# The Effect of a Longer Working Horizon on Individual and Family Labour Supply*

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**Abstract**

When search is costly, the returns from a job depend on its expected duration; in pensions systems in which individuals tend to retire as soon as they reach eligibility, a longer distance to retirement may not only affect the labour supply of individuals around the eligibility threshold, but it may also boost the search effort of younger individuals, whose working horizon has increased. This paper estimates the comprehensive labour supply responses to a longer distance to retirement at the individual and at the household level. Identification exploits the latest pension reform implemented in Italy in 2012, which significantly increased the minimum retirement age, heterogeneously across narrowly defined cells. To isolate the effect of a longer distance to retirement to the one related to the immediate loss of pension eligibility and, thus, pension income, we focus on individuals who were not eligible for retirement even under the pre-reform rules. We estimate sizeable positive effects on female participation at all ages (between 45 and 59), but no response of men. Within families, a longer wife's working horizon also raises her husband's participation; the opposite effect does not seem to be in place.

**Keywords**: Family economics; Labour Supply; Retirement

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# 1 Introduction

Aging is one of the major challenges faced by developed economies in this century, as it puts enormous pressure on fiscal systems and it threatens the sustainability of Pay As You Go pension regimes. Since the '90s, governments responded by implementing different types of pension reforms. Delaying the mandated retirement age and therefore postponing the age at which pension benefits can be claimed has been a widely adopted one, with the ultimate effects of lowering the number of pension recipients and of potentially enlarging the tax base through positive labour supply responses (OECD, 2015).

The extent to which this policy actually increases the labour force participation of the elderly is not *a priori* obvious, however. The available evidence regarding the elasticity of labour supply to pension eligibility tends to find positive but rather small effects; the effect moreover depends on the availability and the generosity of other welfare programs (like disability benefits, see Arpaia et al. (2009) for a discussion), or on the development of private pension schemes which allow individuals to retire even if they do not reach eligibility for a public pension. The labour supply responses of a higher retirement age may, however, not be limited to the mechanical effect on older individuals, who would have been eligible to retire before the increase in the legal retirement age, and have to postpone retirement after the pension reform.

Indeed, the macroeconomic literature identifies a labour supply channel which affects all individuals and operates through the length of their working horizon. In Social Security systems where people retire as soon as they become eligible (like the European ones that impose heavy taxes on continued working activity after retirement, see Gruber and Wise (2004)), the working horizon is delimited by the minimum retirement age, which affects the duration of a job.[1] A longer expected duration of a job increases its value in models in which search is costly and there are search frictions; delaying the pension eligibility therefore affects the labour market behaviour of all individuals, inducing them to participate more in the labour market. Whether this translates into more employment or more unemployment is instead ambiguous; the longer working horizon on the one hand increases search effort (*search effort effect*) but, on the other hand, it allows individuals to be less impatient in accepting a job, therefore boosting their reservation wage (*reservation wage effect*). In addition to individual level responses, the labour supply effect may be amplified or reduced through intra-household spillovers, as changes in one partner's distance to retirement may also have effects on the other partner's labour supply. Suppose that an individual's participation increases in response to her longer working horizon; her partner's working behaviour may change, for instance by reducing his own labour supply (effects via the household budget constraint) or by increasing it, in the impossibility of enjoying leisure together (effects given by the presence of leisure complementarities).

This paper provides a quantification of the distance to retirement effect, both at individual and at the family level. We go beyond the estimates of the mechanical effect on labour participation derived from the immediate loss of the pension eligibility

[1] This literature uses this effect to explain the low employment rates of the elderly, even when they are still not eligible for claiming pension benefits. Before the massive pension reform implemented in Italy, in 2011 the employment rate for individuals aged 55-64 (37.8%) was about half of that of younger age classes (72.2% for 45-54 y.o.; 74.6% for 35-44; 65.3% for 25-34), with the exception of the youngsters (15-24).

criteria (which affects individuals would have been eligible to retire but whose eligibility is delayed), and we focus on participation and job search behaviours of younger individuals, whose working horizon increases, and of their partners, who may respond as well via intra-household interactions.[2]

Several identification issues hinder the estimation of the causal effect of a higher MRA on labour supply. For instance, in a job search model, individuals with better employment opportunities are more likely both to have a longer working horizon and to supply more labour, independently of the direct effect of a longer expected job duration on the probability of looking for a job. A simple comparison of the labour supply of individuals with longer or shorter working lives would therefore be misleading.

To solve for the endogeneity between the duration of one's working life and her labour supply decisions, the empirical analysis exploits changes in the minimum retirement age (from now on MRA) induced by an Italian pension reform that took place in 2012[3] and that increased MRA, on average, by 4 years. Since the mandated increase in MRA was highly heterogeneous, mainly depending on workers' gender, previous contributory history and year of birth, we source on detailed individual level data from the Bank of Italy's Survey on Household Income and Wealth (SHIW) to estimate a difference-in-differences model that exploits variation in the extension to MRA within narrowly defined cells.

We find that an increase in the working horizon set by a delayed MRA has positive effects on labour supply, employment and unemployment probabilities along the entire life-cycle for women. Overall, the probability of participating in the labour market increases by 4.6 percentage points for women between 55 and 59 years old, by 4 percentage points for women aged between 50 and 54 and by 2.1 percentage points for women in their late 40s. While the increase in participation translated into an increase in the employment probability for older women (aged between 50 and 59), it mostly fed the unemployment probability for younger women (45-50 year-olds). The effect, moreover, is mostly concentrated on lower educated individuals: their labour supply is typically more elastic as their marginal benefit in terms of search activity (and therefore of a better match) from the longer working horizon is higher. Much smaller effects are found for men, compatibly with women's greater labour supply elasticity. Our comprehensive set of estimates allows us to infer that about one third of the growth in the activity rate of Italian 15-64 year-old women between 2010 and 2014 can be attributed to the reform-induced increase in the working horizon, which also explains about 19% of the increase in the share of unemployed women observed in the same period.[4] Moreover, we find that the effect on women's labour supply has significant spillovers within the household. Our estimates suggest that husbands are induced to increase their labour supply if their wives' working horizon increases. A one year increase in the wives' working

[2]An increase of the distance to the minimum retirement age for pension eligibility might also imply reductions in the future pension wealth. However, even with this caveat in mind, we are quite confident that we actually estimate the effect of the longer working horizon only, since individuals do not seem particularly accurate in predicting their future pension wealth (Bottazzi et al., 2006).

[3]The minimum retirement age is the minimum age at which an individual can retire under either the old age or seniority pension system. Section 4 provides a detailed description of how this variable is built.

[4]These effects come from the increase in the working horizon of individuals who would not have been eligible to retire in any case, they therefore exclude the possible direct effect coming from the postponement of the pension eligibility criteria for those who would have been eligible otherwise.

horizon increases their husbands' labour supply by 2.9 percentage points, mostly because men postpone their retirement decisions. The contrary does not seems to hold, maybe because there is no direct effect on men in the first place. Overall, spillovers within the family extensively amplify the distance to retirement effect, by affecting men's labour force participation as well.

The literature investigating the labour supply effect of a longer working horizon, net of the mechanical response of individuals who would have been eligible to retire but whose pension income is postponed, is rather scarce. Indeed, most of the previous studies focuses on the elasticity of retirement and employment of the elderly to the pension eligibility threshold (Song and Manchester, 2007; Liebman et al., 2009; Mastrobuoni, 2009; Staubli and Zweimüller, 2013; Manoli and Weber, 2016). Isolating the distance to retirement effect is instead rather demanding, as it requires to find and measure exogenous changes in the individuals' expected retirement age. The Italian setting allows us to overcome many of the reasons why these types of tests are rarely implemented in practice. The increase in the mandated retirement age induced by the 2012 pension reform in Italy was sizeable and well-understood by the majority of the population, probably because of the inflamed public debate around this reform, which, even if important to strengthen the sustainability of public finances, were considered too onerous for the population. Moreover, the increase was largely heterogeneous, depending on one dimension, the continuity of individuals' previous working life, which we can observe in our data. This provides us a suitable control group for our difference-in-difference estimation. To our knowledge, only Hairault et al. (2010) provide causal evidence of the distance to retirement effect on individual labour supply.[5] They take advantage of a pension reform implemented in France in the '90s, which increased the mandated retirement age for old age pensions by about one year per cohort. Since they do not observe the number of accrued years of contribution and they proxy them by using age at first job, their analysis restricts to men who are more likely to have continuous careers. They study the response of individuals older than 57 and find the effect to be positive but non significant, maybe because of the small sample size. We extend the analysis to women, the group with the highest expected elasticity to the policy change, and to individuals in a broader set of age classes (in particular those in their 40s and 50s).[6] Moreover, we do not limit our analysis to the effects at the individual level but we investigate how the effect is magnified or reduced by intra-household responses. Our paper therefore speaks also to the literature on family labour supply and retirement decisions. The existing studies on family's behaviours mainly focus on partners' joint retirement and participation decisions (Coile, 2004; Hospido and Zamarro, 2014; Bloemen et al., 2015; Lalive and Parrotta, 2017) and

[5]Following their analysis, also Sabatier and Legendre (2017) analyze the distance effect on a different French data source which contains information also on health status. They show that the poor health status amplifies the distance effect, which is small on average. Distance to retirement seems to positively affect also older male workers' participation to training programs (Montizaan et al., 2010; Brunello and Comi, 2015) and healthy behavior of middle-age workers (Bertoni et al., 2017): workers try to take advantage of the increased returns to job.

