age of retirement and its effect on income." Chapter 5, 154-160.
- Blau, David M. (1998). "Labor Force Dynamics of Older Married Couples", *Journal of Labor Economics*, University of Chicago Press, vol. 16(3), pages 595-629, July.
- Brender, A. (2009). "Distributive Effects of Israel's Pension System", Bank of Israel Discussion Paper No. 2009.10.
- Cribb, Jonathan, Carl Emmerson, and Gemma Tetlow (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.
- Danzer, A. M. (2013). "Benefit Generosity and the Income Effect on Labour Supply: Quasi-Experimental Evidence", *Economic Journal* 123(571), 1059-1084
- Gustman, A.L. and T.L. Steinmeier (2000). "Retirement in Dual-Career Families: A Structural Model", *Journal of Labor Economics*, 18(3), 503–545.
- Gustman, A. L. and T.L. Steinmeier (2004). "Social Security, Pensions and Retirement Behaviour within the Family", *Journal of Applied Econometrics*, 19, 723–737.
- Hanel, B. and R. T. Riphahn (2012). "The Timing of Retirement: New Evidence from Swiss Female Workers", *Labour Economics*, 19(5), 718-728
- Hernaes, E. (2013). "Pension Systems and Labour Supply—Review of the Recent Economic Literature", Working Paper 1/2013, Ragnar Frisch Centre for Economic Research
- Hurd, M. D. (1990). "The Joint Retirement Decision of Husbands and Wives", In D. A. Wise (Ed.), *Issues in the Economics of Aging*. Chicago: University of Chicago Press.
- Mastrobuoni, G. (2009). "Labor Supply Effects of the Recent Social Security Benefit Cuts: Empirical Estimates Using Cohort Discontinuities", *Journal of Public Economics*, 93(11-12), 1224-1233.

Michaud, P., and F. Vermeulen (2011). “A Collective Labor Supply Model with Complementarities in Leisure: Identification and Estimation by Means of Panel Data”, *Labour Economics*, 18, 159–167.

Selin (2017). “What Happens to the Husband’s Retirement Decision When the Wife’s Retirement Incentives Change?”, *International Tax and Public Finance*, June 2017, Volume 24, Issue 3, pp 432–458.

Staubli, S., and J. Zweimuller (2013). “Does Raising the Retirement Age Increase Employment of Older Workers?”, *Journal of Public Economics*, 108, 17-32.

Terkel E. and A. Spivak (2001). "Towards Mandatory Pension Coverage in Israel", *The Economic Quarterly* 2001, Vol. 48, 317-334.

Vermeulen, F. (2002). “Collective Household Models: Principles and Main Results”, *Journal of Economic Surveys*, 16, 533–564.

Vestad, O.L. (2013). “Labor Supply Effects of Early Retirement Provision”, *Labour Economics*, 25, 98-109.

Zweimüller, J., R. Winter-Ebmer and J. Falkinger (1996). “Retirement of Spouses and Social Security Reform”, *European Economic Review*, 40, 449–472.

**Table 1: Definition of Treatment and Control Groups of Men and Women**

	New Statutory Retirement Age		Treatment Group		Control Group	
	Retirement Age	Birthdates	Age in the Sample	Birthdates	Age in the Sample	Birthdates
	(1)	(2)	(3)	(4)	(5)	(6)
<b>A. Men</b>						
First Age Group	65.04	[3/1939,8/1939)	60 - 60.04	[3/1939,3/1941)	60 - 60.04	[3/1937,3/1939)
Second Age Group	65.08	[9/1939,4/1940)	60.04 - 60.08	[9/1939,9/1941)	60.04 - 60.08	[9/1937,9/1939)
Third Age Group	66	[5/1940,12/1940)	60.08 - 61	[5/1940,5/1942)	60.08 - 61	[5/1938,5/1940)
Fourth Age Group	66.04	[1/1941,8/1941)	61 - 61.04	[1/1941,1/1943)	61 - 61.04	[1/1939,1/1941)
Fifth Age Group	66.08	[9/1941,4/1942)	61.04 - 61.08	[9/1941,9/1943)	61.04 - 61.08	[9/1939,9/1941)
Sixth Group	67	[5/1942, .)	61.08 - 62	[5/1942,5/1944)	61.08 - 62	[5/1940,5/1942)
<b>B. Women</b>						
First Age Group	60.04	[3/1944,8/1944)	60 - 60.04	[3/1944,3/1946)	60 - 60.04	[3/1942,3/1944)
Second Age Group	60.08	[9/1944,4/1945)	60.04 - 60.08	[9/1944,9/1946)	60.04 - 60.08	[9/1942,9/1944)
Third Age Group	61	[5/1945,12/1945)	60.08 - 61	[5/1945,5/1947)	60.08 - 61	[5/1943,5/1945)
Fourth Age Group	61.04	[1/1946,8/1946)	61 - 61.04	[1/1946,1/1948)	61 - 61.04	[1/1944,1/1946)
Fifth Age Group	61.08	[9/1946,9/1947)	61.04 - 61.08	[9/1946,9/1948)	61.04 - 61.08	[9/1944,9/1946)
Sixth Age Group	62	[5/1947, .)	61.08 - 62	[5/1947,5/1949)	61.08 - 62	[5/1945,5/1947)