[6]Engels et al. (2017) also look at the labour market effects of pension rules on non eligible individuals, called anticipation effects. They do not identify a distance effect since the reform they exploit introduced monetary disincentives for early retirement and did not change the mandated retirement age. The anticipation effect for women aged 55-59 is positive regarding employment, negative on unemployment. These effects are not evaluated for younger cohorts, as we do.

their time allocation after retirement (Stancanelli and Soest, 2012; Ciani, 2016). They tend to find large within-household interactions, which importantly amplify the individual direct effects. We contribute to this literature by providing estimates of how partners' distance to retirement affects the overall family labour supply. We show that participation and retirement decisions depend not only on partners' pension eligibility, both at the individual and at the family level, but also on how far they are to retirement eligibility.

From a policy perspective, our results support the effectiveness of policies aimed at postponing the mandated retirement age in boosting labour market participation, especially of those population groups less attached to the labour market - low educated women. We find evidence that, in settings in which individuals retire once they reach pension eligibility, a higher MRA generates a positive labour supply effect, which involves individuals (and their partners) at younger ages through their longer working horizon.

The remainder of the paper is organized as follows: Section 2 provides a short description of the dataset; Section 3 introduces the Italian pension system and describes the reform exploited in the empirical analysis for the identification of the estimated effects; our empirical strategy is then explained and discussed in Section 4; Section 5 shows the descriptive statistics of our selected samples; we provide evidence to validate our identification in Section 6; in Section 7 we report the results of the empirical analysis both at the individual and at the family level; Section 8 provides estimates of the mechanical effect linked to postponing eligibility. Section 9 concludes.

# 2 Data

In our analysis, the information on labour status and expected distance to retirement is obtained from the Italian Survey of Household Income and Wealth (SHIW). SHIW is a biannual survey administered by the Bank of Italy to a sample of Italian households and is the main source of information about family income and wealth in Italy. The Survey is conducted since 1960; however we use the most recent waves, from 2004 to 2016, which include the years around the pension reform we analyze. The sample of the most recent surveys comprises about 8,000 households (20,000 individuals).

SHIW data allow us to construct pension eligibility criteria because they include information on age, gender, sector and type of employment and, importantly, on accrued years of contribution; this allows us to build for each individual the MRA on the basis of the eligibility rules at place each year. Moreover, being a survey, it has the advantage of providing information on expected working life and expected replacement rate, which allows us to support our identifying assumption and the soundness of our approach. Finally, it provides information on labour supply of both spouses within a household, necessary to test for within family interactions.

Despite there is a panel component, for our analysis we only use repeated cross sections, because the panel is short and covers only half of the original sample.

# 3 The Italian pension system and the 2011 pension reform

The Italian pension system is based on two types of benefits linked to the working activity: the old age and the seniority pensions. The first entails that individuals retire after having achieved a certain minimum age; under the second, individuals retire after having accrued a given number of years of paid contribution. At the end of 2011 during the sovereign debt crisis, when the tensions in sovereign debt markets reached unprecedented levels, a substantial pension reform, which affected both pension schemes by introducing stricter eligibility rules, was announced and implemented a few days later (Law 22 December 2011 n. 201, known as "Fornero Reform").[7]

As for the old age pension scheme, before the reform the retirement age was 60 for women and 65 for men, requiring also a minimum number of accrued years of contribution.[8] The Fornero pension reform[9] smoothly increased the retirement age for all workers up to 67 by 2020, both for men and for women, with at least 20 years of paid contribution; moreover, the reform allowed all individuals to retire at 70, as long as they have accrued at least 5 years of contribution.

As for the seniority pension scheme, before the reform, eligibility required either 40 years of contributions (irrespective of age) or a mix of age and years of contributions, the so called "quota system" (for instance the sum of age and years of contributions should have been 96 in 2006, with at least 59 years of age and 36 years of contribution; see Table 1). Rules changed depending on the sector of employment. The Fornero reform abolished the "quota system" and raised the minimum years of paid contributions in 2012 from 40 to 42 for men, to 41 for women.[10]

The new rules in place since 2012 allowed workers who were already eligible for a public pension when the bill passed to retire under the pre-reform rules, without loosing their previous eligibility. This option was not available before the reform: workers could retire in a given year only if eligible under the rules in place that given year.

Finally, the Fornero reform, in addition to increasing the mandated retirement age, changed the pension benefit formula moving individuals with at least 18 years of accrued contribution by January 1996 from a defined benefit to a defined contribution pension scheme for the years after 2011 (therefore linking the pension benefit to the total amount of years of contribution accrued over post 2011 years rather than the last earned wages). In our empirical analysis we take control of it.

The different retirement age by gender, cohort, sector and, mostly, by previously accrued years of contribution implies that individuals have been differently affected by the

[7] At the end of 2010 another pension reform was implemented only in the public sector (Law 30 July 2010 n. 122, known as "Sacconi Reform"). We do not take advantage of it since we do not have data for 2011. A series of reforms aimed at making the Italian pension system sustainable has been implemented since 1993; the Sacconi and Fornero reforms are the most recent ones.

[8] They were at least 20 years for individuals who had started to work before January 1 1996; at least 5 years for those who had started to work after January 1 1996.

[9] The reform passed by decree and could not be anticipated by workers and firms; moreover, it became effective on the 1st of January 2012, ten days after its approval.

[10] In 2013 minimum required years of contributions rise to 43 for men and 42 for women; from 2014 onward to 44 for men and 43 for women.

reform in terms of length of the residual working period before retirement. To understand why, consider three groups of workers differing by the age at which they started to work and by the continuity of their working life; these characteristics determine the pension scheme according to which they will retire and, thus, the shock induced by the pension reform. Those who started to work early and continuously would have retired before the reform under the seniority scheme requiring 40 years of accrued contribution (group 1). Workers with a slightly less continuous working life or who started to work later, would have retired under the "quota" for seniority pension (group 2). Finally, workers with discontinuous working life or who started to work much later, would have retired under the old age scheme (group 3). Depending on gender, the reform differently affected these three groups. As for women, those more exposed have been those who have retired under the old age or the quota scheme, thus those with less continuous working lives (groups 2 and 3). More affected men have been those with an "intermediate" working life (group 2), those hit by the abolishment of the "quota". Panel a of Figure 1 clearly shows this difference. The blue histogram refers to the retirement age under the old age pension system: it went from 60 in 2010 to 67 in 2012 for women, and from 65 to 67 for men. The red histogram reports the average retirement age under the seniority system, given the existing distribution of years of contribution in the population of men and women. On average, women's minimum retirement age (the grey histogram, that is the minimum age between that for old age eligibility and that for seniority pension eligibility) increased from 60 to 64, moving from eligibility for old age scheme before the reform to eligibility for seniority scheme after 2011. Men, because of their more continuous working life, were more likely to retire under the seniority scheme than women before the reform; after, many men reach sooner the eligibility for the old age scheme than that for the seniority one; thus, the minimum retirement age increased from about 63 to 67 years old.

# 4 Identification strategy

Our identification strategy studies the labour supply response of individuals who would not have been eligible to retire even under the pre-reform rules and compares over time the participation rate of those more and less exposed to the increase in MRA, as induced by the 2012 pension reform.

We compute the degree of exposure to the policy of each individual, by constructing cells (denoted as $q$) based on the full interaction of all the characteristics needed to determine MRA in Italy (age, gender, years of contribution and sector of employment).[11]

We create a time invariant measure of exposure to the shock, by taking the difference between the expected MRA under the post-reform and the pre-reform rules ($T_q = MRA_{q,2012} - MRA_{q,2010}$, which determines the cross sectional variation of our shock).

In order to obtain the expected MRA before and after the reform for younger individuals ($MRA_{q,2010}$ and $MRA_{q,2012}$), we need to make assumptions about the expected amount of accrued years of contribution at the end of individuals' working careers. Throughout the paper we assume that individuals in our sample will accumulate years of contribution continuously from the year of the interview onward; this means we mainly exploit heterogeneity in the continuity of their working life in place before the reform. Even if this assumption

[11] This refers to the usual sector of employment for not employed individuals.

may appear problematic for women, whose working life is usually more fragmented, this is the most restrictive choice, as, if anything, we are overestimating the probability that they retire under the seniority regime and we are therefore underestimating their expected shock to MRA. Moreover, using the administrative records of the Italian Social Security Institute, we find that the discontinuous spells in individuals' careers are concentrated before the age of 35 (because of maternity leave periods or longer study paths) and after 60. Comparing the actual contributory histories obtained from the administrative records, we find that the error generated by assuming continuous working lives under a four-year horizon would be on average 1 year and 3 months for individuals in their mid 30s, about 1 year for individuals in their mid 40s and about 9 months for individuals in their mid 50s; the error is more than halved if we consider individuals with more continuous working lives (with at least 10 years of experience). For these reasons, to minimize the possible error generated by this assumption on future contribution years, we exclude from our sample individuals aged less than 45 and those very little attached to the labour market, with less than 10 years of contribution.

Panel a of Figure 2 describes the distribution of the size of the shock to distance from MRA induced by the reform across the population of women, which allows us to identify our control and treatment group for the difference-in-differences analysis. A simple example illustrates one source of the variation in the shock (Table 2). Consider two women, Maria and Antonia, aged 58; they differ in the number of total accrued years of contribution, respectively 38 and 26, because of differences in the continuity of their working lives. Before the reform, the MRA at which Maria could retire was 60 (under the seniority pension regime); after the reform, she could retire at 62, once she reaches 42 years of contribution. As for Antonia, her MRA corresponded to the mandated retirement age for the old age pension, 60, before the reform. Since after the reform it became 67 and since she is not eligible for the seniority pension because of the smaller number of accrued years of contribution, she will have to wait to be 67 to retire. The reform increased the length of the working horizon differently for Maria and Antonia: the former experiences a 2-year increase, the latter a 7-year increase. Figure 2 shows that roughly 30% of women experienced a 7-year shock (like Antonia), because they accrued few contribution years and have to wait till they reach the new MRA for the old age regime after the reform. About 15% of women experience a 2-year shock, because they can still retire under the seniority regime with a given number of years of contribution. Panel b of Figure 2 reports the distribution of the shock for men. The source of variation in the shock for men is different: those who experienced a larger shock are men who would have retired under the quota system before the reform (Mario or Luigi in the example of Table 2); those who experienced a smaller shock are instead men who would have retired under the old age system (like Valerio in the example, whose MRA increased from 65 to 67) and men who started to work very early and could retire with 40 years of social contribution before the reform, 43 after the reform (like Giovanni in Table 2). Figure 2 confirms that, apart from rounding, the minimum $T_q$ for men is 2 years (for men who retire under the old age system at 67 instead of 65); the maximum is 7 years (for men who could have retired under the 97 quota before 2012 -if they were aged at least 62 with at least 35 accrued years of contribution- and have to wait till they achieve 43 years of contribution after the reform).

To capture the variation in distance to retirement exclusively induced by the pension

reform, we estimate the following empirical model separately for men and women and for different age classes. Let $Y_{iqt}$ be a variable that indicates individual $i$'s labour force status in year $t$ within the same cell $q$. The reduced form specification for individual $i$'s labour force status is:

$$Y_{iqt} = \beta_1 T_q * post2011_t + \beta_2 \triangle W_{iqt} + \beta_3 X_{iqt} + \alpha_t + \alpha_q + \epsilon_{iqt} \quad (1)$$

where $T_q$ is the change in the distance to retirement imposed on the cell $q$ by the reform ($MRA_{q,2012} - MRA_{q,2010}$, described in Figure 2), a time invariant measure of exposure to the policy;[12] $post2011_t$ is a dummy that indicates the post reform period; $X_{iqt}$ is a vector of controls at the individual level;[13] $\alpha_t$ are year fixed effects, absorbing long term or cyclical developments that affect all individuals in the same way, and $\alpha_q$ are the fixed effects for each cell $q$, absorbing variations in labour supply that depend on years of experience, age or sector of employment. Moreover, $\alpha_q$ absorb all pre-reform differences in distance to MRA. Finally, $\epsilon_{iqt}$ is an error term. Standard errors are clustered at the cell $q$ level, which defines the cross sectional level of variability of the treatment.

$\triangle W_{iqt}$ is the change in pension wealth induced by the 2012 reform. The 2012 pension reform modified not only the MRA but also the expected pension benefits, for two main reasons. On the one hand, as mentioned in Section 3, it prescribed that all pension benefits would be computed according to a Notional Defined Contribution rule (NDC), starting from 2012. This affected those individuals whose benefits were still computed according to the Defined Benefit (DB) regime.[14] On the other hand, as the 2012 reform increased MRA and therefore individuals now expect to contribute more, it also augmented expected benefits under the NDC system. This channel may affect labour supply through an income effect and may be correlated with $T_q$, as more affected individuals will also receive larger pension benefits. To isolate the distance to retirement effect, we include among the controls $\triangle W_{iqt}$, which simulates the change in pension wealth generated by the new pension rules, under the assumption that individuals will work all years form the year of the interview till the end on their working life.

The coefficient $\beta_1$ therefore estimates the average labour supply differences between cells with longer or shorter working horizons, exclusively depending on their degree of exposure to the policy, around its implementation.

In order to capture changes in labour force status of individuals who were actually exposed to the policy, we exclude from the sample retired individuals and those who could have retired but chose not to, because they represent a very selected sample of the population. In other words, we exclude cells whose $d_{qt} = MRA_{qt} - age_{qt} < 0$.[15] Finally, in our regressions we only consider individuals belonging to cells $q$ - i.e. combinations of age and accrued years of contribution - reasonably close to retirement: we exclude women with less than 10 and men with less than 20 accrued years of contribution, as

[12] We attribute to each cell $q$ for all years the change in distance to retirement $T_q$ experimented by the same cell $q$ in the post reform years.

[13] Marital status, region of residence, usual sector of employment.

[14] Those who in January 1996 - when the Dini reform was implemented - had at least 18 years of contribution. According to our estimates less than 30% of individuals in our sample was affected by the change in the pension benefit formula.

[15] These are women older than 59, men older than 64, individuals with more than 40 years of contribution and individuals eligible to retire under the quota system.

well as individuals younger than 45. Our results are robust to changes in the considered sample.

To fully evaluate the aggregate labour supply effect of increasing the time horizon, we also consider interactions within the family. For instance, a positive effect of a longer working horizon on women labour supply may affect also their husbands' participation or employment probability, positively in the presence of leisure complementarities or negatively because of income effects. To study these interactions, we apply the same strategy as in equation (1) to married or cohabiting couples only. We estimate the labour supply effect on each partner $s = \{w, h\}$ belonging to couple $j$ of an increase in the distance to retirement of partner $s' = \{w, h\}$, where $s$ can be equal or different from $s'$. In particular, we run the following linear probability model, for both partners:

$$Y^s_{jq_sq_{s'}t} = \beta^s_1 T_{q_{s'}} * post2011_t + \beta^s_2 \triangle W_{iq_{s'}t} + \beta^s_3 X_{jt} + \alpha^s_{q_{s'}} + \alpha^s_t + \alpha^s_{q_st} + \epsilon^s_{jq_sq_{s'}t} \quad (2)$$

where $Y^s_{jq_sq_{s'}t}$ is a dummy that indicates the labour force status of spouse $s$ in household $j$ belonging to cell $q_s$ and whose partner $s'$ belongs to the age-contribution cell $q_{s'}$; $T_{q_{s'}}$ is the time invariant indicator of the cells more exposed to the policy based on the observable characteristics of partner $s'$; $post2011_t$ indicates the post reform period; $\triangle W_{iq_{s'}t}$ is the post-2012 change in pension wealth for partner $s'$; $X_{jt}$ is a vector of controls at the individual and household level (region of residence, the difference in distance to retirement and age among partners); $\alpha^s_t$ are year dummies and $\alpha^s_{q_{s'}}$ are fixed effects for the cell $q_s$ based on the characteristics of partner $s$. In order to absorb changes in $s$'s labour supply induced by variation in her own MRA, in our controls we include partner $\alpha^s_{q_st}$, which absorbs partner $s$'s shock to distance to retirement. Finally, $\eta^s_{jq_{s'}t}$ is an error term. The coefficient $\beta^s_1$ estimates the labour supply response of partner $s$ to a longer distance to retirement of partner $s'$.

We apply the same restrictions as in equation (1), for partner $s'$. We do not distinguish, however, by age classes, in order to enlarge the sample size, given the high number of controls. In particular, for the regressions where wives are treated, we consider women aged between 45 and 59 with at least 10 accrued years of contribution; for the regressions where husbands are treated, we consider men aged between 45 and 64 with at least 20 accrued years of contribution. In order to capture the full response of the other partner $s$, even if already eligible to retire, we do not impose restrictions for partner $s$.

# 5 Descriptive statistics

The top panel of Table 3 shows some descriptive statistics about the groups of women and men, more and less exposed to the changes in the pension rules in our sample.[16] Columns 1 and 5 report statistics for the entire sample of women aged 45-59 and men aged 45-64, respectively; Columns 2 and 6 display descriptives for our sample (of individuals not eligible to retire either before and after the reform, and attached enough to the labour

[16]We divide the sample in the following way: women more exposed to the shock are those whose variation in MRA due to the pension rules was $\geq 7$ years and most exposed men are those whose change in MRA was $\geq 4$ years.

market, so to be affected by the change in the working horizon).[17] Individuals in our sample are slightly younger, as we are excluding those eligible to retire (and those retired), and display higher participation rates. Finally, Columns 3 and 4 (and 7 and 8) split the sample between those more or less exposed to the pension reform. Consistent with our discussion above, the table confirms that the most affected among men are the ones with more continuous working lives (with more years of contribution on average with respect to their age, with the exception of those who started to work very early and could retire with 40 years of contribution before the reform, who only experience a three year shock after the reform); while among women, the most affected by the shock are those with more fragmented working lives (who accrued less years of contribution relatively to their age).

The bottom panel of Table 3 displays some descriptive statistics of the couples we consider for our analysis, distinguishing those treated because of a larger shock to the wife's distance to retirement (and the corresponding control group, Columns 1 to 4) and those treated because of a larger shock to the husband's distance to retirement (and the control group, Columns 5 to 8). The table confirms that the wives most exposed to the policy are those with more fragmented working lives, while the most exposed husbands are those who accrued more years of contribution during their working life. Importantly, partners belonging to couples in which either the wife or the husband is treated, are less likely to participate in the labour market than individuals directly treated (Column 6 and 2 of the top panel). The reason is probably that we are not imposing any restriction on the sample of partners, therefore we are including also older individuals already eligible to retire and less attached to the labour market as well as housewives.