Notes: The table presents the definition of treatment and control groups, of men (Panel A) and women (Panel B). The first two columns present the new statutory retirement ages (column 1) for the different birth cohorts (column 2). Since the implementation of the reform was gradual, six age groups of men and women were defined according to their different retirement ages deferrals (columns 3 and 5). The treatment groups include all individuals at these ages, whose date of birth is up to two years later than the date for which the new retirement age went into effect (column 4). The control groups include all the individuals at these ages born up to two years prior to that date (column 6).

**Table 2: Summary Statistics of Individuals and their Spouses, by Gender**

	<b>Men</b>	<b>Women</b>
	(1)	(2)
Number of Children	3.264 (1.825)	3.178 (1.811)
High Education	0.222 (0.415)	0.182 (0.386)
Asian Ethnicity	0.267 (0.442)	0.241 (0.428)
African Ethnicity	0.211 (0.408)	0.210 (0.407)
European/American Ethnicity	0.491 (0.500)	0.523 (0.499)
Israeli Ethnicity	0.031 (0.173)	0.029 (0.168)
New Immigrant	0.069 (0.253)	0.068 (0.253)
Religiosity (Religious Studies=1)	0.016 (0.127)	0.001 (0.246)
High Education Spouse	0.186 (0.389)	0.226 (0.418)
Spouse of Asian Ethnicity	0.024 (0.428)	0.271 (0.445)
Spouse of African Ethnicity	0.241 (0.428)	0.206 (0.405)
Spouse of European/American Ethnicity	0.521 (0.499)	0.491 (0.499)
Spouse of Israeli Ethnicity	0.026 (0.159)	0.031 (0.173)
New Immigrant Spouse	0.079 (0.276)	0.079 (0.270)
Household Income in 1995	11383 (15343)	11389 (15008)
Work Status in 1995 (Employed==1)	0.874 (0.332)	0.715 (0.451)
Number of Observations	3477	3285

**Notes:** The table presents the characteristics of individuals and their spouses, for the two datasets of men and women. Higher education is a dummy that equals 1 if holding a B.A. degree or higher. New immigrant is a dummy that equals 1 if the individual immigrated to Israel after 1990. Household income consists of wage income, allowances and pension payments and income from other sources in 1995. Working status equals 1 if the individual was employed in 1995. Standard deviations are reported in parentheses.

**Table 3: Balancing Tests for the Assignments of Individuals and their Spouses in a Specific Month to the Treatment Group, by Gender**

	<b>Men</b> (1)	<b>Women</b> (2)
Number of Children	-0.061 (0.054)	-0.152 (0.053)
High Education	0.021 (0.014)	0.007 (0.013)
Asian Ethnicity	-0.016 (0.026)	-0.020 (0.016)
African Ethnicity	0.011 (0.009)	-0.019 (0.013)
European/American Ethnicity	0.011 (0.030)	0.042 (0.023)
Israeli Ethnicity	-0.006 (0.006)	-0.002 (0.004)
New Immigrant	0.005 (0.008)	0.008 (0.009)
Religiosity (Religious Studies=1)	-0.001 (0.002)	0.001 (0.001)
High Education Spouse	0.023 (0.016)	-0.007 (0.014)
Spouse of Asian Ethnicity	-0.006 (0.018)	-0.010 (0.017)
Spouse of African Ethnicity	-0.004 (0.011)	-0.010 (0.011)
Spouse of European/American Ethnicity	0.015 (0.020)	0.028 (0.017)
Spouse of Israeli Ethnicity	-0.006 (0.018)	-0.008 (0.017)
New Immigrant Spouse	0.004 (0.008)	0.008 (0.010)
Household Income in 1995	1248 (859)	-606 (546)
Work Status in 1995 (Employed==1)	0.008 (0.010)	-0.005 (0.014)
Number of Observations	24,963	24,756