# 6 Supporting evidence on the identifying assumptions

Our estimation strategy relies on three main identifying assumptions. The first is that individuals tend to retire as soon as they reach the MRA, so that changes in MRA truly affect the actual retirement age and the actual working horizon. Figure 3 provides evidence in support for the first hypothesis; it shows that a large fraction of individuals retires as soon as they become eligible (i.e. when $MRA = age$), meaning that changes in MRA translate into changes in actual retirement age. The figure plots the probability of being a pensioner, depending on each individual's distance to retirement eligibility ($MRA - age$) in year $t$, for women and men separately. It displays a sharp increase in the probability of retiring around 0 (see also Battistin et al. (2009), Ciani (2016) and Manacorda and Moretti (2006)).[18] This evidence supports the view that the tax on continued activity is relevant in Italy, as the pension system is still not completely actuarially fair. Moreover, the fast sequence of changes in retirement eligibility rules might have introduced uncertainty about the rules in the next future, inducing workers to retire as soon as they become eligible.

[17] As stated in Section 4, we exclude women with less than 10 and men with less than 20 years of contribution, as they are in any case very far away from pension eligibility.

[18] The two vertical lines report the interval between -2 and 2. We highlight this interval because, given the existence of the so-called "finestre mobili" (moving window) most times individuals stay at work one or two year longer because they perceive the retirement benefits with one or one and a half years of delay.

Second, our empirical strategy relies on the assumption that individuals actually modify their expected retirement age according to the new rules introduced by the pension reform. This would imply, for instance, that the expected retirement age of women with more discontinuous working lives, who think they would retire under the old age regime (our treatment group), increased more after 2011 than the expected retirement age of women with more continuous working lives, who would probably retire under the seniority regime (our control group). The top panel of Figure 4 provides support to this second assumption; it shows that, in our sample, women with more fragmented working lives expect their retirement age to increase more after 2011 than women with more continuous working lives. Vice versa, the increase in expected retirement age after 2011 among men who accrued less years of contribution (our control group) is smaller than that of men who accrued more years of contribution and therefore expect to retire under the quota system (our treatment group).

Third, as standard for the estimation of difference-in-difference models, we need to show that the trends in participation rates would have been parallel for individuals with different exposure to the shock, absent the change in the pension rules. In order to test for this assumption, we show that the difference in the labour supply behaviour of individuals with different exposure to the shock was constant before 2012 and starts changing exactly after the introduction of the new pension rules, in 2012. We estimate the following equation for men and women separately:

$$Y_{iqt} = \sum_{r=2006}^{2014} \gamma_r \left(T_q * \delta_r\right) + \gamma Z_{iqt} + \delta_q + \delta_t + \eta_{iqt} \tag{3}$$

where all variables are defined as in equation (1) and $\delta_r$ are year dummies.

We repeat the same exercise for the within family estimation, by estimating the following equation:

$$Y^s_{jq_sq_{s'}t} = \sum_{r=2006}^{2014} \zeta^s_r \left(T_{q_{s'}} * \alpha^s_r\right) + \beta^s Z_{jt} + \alpha^s_{q_{s'}} + \alpha^s_t + \alpha^s_{q_s} + u^s_{jq_sq_{s'}t} \tag{4}$$

where again all variables are defined as in equations (2) and $\alpha^s_r$ are year dummies.

The coefficients $\gamma_r$ and $\zeta^s_r$ of equation (3) and (4) show how the difference in the outcomes $Y_{iqt}$ (or in their spouse's outcomes $Y^s_{jq_sq_{s'}t}$) between individuals ($i$ or $s'$) belonging to the most and the least exposed cells $q$ evolves over time, with respect to the omitted, pre-reform, year. If the parallel trend assumption holds, the coefficients should be close to zero for the years before the reform, implying that the difference in the outcomes is constant when compared to the omitted year, and positive after the reform, if the longer working horizon actually boosts individuals' labour supply. Figure 5 displays the coefficients $\gamma_r$ and the corresponding confidence intervals obtained from estimating equation (3) for women and men (panels a and b, respectively). It shows that for both women and men, the trend was parallel before the 2011 reform. Moreover, it is clear from the figure that after 2011 the labour supply of women more affected by the reform increased relative to that of less affected women, while that of men did not change differentially. In the same way, the figure displays the coefficients $\zeta^s_r$ and the corresponding confidence intervals obtained from estimating equation (4) for wives and husbands (panels

c and d, respectively). In particular, it displays the cross-partner effects and it shows that the trend in the participation probability of both wives and husbands, whose partners were differently exposed to the policy, was parallel before the 2011 reform.

# 7 Results

## 7.1 Individual level analysis

Table 4 reports the results obtained from estimating equation (1) with different dependent variables: a dummy for activity, a dummy for employment and a dummy for unemployment. Moreover, we study the nature of the changes in employment probability: we look at the probability of being employed in a part-time or a full-time job, in a temporary or a permanent job. We choose to split our analysis by gender, both because men and women tend to have heterogeneous labour supply responses and because they have different MRA. We consider different age classes: Columns 1, 2 and 3 report results for women aged 55-59, 50-54 and 45-49, respectively; Columns 4, 5 and 6 report results for men belonging to the same age-classes as shown for women. We chose 5 year long intervals so to have three age brackets and not to look at individuals too young, for whom the assumptions on total expected accrued years of contribution at the end of their working life are more problematic (and also the distance to retirement effect is less likely to be at work).

We find that increasing the length of the working life has a positive effect on female labour force participation for all the considered age classes. The effect is larger for individuals at the end of their working life. These are individuals who would not have been eligible to retire even before the reform, but who may probably respond more because they need to respond more quickly, since they will retire sooner in any case. In particular, we find that if the length of the working life increases by one year, the labour supply increases by 4.6 percentage points for women aged 55-59, by 4 ppt. for women between 50 and 54 and by 2.1 ppt. for younger women (45-50). The increased labour supply translates into higher unemployment (for younger individuals) and into higher employment (especially for older individuals). The type of employment also changes (Table 5): women are more likely to switch from working part-time to working full time, in all age classes. This evidence seems to suggest that workers respond also along the intensive margin of labour supply, and not simply by having a job in order to meet the stricter requirements in terms of accrued years of contribution. Moreover, older women are more likely to be employed on a permanent basis

In line with the existing literature which underlines that male labour supply is much less elastic than the female one, men do not seem to react much to changes in their working horizon, maybe also given the nature of our diff-in-diff exercise, according to which treated men are those more attached to the labour market, while the contrary is for women. Our results for men are broadly in line with Hairault et al. (2010), who find positive but borderline significant effects of a longer working horizon for men.

As stated in the Section 1, the effect on employment might be ambiguous, given by the *search effort* and the *reservation wage* effect. In particular, if on one side the longer distance to retirement eligibility increases the returns from a job and incentivizes search effort (the first aforementioned effect), thus increasing job opportunities, on the other side

it reduces the cost of waiting for a better offer, implying a prolonged unemployment status (the reservation wage effect). Our estimates across age classes seem to suggest that for older individuals the *search effort effect* dominates, translated into higher employment, while for younger individuals dominates the *reservation wage effect*, and unemployment consequently increases. In the attempt to validate this interpretation and to exclude that the unemployment effects are driven by the scarcity of jobs for relatively younger individuals, we estimate our model focussing on those Italian regions characterized by high labour demand; the underlying assumption is that, in more fluid labour markets, unemployment is not driven by the lack of jobs but by changes in the job acceptance rule. If the reservation wages were not altered by the changes in distance to retirement, the increase in participation would translate mechanically into higher employment. Table 6 shows that the effect on unemployment for women aged 50-54 persists even in the presence of high labour demand,[19] suggesting that at least part of the effect is driven by changes in the reservation wage.

Moreover Table 7 shows that our results are robust to the inclusion of age specific time trends, which absorb, for instance, cohort specific trends in labour market participation and employment prospects due to increasing level of women's education and cultural changes.

Table 9 evaluates how the effect differs by educational levels, in particular depending on whether individuals achieved at least a secondary school degree. The results show that the effect is concentrated on individuals with lower levels of education. If we take education as a proxy for permanent income, this implies that individuals with lower income are more affected by an increase in the length of their working horizon. This is consistent with the fact that labour supply elasticity is higher for lower educated- lower income individuals: by standard assumptions about concavity of the utility function, the marginal return of working one year more is higher for lower income individuals.

Overall, we estimate that the increase (by 4 years on average) in the working horizon for women aged 45-59 caused by the reform explains around one third of the increase in the activity rate of women 15-64 between 2010 and 2014 and 19% of the increase in the share of unemployed women.

## 7.2 Within family interactions

Table 10 analyses the presence of cross elasticities within the couple. Columns 1 and 2 look at the effect of a shock to the wife's working horizon, on the wife herself and on her husband, respectively. Columns 3 and 4 report the effect of an increase in the husband's working horizon on the husband himself and on his wife. Similarly to what found in Table 4, Columns 1 and 3 confirm that there is a positive effect of an increase in one's own working horizon on women labour supply, while no effect for men. Column 2 shows that the longer wife's working horizon, and consequently higher participation, also increases her husband's participation. A one year increase in a wife's distance to retirement increases her husband's labour supply by more than 2 ppt., supporting the hypothesis of leisure complementarities (similarly to some of the available literature on

[19] We use the ratio between vacancies and unemployed by region and year (taken from the Italian National Statistical Office) as a proxy for labour demand. We define as regions with high labour demand those with a vacancy rate higher than the highest third of the distribution of vacancy rates.

joint labour supply decisions like, for instance, Blau (1998)). The opposite effect, that of an increase in the husband's distance to retirement on his wife's labour supply, does not seem to be in place. Probably because men do not respond to their own shock in the first place.

What appears more puzzling, instead, is that husbands respond more to their wives' rather than to their own shocks (Column 2 against Column 3 of Table 10). We believe the reason is be that, as discussed before, the sample of men in Column 2 is different from that considered in Column 3. The first group of men is much less likely to participate in the labour market (the share of participants over the reference population is, respectively, 74% and 99%), they tend to be older and some of them are probably already eligible to retire; their labour supply elasticity is therefore higher: they supply more labour and postpone retirement so to jointly retire with their partners (in line with the literature on joint retirement, see for instance Coile (2004)). Some papers in the literature point out that men are particularly responsive, more than women, to their partner's employment decision (Coile (2004), Zweimüller et al. (1996) and Bingley and Lanot (2007); Goux et al. (2014) find exactly that men respond more to thier wives's shocks than to their own shocks in working hours). Zweimüller et al. (1996) suggest this may be due to asymmetric preferences concerning joint leisure, as husbands in traditional families are not used to be alone and may have stronger preferences about spending their leisure time with their wives. Moreover, even if preferences towards joint leisure are identical across partners, a difference may arise because wives can still carry on with household production while not working on the market (i.e. by providing care to their grandchildren (Battistin et al., 2014; Bratti et al., 2016) or to their elderly parents in case of younger women), while men are much less likely to be involved in housework and their non-working time is more likely to be related to leisure.

Finally, Table 11 evaluates how the within couple effect differs by level of education of the spouses, where again we use education as a proxy for permanent income and wages. The results confirm what found in Table 9: low educated individuals are the ones who respond the most to changes in their own working horizon, because their marginal utility from working more is higher. There does not seem to be instead significant heterogeneity on the spouses's responses, based on their own education level.

Overall, we show that, once we consider not only the direct effect of the longer women's working horizon on their own labour supply, but also the indirect effect on their husbands, the overall impact on labour supply is almost twice as large.

# 8 Extension: the *mechanical effect*

In the Introduction we have distinguished between two types of effects associated to the delaying of retirement age: the *mechanical effect*, that on individuals who were supposed to retire under the previous rules but have to postpone retirement when the new rules become effective, thus loosing entitlement to receiving the pension benefit; and the *the distance to retirement effect*, that on individuals who would not have been eligible to retire under any scenario, but whose working horizon has increased.

The mechanical effect has been widely estimated by the previous literature, in different contexts and for different countries by Mastrobuoni (2009) and Staubli and Zweimüller

(2013), among others. In this section we also provide its estimate for our setting, since this helps us evaluating better the magnitude of the distance to retirement effect.

Our identification strategy for the mechanical effect in inspired by the *difference in discontinuity* approach, proposed in the seminal work by Grembi et al. (2016). Let's denote $E_i$ a variable that indicates whether individual $i$ was eligible to retire under the pre-reform rules, those in force in 2010:

$$E_i = \begin{cases} 1, & \text{for } d_{2010i} \leq 0 \\ 0, & \text{for } d_{2010i} > 0 \end{cases} \tag{5}$$

where $d_{2010i} = MRA_{2010i} - age_{2010i}$ indicates distance to retirement under the pre-reform rules, equal to the difference between age in 2010 and minimum retirement age according to the 2010 pension rules.

Our estimating equation compares the size of discontinuity in the probability of retiring around $E_i$; more specifically it compares the probability of being retired (or being active) in the pre-reform and in the post-reform period of those who were around the pension eligibility threshold according to the pre-reform pension rules. While in the pre-reform period there should be a large discontinuity around $E_i$, in the post-reform period individuals who loose their eligibility cannot retire and there should be a larger portion of non-retired individuals around $E_i$. Figure 6 provides visual inspection of the variation we exploit. The first panel shows that, while there is a jump around $E_i$ in the probability of retiring in the pre-2010 years (yellow dots), in the post-2012 years there is a much lower probability of being a pensioner around 0, -1 and -2 (exactly because MRA has been postponed). The second panel shows how this translates into an increase in labour market participation after 2012.

We estimate the following equation:

$$Y_{it} = post2011_t[E_i(\beta + f_r(d_{2010i})) + (1-E_i)f_l(d_{2010i})] + E_i(\delta + f_r^p(d_{2010i})) + (1-E_i)f_l^p(d_{2010i}) + \psi_t + v_{it} \tag{6}$$

where $Y_{it}$ represents labour supply of individual $i$ in year $t$; $post2011_t$ is an indicator for the post reform period; $E_i$ indicates whether individual $i$ was eligible to retire under the pre-reform rules (see equation (5)); $d_{2010i}$ is distance to retirement under the pre-reform rules (our running variable); $f_r$, $f_l$, $f_r^p$ and $f_l^p$ are some polynomials of $d_{2010i}$; $\psi_t$ represent year fixed effects and $v_{it}$ is an error term, which we cluster at the individual level. $\beta$ is our parameter of interest, that indicates to what extent labour market participation is higher after the reform, around the pre-reform eligibility threshold.

Table 12 reports the results obtained from estimating equation (6). We find that both women and men participate more in the labour market in response of the postponement of pension eligibility; the effect comes from those who keep on working in response to the pension reform since we do not find any effect on the probability of being unemployed. The effects are sizable, comparable across genders, and reasonably larger than the distance to retirement effects estimated in the previous sections. It is worth to notice that the distance to retirement effect we found in the previous sections act in creating a downward bias in the mechanical effect we estimate, since it increases the participation rate of those who are slightly on the right of the $E_i$ threshold in Figure 6.

# 9 Conclusions

This paper provides quasi-experimental evidence for the existence of a distance to retirement effect on labour supply. In Social Security systems characterized by implicit tax on continuing working after having reached MRA, a longer distance to the pension benefits eligibility not only mechanically affects the retirement decision of those who would have been eligible to retire otherwise, but it may also increase the labour supply of younger individuals, not eligible in any case. Such mechanism has been mainly analyzed by search models, which show that the smaller is the distance to retirement, the lower are the returns from working and looking for a job, weakening the incentives to participate in the labour market and to exert job effort. Given the relevance of intra-family interactions, we provide a comprehensive assessment of the magnitude of the distance to retirement effect by investigating whether the distance effect has spillovers on the partner's labour supply. By exploiting the difference in eligibility criteria for pension benefits across individuals' observable characteristics, we analyze the distance to retirement effect both in terms of participation, employment and unemployment, and in terms of type of employment, at the individual and at the family level.

We find that lengthening the working horizon has positive effects on participation and job search effort for individuals in younger age classes, far from pension eligibility. The effect is concentrated on women, whose labour supply is more elastic. Moreover, we estimate that there exist spillover effects within the family: in particular, men tend to increase their labour supply in response to their wives' longer working horizon, while the contrary does not seem to hold.

Overall, our estimates suggest that there exist positive labour supply responses which go well beyond the direct impact on the age groups forced to remain longer in the labour market due to the delaying of their pension benefits and the temporary loss of pension income. Our findings open important avenue for future research, i.e. it is important to understand what are the welfare costs related to this policy (for instance in terms of lost household production or leisure) and whether alternative policies, like modifying the tax schedule for older workers, may generate higher welfare gains.