**Notes:** The table presents balancing tests for the assignment of individuals and their spouses in a specific month to the treatment group, separately for men (column 1) and women (column 2). The dependent variable in each regression is the characteristic of the individual or his/her spouse and the explanatory variable is a dummy for being assigned to the treatment group in a specific month. Additionally, all regressions include the ages of both spouses (at a monthly level) and year fixed effects, and are run separately for men (column 1) and women (column 2). Standard errors are corrected for couples' years of birth interaction clustering and are presented in parentheses.



**Table 4: Estimated Effects of Own and Spouse's Retirement Age Deferrals and its Interaction on Own Probability of Working**

	Men			Women		
	Own Deferral (1)	Spouse's Deferral (2)	Interaction Term (3)	Own Deferral (4)	Spouse's Deferral (5)	Interaction Term (6)
Year FE	0.097 (0.006)	0.007 (0.014)	-0.016 (0.020)	0.059 (0.014)	0.044 (0.011)	-0.033 (0.013)
Year FE and Couples' Ages	0.094 (0.007)	0.016 (0.017)	-0.015 (0.020)	0.062 (0.014)	0.044 (0.009)	-0.032 (0.012)
Year FE and Couples' Ages and Other Characteristics	0.084 (0.013)	0.004 (0.011)	-0.006 (0.015)	0.056 (0.011)	0.027 (0.010)	-0.019 (0.011)
Year FE, Couples' Ages, Other Characteristics and Years of Birth FE	0.067 (0.026)	0.013 (0.011)	0.004 (0.031)	0.060 (0.016)	0.046 (0.016)	-0.048 (0.022)
Number of Observations	23,862			23,720		

Notes: The table presents the effects on individual's probability of working of own retirement age deferral (columns 1 and 4), of spouse's retirement age deferral (columns 2 and 5) and its interaction (columns 3 and 6), separately for men and women according to the double regression discontinuity estimation strategy. The table presents the coefficient estimated according to four different specifications. The first specification includes only year fixed effects, the second specification includes also the ages of the couples (at a monthly level); and the third specification, which is our baseline specification, includes additional couples' characteristics. The fourth specification include an additional control: the interaction between the couples' years of birth fixed effects. Standard errors are corrected for couples' years of birth interaction clustering and are presented in parentheses.

**Table 5: Estimated Effects of Own and Spouse's Retirement Age Deferrals on Own Probability of Working, from Simplified Versions of the Model**

	Men			Women		
	Including only Own Deferral Effect	Including both Own and Spouse Deferral Effects		Including only Own Deferral Effect	Including both Own and Spouse Deferral Effects	
	Own Deferral (1)	Own Deferral (2)	Spouse's Deferral (3)	Own Deferral (4)	Own Deferral (5)	Spouse's Deferral (6)
Year FE and Couple's Ages and Other Characteristics	0.082 (0.014)	0.082 (0.014)	0.001 (0.017)	0.046 (0.011)	0.046 (0.011)	0.017 (0.009)
Year FE and Couple's Ages, Other Characteristics and Years of Birth FE	0.074 (0.021)	0.075 (0.021)	-0.006 (0.014)	0.033 (0.014)	0.033 (0.014)	0.022 (0.012)
Number of Observations						

Notes: The table presents the effects on individual's probability of working from two simplified versions of the model: 1) a version where the interaction term is not incorporated in the model (columns 2-3 for men and columns 5-6 for women); 2) and another version where no spouses' effects are incorporated at all (column 1 for men and column 4 for women). In both versions, the main specifications (baseline and couples' years of birth fixed effects specifications) are the same as in Table 4. In the first version standard errors are corrected for couples' years of birth interaction clustering. In the second version without spouse's effects, standard Errors are clustered within individual's year of birth and are presented in parentheses.