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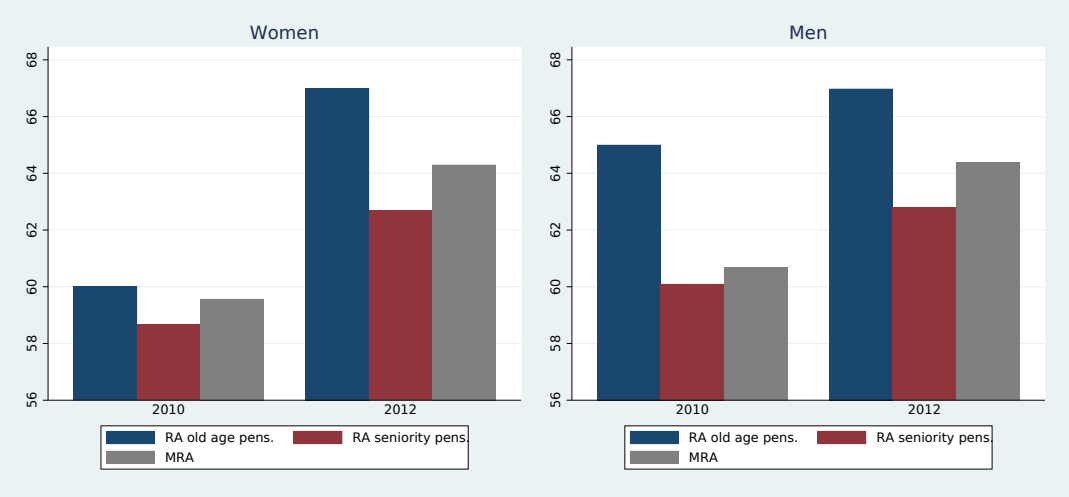
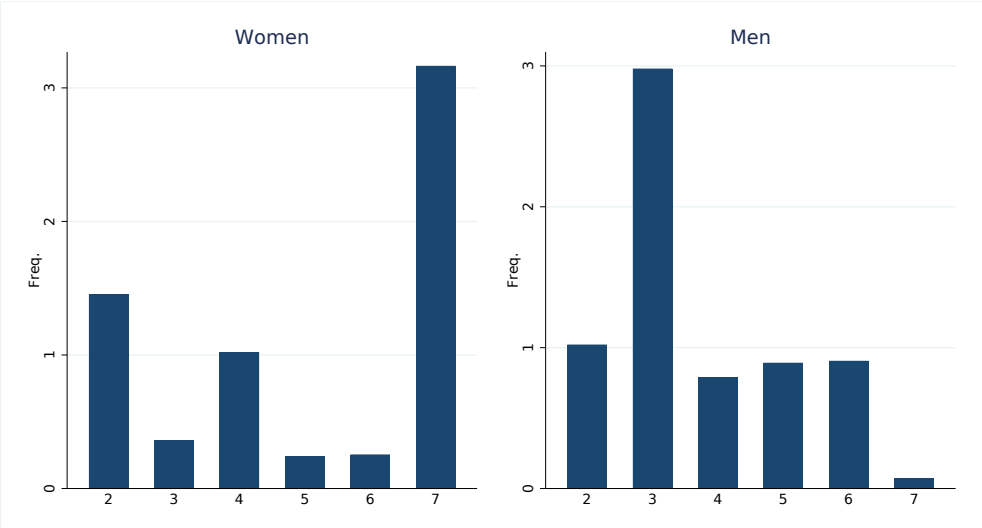
Figure 1: Minimum retirement age before and after the pension reform by gender

(a) Retirement age, women vs men



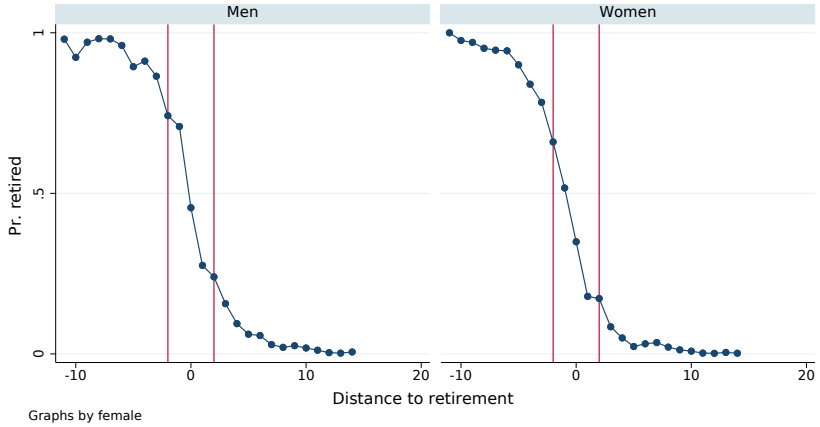

**Source**: SHIW.
**Note** The Figure shows that after pension reform, MRA by 4 years on average. For women, the increase was mostly concentrated on those who retire under the old age regime; for men it is the opposite.

Figure 2: Distribution of the shock in distance to minimum retirement age (variation between $t \geq 2012$ and 2008), by gender



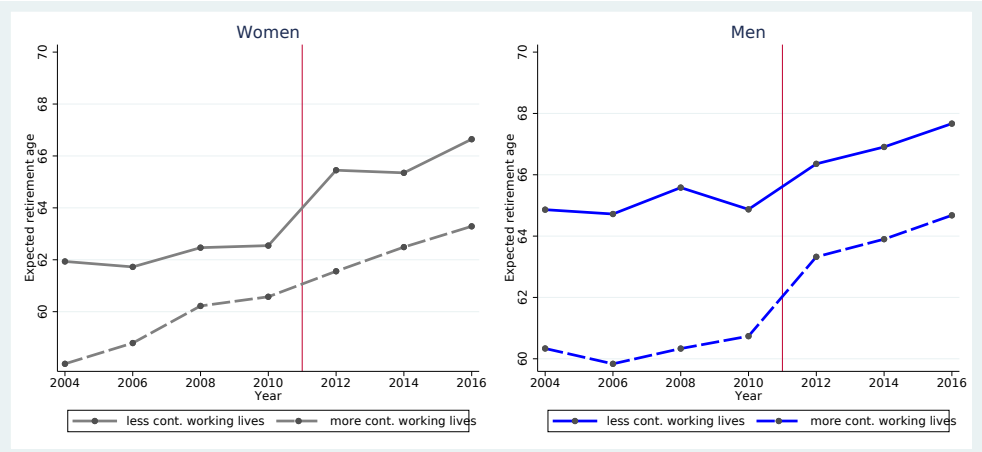

**Source**: SHIW.
**Note**: The Figure displays the distribution of the reform-induced shock to the working horizon, by gender. It shows the distribution of the difference between the post and the pre reform MRA for individuals in our sample (women aged between 45 and 59, with at least 10 accrued years of contribution, eligible to retire neither before nor after the reform; men aged between 45 and 64, with at least 20 accrued years of contribution, eligible to retire neither before nor after the reform). Data are at the individual level, the y axis reports the probability of observing a certain shock. This is the variation used to compute the analysis.

Figure 3: Probability of retiring and distance to minimum retirement age, by gender




**Source**: SHIW, 2008-2016.
**Note**: The Figure shows that individuals actually retire when they reach their MRA, i.e. when their distance to retirement ($=MRA-age$) approaches 0.

Figure 4: Expected retirement age over time, by gender and working life's continuity

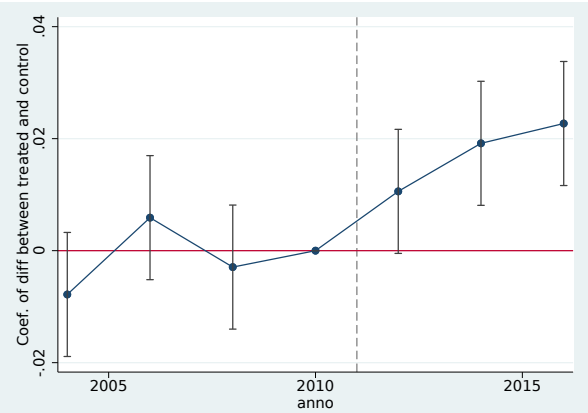



**Source**: SHIW, question on expected retirement age.
**Note**: The Figure shows that the expected retirement age (and the activity rate) increases more around the reform (2012) for women with less continuous working lives (most treated) and men with more continuous working lives (most treated). Only individuals with at least 10 (for women) or 20 (for men) and no more than 40 accrued years of contribution; women aged 50-59; men aged 55-64, not eligible to retire either before and after the reform. The question on expected retirement age is asked only to employed individuals. Working life's continuity is defined as whether individuals are in the first of in the third tertile of the ratio between actual years of contribution accrued in year $t$ and the theoretical length of a continuous working life (age at year $t$-18, assuming individuals started to work at 18 years old).

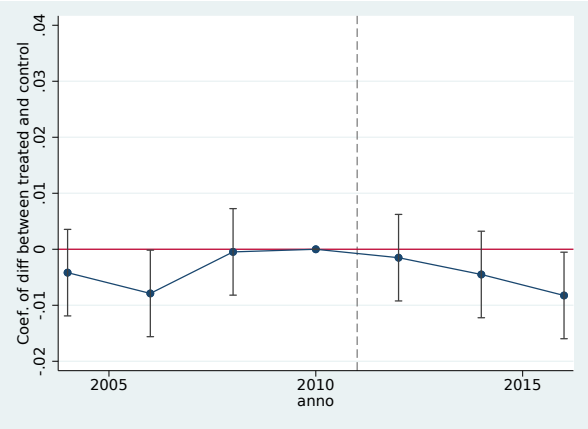
Figure 5: Effect of reform-induced changes in distance to retirement: evolution of the difference in the probability of being active/employed between more and less exposed individuals