**Table 6: Estimated Effects of Own Retirement Age Deferral on Own Probability of Working, by Sub-Samples of Missing and Non-Missing Month of Birth**

	<b>Men</b>		<b>Women</b>	
	<b>Individuals with Inadequate Month of Birth</b>	<b>Individuals with Adequate Month of Birth</b>	<b>Individuals with Inadequate Month of Birth</b>	<b>Individuals with Adequate Month of Birth</b>
	(1)	(2)	(3)	(4)
Year FE, Individuals' Age and Other Characteristics and Year of Birth FE	0.063 (0.015)	0.074 (0.025)	0.048 (0.002)	0.035 (0.018)
Number of Observations	6,691	18,272	6333	18,418

Notes: The table presents the effect of own retirement age deferral for men and women respectively, based on the simplified version of the model without including spouses' retirement age deferral effects. Columns 1-2 and 3-4 present the effects of own retirement age deferral for men and women respectively according to two sub-samples: one sub-sample of individuals with inadequate date of birth and the other with adequate date of birth. The regressions include the effect of own retirement age deferral, controlling for individuals' age and other characteristics and year of birth fixed effect. Standard Errors are clustered within individuals' year of birth and are presented in parentheses.

**Table 7: Estimated Effects of Own and Spouse's Retirement Age Deferrals and its Interaction on Own Probability of Working, by Couples' Characteristics**

	Men						Women					
	Own Deferral	Spouse's Deferral	Interaction Term	Own Deferral	Spouse's Deferral	Interaction Term	Own Deferral	Spouse's Deferral	Interaction Term	Own Deferral	Spouse's Deferral	Interaction Term
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<b>A. Couples' Working Status</b>	<b>Working Couples</b>			<b>At Least One Spouse is not Working</b>			<b>Working Couples</b>			<b>At Least One Spouse is not Working</b>		
Year FE, Couples' Ages and Other Characteristics	0.082 (0.018)	0.008 (0.016)	0.000 (0.027)	0.089 (0.039)	-0.007 (0.027)	-0.019 (0.045)	0.070 (0.023)	0.022 (0.028)	-0.013 (0.027)	0.033 (0.021)	0.051 (0.037)	-0.033 (0.042)
Year FE, Couples' Ages, Other Characteristics and Years of Birth FE	0.077 (0.031)	0.036 (0.016)	-0.012 (0.043)	0.060 (0.042)	-0.019 (0.030)	0.011 (0.051)	0.099 (0.020)	0.062 (0.031)	-0.079 (0.032)	0.006 (0.020)	0.025 (0.032)	-0.008 (0.048)
Number of Observations	15291			8344			15251			8245		
<b>B. Individual Salary</b>	<b>High Individual Salary</b>			<b>Low Individual Salary</b>			<b>High Individual Salary</b>			<b>Low Individual Salary</b>		
Ba Year FE, Couples' Ages and Other Characteristics	0.095 (0.027)	0.004 (0.002)	-0.026 (0.035)	0.073 (0.021)	0.007 (0.026)	0.013 (0.027)	0.071 (0.031)	0.036 (0.022)	-0.033 (0.033)	0.038 (0.025)	0.016 (0.017)	0.007 (0.029)
Year FE, Couples' Ages, Other Characteristics and Years of Birth FE	0.077 (0.051)	0.011 (0.026)	-0.013 (0.051)	0.057 (0.046)	0.020 (0.028)	0.014 (0.030)	0.086 (0.037)	0.087 (0.034)	-0.090 (0.055)	0.026 (0.039)	-0.006 (0.016)	0.015 (0.037)
Number of Observations	12507			11355			12031			11689		

**Table 7: Estimated Effects of Own and Spouse's Retirement Age Deferrals and its Interaction on Own Probability of Working, by Couples' Characteristics- Continued**

	Men						Women					
	Own Deferral	Spouse's Deferral	Interaction Term	Own Deferral	Spouse's Deferral	Interaction Term	Own Deferral	Spouse's Deferral	Interaction Term	Own Deferral	Spouse's Deferral	Interaction Term
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<b>C. Individual's Education Level</b>	<b>High Education</b>			<b>Low Education</b>			<b>High Education</b>			<b>Low Education</b>		
Year FE, Couples' Ages and Other Characteristics	0.180 (0.061)	0.144 (0.021)	-0.126 (0.079)	0.070 (0.013)	-0.015 (0.014)	0.012 (0.015)	0.156 (0.045)	0.114 (0.051)	-0.159 (0.061)	0.047 (0.010)	0.015 (0.011)	0.002 (0.012)
Year FE, Couples' Ages, Other Characteristics and Years of Birth FE	0.088 (0.071)	0.178 (0.038)	-0.060 (0.095)	0.073 (0.024)	-0.005 (0.017)	0.001 (0.029)	0.225 (0.042)	0.127 (0.024)	-0.222 (0.089)	0.048 (0.013)	0.040 (0.018)	-0.031 (0.022)
Number of Observations	2770			21048			2760			20889		

Notes: The table presents the effect on individual's probability of working of own retirement age deferral, of spouse's retirement age deferral and its interaction, separately for men and women, based on three stratification of the sample: Panel A shows the results of the stratification based on whether both spouses were working in 1995 or not, according to 1995 Israeli census; Panel B presents the stratification of the sample by high versus low individual income in 1995 (higher or lower than the median salary income); and Panel C displays the results of the reform by individuals' level of education (dummy for highly educated=1 if holding a B.A. degree or higher). The estimates are from both the baseline specification and the couples' years of birth fixed effect specification. Standard errors are corrected for couples' years of birth interaction clustering and are presented in parentheses.

**Table 8: Estimated Effects of Own and Spouse's Retirement Age Deferrals and its Interaction on Own Probability of Working, by Age Group Cohorts**

	Men			Women		
	Own Deferral	Spouse's Deferral	Interaction Term	Own Deferral	Spouse's Deferral	Interaction Term
	(1)	(2)	(3)	(4)	(5)	(6)
<b>A. First Two Age Cohorts</b>						
Year FE, Couples' Ages and Other Characteristics	0.120 (0.034)	0.062 (0.027)	-0.133 (0.027)	0.117 (0.036)	0.060 (0.034)	-0.082 (0.036)
Year FE, Couples' Ages, Other Characteristics and Years of Birth FE	0.086 (0.021)	0.035 (0.031)	-0.120 (0.037)	0.112 (0.048)	0.064 (0.043)	-0.099 (0.048)
Number of Observations		9,310			9,269	
<b>B. First Three Age Cohorts</b>						
Year FE, Couples' Ages and Other Characteristics	0.094 (0.025)	0.010 (0.015)	-0.047 (0.020)	0.091 (0.021)	0.021 (0.020)	-0.042 (0.019)
Year FE, Couples' Ages, Other Characteristics and Years of Birth FE	0.088 (0.036)	0.007 (0.014)	-0.049 (0.026)	0.088 (0.030)	0.033 (0.020)	-0.066 (0.027)
Number of Observations		14,730			14,674	
<b>C. First Four Age Cohorts</b>						
Year FE, Couples' Ages and Other Characteristics	0.096 (0.017)	0.000 (0.012)	-0.013 (0.018)	0.060 (0.016)	0.023 (0.014)	-0.013 (0.015)
Year FE, Couples' Ages, Other Characteristics and Years of Birth FE	0.088 (0.032)	0.011 (0.013)	-0.019 (0.030)	0.067 (0.024)	0.038 (0.016)	-0.048 (0.027)
Number of Observations		19,529			19,445	
<b>D. First Five Age Cohorts</b>						
Year FE, Couples' Ages and Other Characteristics	0.088 (0.013)	0.006 (0.012)	-0.010 (0.016)	0.059 (0.012)	0.032 (0.011)	-0.019 (0.011)
Year FE, Couples' Ages, Other Characteristics and Years of Birth FE	0.074 (0.028)	0.017 (0.011)	-0.003 (0.031)	0.066 (0.017)	0.052 (0.018)	-0.056 (0.022)
Number of Observations		22,991			21,760	

**Notes:** The table presents the effects of retirement age deferral on the different age cohorts of the sample, adding gradually each age cohort at a time (the different age cohorts are defined in Table 1). Panel A, presents the effect of retirement age deferral only on the first two age cohorts (men/women aged 65/60 to 65/60 and 8 months); Panel B, presents similarly the effects for the first three age cohorts (men/women aged 65/60 to 66/61); Panel C, presents similarly the effects for the first four age cohorts (men/women aged 65/60 to 66/61 and 4 months); and Panel D, presents similarly the effects for the first five age cohorts (men/women aged 65/60 to 66/61 and 8 months). The estimated effects are presented for the baseline specification and on a specification that includes additionally couples' year of birth interaction fixed effects. Standard errors are corrected for couples' years of birth interaction clustering and are presented in parentheses.