**Individual effects**

(a) Prob of being active women
women's shock

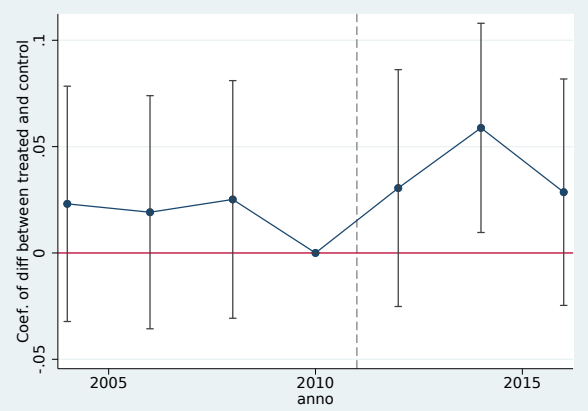



(b) Prob of being active men
men's shock

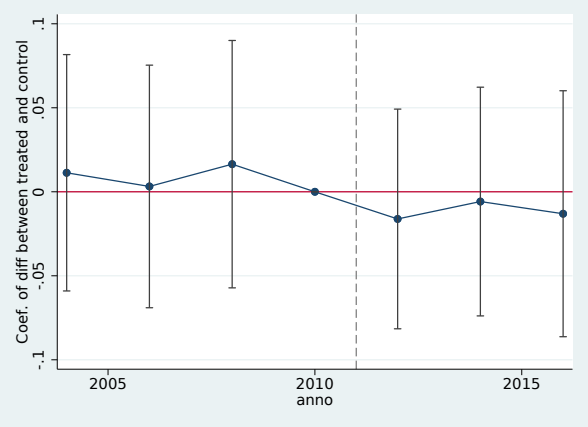



**Intra-family cross-effects**

(c) Prob of being active husbands
wives' shock

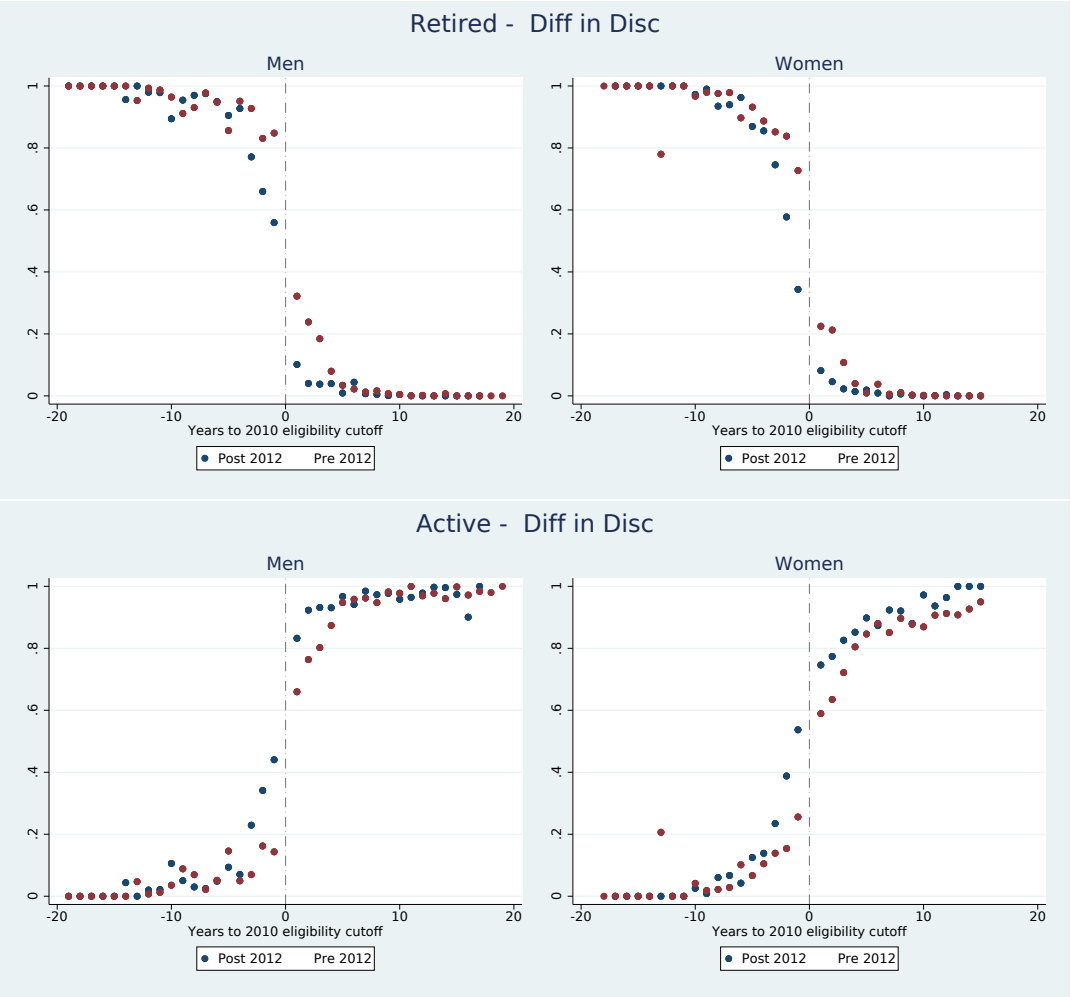



(d) Prob of being active wives
husbands' shock




**Source**: SHIW, from 2006 to 2014.
**Note** The graphs test the parallel trend assumption by plotting the coefficients $\gamma_r$ and $\zeta_r^s$ (and the corresponding 5% confidence intervals) obtained from estimating equations 3 and 4. Pre-reform years: 2004-2006-2008-2010, post-reform years: 2012-2014.

Figure 6: Mechanical effect




**Source**: SHIW
**Note**:

Table 1: Seniority pension eligibility rules

| Year | Private & Public | | Self-employed | |
|---|---|---|---|---|
| | $A$, $C$, $Q$ | only $C$ | $A$, $C$, $Q$ | only $C$ |
| *Before Fornero reform* | | | | |
| 2007 | 57, 35 | 39 | 58, 35 | 40 |
| 2008 | 58, 35 | 40 | 59, 35 | 40 |
| 2009-2010 | 59, 35, 95 | 40 | 60, 35, 96 | 40 |
| 2011 | 60, 35, 96 | 40 | 61, 35 97 | 40 |
| 2011-2012 | 60, 35, 96 | 40 | 61, 35, 97 | 40 |
| 2013 onwards | 61, 35, 97 | 40 | 62, 35, 98 | 40 |
| *After Fornero reform* | | | | |
| 2012- (men) | | 43 | | 43 |
| 2012- (women) | | 42 | | 42 |

**Notes:** $A$ stands for age, $C$ for number of years of contribution, $Q = A + C$ is the so-called "quota", the sum of age and years of contribution must be larger or equal than $Q$ to have retirement eligibility. Independently from actual age, retirement eligibility is also granted when the number of years of contribution is sufficiently high (39 in 2007, 40 in the following years, 42 or 43 after the reform).

Table 2: Difference in differences, examples of treated and control in the private sector group

| | 2010 | | 2012 | | Delta distance |
|---|---|---|---|---|---|
| | Seniority | Old | Seniority | Old | (2012 - 2010) |
| Women, 58 years old | | | | | |
| Maria, $C = 38$ | **60** | 60 | **62** | 67 | 2 |
| Antonia, $C = 26$ | 67 | **60** | **67** | **67** | 7 |
| Men, 58 years old | | | | | |
| Mario, $C = 38$ | **60** | 65 | **63** | 67 | 3 |
| Antonio, $C = 32$ | **61** | 65 | 69 | **67** | 6 |
| Valerio, $C = 26$ | 67 | **65** | 75 | **67** | 2 |
| Men, 56 years old | | | | | |
| Giovanni, $C = 40$ | **56** | 65 | **59** | 67 | 3 |
| Luigi, $C = 32$ | **60** | 65 | **67** | **67** | 7 |

**Notes:** This table reports an example of individuals differentially treated by the mandated extension of the MRA, because of heterogeneity on their previous working histories. Minimum retirement age by type of pension benefit for individuals working as employees in the private sector. $C$ is the number of accrued years of contribution. Delta distance is the difference between the minimum retirement age (the minimum between the mandated retirement age for old age and seniority regime) after and before the reform that took place in 2012.