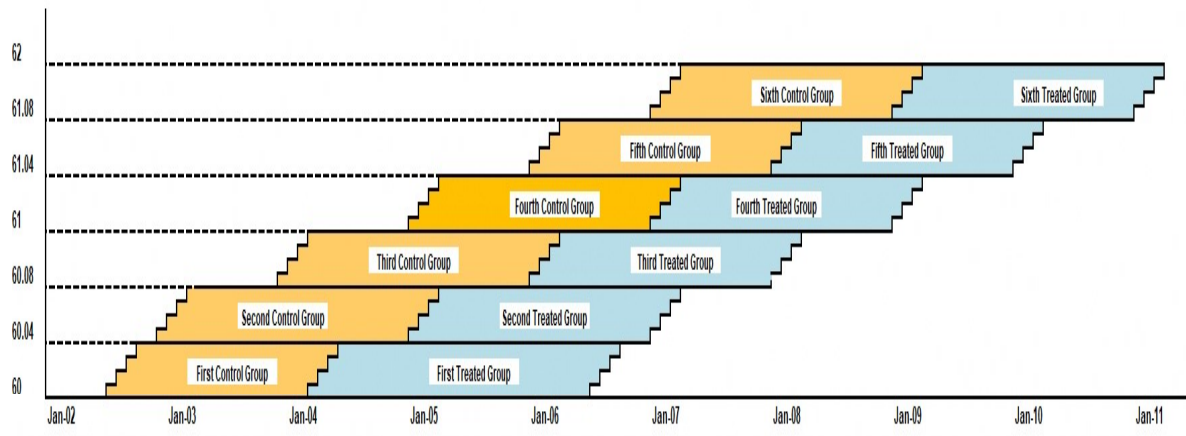
**Table 9: Double Difference-in-Differences Estimation**

	Men			Women		
	Own Deferral	Spouse's Deferral	Interaction Term	Own Deferral	Spouse's Deferral	Interaction Term
	(1)	(2)	(3)	(4)	(5)	(6)
<b>A. Mean Working Month per Year</b>						
Couples' Characteristics and Year Fixed Effects	0.086 (0.0210)	0.006 (0.018)	-0.022 (0.031)	0.031 (0.021)	0.012 (0.016)	-0.021 (0.028)
Number of Observations		50,216			49,761	
<b>B. Annual Salary of all Individuals</b>						
Couples' Characteristics and Year Fixed Effects	31,375 (5,948)	1,410 (5,256)	-12,508 (8,547)	8,933 (3,879)	9,145 (2,196)	-8,865 (4,613)
Number of Observations		50,506			49,633	
<b>C. Annual Salary of Working Individuals</b>						
Couples' Characteristics and Year Fixed Effects	14,823 (6,620)	6,262 (7,020)	-16,077 (9,340)	5,949 (5,408)	11,847 (3,525)	-13,130 (5,932)
Number of Observations		29,620			22,190	
<b>D. Probability of Keeping the Same Job in a Given Year</b>						
Couples' Characteristics and Year Fixed Effects	0.036 (0.01)	-0.028 (0.014)	0.0142 (0.017)	0 (0.011)	0.007 (0.01)	-0.08 (0.01)
Number of Observations		20,366			19,656	

**Notes:** The table presents the difference-in-difference estimated effects of own retirement age deferral (columns 1 and 4), of spouse's retirement age deferral (columns 2 and 5) and its interaction (columns 3 and 6) on several labor force characteristics: the mean number of working months within a year (Panel A), annual salary of all individuals (Panel B), annual salary of workers (Panel C) and the probability of keeping the same job within a given year (Panel D). Each regression includes the couple's characteristics, separately for men and women. Standard errors are corrected for couples' years of birth interaction clustering and are presented in parentheses.

Figure 1: Treatment and Control Groups, by Gender

### Women's Age



### Men's Age