Table 3: Descriptive statistics

| | Individual level analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Women | | | | Men | | | |
| | All 45-59 [1] | Sample not elig [2] | Control $T_q < 7$ [3] | Treated $T_q \geq 7$ [4] | All 45-64 [5] | Sample not elig [6] | Control $T_q < 4$ [7] | Treated $T_q \geq 4$ [8] |
| Age | 51.665 | 51.335 | 50.802 | 51.721 | 53.877 | 52.107 | 52.172 | 52.019 |
| | (4.280) | (4.108) | (3.815) | (4.267) | (5.728) | (4.626) | (4.925) | (4.179) |
| Y. contrib | 15.853 | 23.950 | 30.476 | 19.227 | 28.120 | 28.707 | 29.502 | 27.617 |
| | (13.343) | (7.696) | (4.257) | (5.986) | (11.331) | (5.195) | (5.401) | (4.685) |
| 1=married | 0.762 | 0.718 | 0.729 | 0.710 | 0.830 | 0.840 | 0.836 | 0.845 |
| 1=sec. edu | 0.497 | 0.616 | 0.663 | 0.582 | 0.484 | 0.538 | 0.467 | 0.636 |
| 1=children | 0.660 | 0.632 | 0.605 | 0.651 | 0.640 | 0.617 | 0.626 | 0.605 |
| 1=active | 0.583 | 0.881 | 0.976 | 0.812 | 0.795 | 0.979 | 0.973 | 0.989 |
| 1=unempl | 0.043 | 0.044 | 0.022 | 0.060 | 0.071 | 0.050 | 0.052 | 0.048 |
| 1=part time | 0.102 | 0.147 | 0.144 | 0.150 | 0.022 | 0.017 | 0.017 | 0.018 |
| 1=perm. contr | 0.401 | 0.641 | 0.806 | 0.521 | 0.500 | 0.674 | 0.655 | 0.700 |
| log(wage net) | 9.522 | 9.560 | 9.669 | 9.450 | 9.799 | 9.848 | 9.838 | 9.860 |
| | (0.568) | (0.548) | (0.425) | (0.629) | (0.480) | (0.428) | (0.413) | (0.446) |
| Observations | 16157 | 9037 | 3853 | 5184 | 19313 | 10732 | 6178 | 4554 |
| | Family level analysis | | | | | | | |
| | Treated Wives | | | | Treated Husbands | | | |
| | All wife 45-59 [1] | Sample not elig [2] | Control $T_q^w < 7$ [3] | Treated $T_q^w \geq 7$ [4] | All husb 45-64 [5] | Sample not elig [6] | Control $T_q^h < 4$ [7] | Treated $T_q^h \geq 4$ [8] |
| Age w | 51.654 | 51.761 | 51.051 | 52.349 | 50.240 | 50.499 | 50.240 | 50.846 |
| | (4.264) | (4.026) | (3.781) | (4.127) | (6.752) | (3.663) | (3.669) | (3.628) |
| Age h | 55.089 | 55.286 | 54.524 | 55.917 | 54.052 | 52.984 | 52.545 | 53.569 |
| | (5.702) | (5.149) | (4.926) | (5.245) | (5.682) | (3.912) | (4.145) | (3.494) |
| Y. contrib w | 15.128 | 24.715 | 30.813 | 19.668 | 14.581 | 24.434 | 24.584 | 24.235 |
| | (13.447) | (7.663) | (4.204) | (6.036) | (13.519) | (7.492) | (7.522) | (7.449) |
| Y. contrib h | 30.286 | 33.839 | 33.934 | 33.759 | 29.026 | 30.734 | 31.651 | 29.510 |
| | (10.517) | (6.415) | (5.826) | (6.864) | (10.698) | (4.486) | (4.708) | (3.846) |
| 1=sec edu w | 0.486 | 0.603 | 0.672 | 0.545 | 0.501 | 0.664 | 0.615 | 0.729 |
| 1=sec edu h | 0.483 | 0.558 | 0.599 | 0.523 | 0.493 | 0.627 | 0.548 | 0.732 |
| 1=children | 0.705 | 0.690 | 0.665 | 0.712 | 0.678 | 0.654 | 0.654 | 0.654 |
| 1=active w | 0.523 | 0.841 | 0.971 | 0.733 | 0.508 | 0.859 | 0.838 | 0.886 |
| 1=active h | 0.768 | 0.777 | 0.820 | 0.741 | 0.794 | 0.987 | 0.984 | 0.991 |
| 1=unempl w | 0.035 | 0.039 | 0.019 | 0.055 | 0.037 | 0.037 | 0.037 | 0.036 |
| 1=unempl h | 0.058 | 0.025 | 0.020 | 0.030 | 0.060 | 0.030 | 0.034 | 0.024 |
| log(wage net) w | 9.510 | 9.563 | 9.662 | 9.435 | 9.490 | 9.583 | 9.542 | 9.633 |
| | (0.592) | (0.555) | (0.447) | (0.646) | (0.608) | (0.546) | (0.554) | (0.531) |
| log(wage net) h | 9.841 | 9.927 | 9.969 | 9.886 | 9.829 | 9.933 | 9.920 | 9.948 |
| | (0.470) | (0.420) | (0.379) | (0.453) | (0.461) | (0.420) | (0.415) | (0.425) |
| Observations | 11843 | 5510 | 2566 | 2944 | 15204 | 3825 | 2166 | 1659 |

**Notes:** for the top panel: column 1 (5) reports the entire sample of women (men) aged between 45-59 (45-64); column 2 (6) only individuals in our sample (not eligible to retire either before and after the reform and with at least 10 (for women) and 20 (for men) accrued years of contribution); columns 3 and 4 (7 and 8) split the sample between treated and control individuals (women (men) are defined as treated if experienced a shock to distance to minimum retirement of >= 7 (>= 4) years after 2011 reform). w stands for wives, h stands for husbands. For the bottom panel: restrictions are imposed only on the treated spouse.

Table 4: Effects of the longer working horizon on working status

| | Women | | | Men | | |
|---|---|---|---|---|---|---|
| | 55-59 | 50-54 | 45-49 | 55-64 | 50-54 | 45-49 |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | *Participation* | | | |
| T*post2011 | 0.046*** | 0.040*** | 0.021*** | -0.002 | -0.003 | 0.005 |
| | (0.008) | (0.006) | (0.006) | (0.004) | (0.002) | (0.004) |
| benefit $\triangle$ post2011 | -0.041*** | -0.050*** | -0.014** | 0.001 | 0.002 | 0.000 |
| | (0.015) | (0.010) | (0.007) | (0.003) | (0.003) | (0.003) |
| | | | *Unemployment* | | | |
| T*post2011 | 0.011* | 0.013** | 0.008** | 0.001 | 0.001 | -0.005 |
| | (0.006) | (0.006) | (0.004) | (0.008) | (0.007) | (0.012) |
| benefit $\triangle$ post2011 | -0.007 | -0.016* | -0.008** | 0.000 | -0.008 | 0.014 |
| | (0.007) | (0.009) | (0.004) | (0.007) | (0.007) | (0.014) |
| | | | *Employment* | | | |
| T*post2011 | 0.035*** | 0.028*** | 0.013* | -0.003 | -0.005 | 0.011 |
| | (0.009) | (0.007) | (0.007) | (0.008) | (0.007) | (0.013) |
| benefit $\triangle$ post2011 | -0.034** | -0.034*** | -0.006 | 0.001 | 0.010 | -0.014 |
| | (0.016) | (0.012) | (0.007) | (0.007) | (0.007) | (0.016) |
| N | 2287 | 3263 | 3054 | 3470 | 3843 | 3191 |

**Notes:** Additional controls: year and cell $q$ fixed effects, region and sector fixed effects, time fixed effects, marital status. The sample consists of individuals that are not eligible for a public pension either before and after the reform and have accrued a number of years of contribution greater than 9 for women or 19 for men, and smaller than 40. Robust standard errors clustered at the cell $q$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Effects of the longer working horizon on employment characteristics

| | Women | | | Men | | |
|---|---|---|---|---|---|---|
| | 55-59 | 50-54 | 45-49 | 55-64 | 50-54 | 45-49 |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | *Full-time employment* | | | |
| T*post2011 | 0.034*** | 0.038*** | 0.025*** | -0.005 | 0.001 | 0.013 |
| | (0.009) | (0.009) | (0.009) | (0.009) | (0.008) | (0.017) |
| benefit △ post2011 | -0.028* | -0.039*** | -0.005 | 0.000 | 0.011 | -0.025 |
| | (0.016) | (0.014) | (0.008) | (0.007) | (0.008) | (0.017) |
| | | | *Part-time employment* | | | |
| T*post2011 | -0.000 | -0.011 | -0.016* | -0.000 | 0.000 | -0.007 |
| | (0.008) | (0.008) | (0.009) | (0.003) | (0.004) | (0.009) |
| benefit △ post2011 | -0.009 | 0.006 | -0.000 | 0.002 | 0.000 | 0.014 |
| | (0.009) | (0.013) | (0.008) | (0.003) | (0.004) | (0.009) |
| | | | *Permanent employment* | | | |
| T*post2011 | 0.028*** | 0.019** | 0.009 | -0.000 | -0.003 | -0.014 |
| | (0.009) | (0.008) | (0.007) | (0.008) | (0.008) | (0.013) |
| benefit △ post2011 | -0.035** | -0.022* | -0.006 | 0.002 | -0.004 | -0.004 |
| | (0.015) | (0.013) | (0.007) | (0.008) | (0.008) | (0.013) |
| | | | *Temporary employment* | | | |
| T*post2011 | 0.006 | 0.007 | -0.000 | -0.004 | 0.004 | 0.020* |
| | (0.005) | (0.006) | (0.004) | (0.005) | (0.006) | (0.010) |
| benefit △ post2011 | -0.001 | -0.011 | 0.001 | 0.000 | 0.014*** | -0.007 |
| | (0.008) | (0.010) | (0.004) | (0.005) | (0.005) | (0.011) |
| N | 2287 | 3263 | 3054 | 3470 | 3843 | 3191 |

**Notes:** Additional controls: year and cell $q$ fixed effects, region and sector fixed effects, time fixed effects, marital status. The sample consists of individuals that are not eligible for a public pension either before and after the reform and have accrued a number of years of contribution greater than 9 for women or 19 for men, and smaller than 40. Robust standard errors clustered at the cell $q$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Effects of the longer working horizon on working status in regions with vacancy rate higher than the highest third

| | Women | | | Men | | |
|---|---|---|---|---|---|---|
| | 55-59 | 50-54 | 45-49 | 55-64 | 50-54 | 45-49 |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | *Participation* | | | |
| T*post2011 | 0.053*** | 0.053*** | 0.022*** | -0.009 | -0.010** | 0.008 |
| | (0.012) | (0.009) | (0.008) | (0.007) | (0.005) | (0.006) |
| | | | *Unemployment* | | | |
| T*post2011 | 0.007 | 0.016** | 0.003 | -0.005 | 0.002 | 0.009 |
| | (0.008) | (0.008) | (0.006) | (0.015) | (0.011) | (0.023) |
| | | | *Employment* | | | |
| T*post2011 | 0.047*** | 0.037*** | 0.019* | -0.004 | -0.013 | -0.000 |
| | (0.012) | (0.011) | (0.010) | (0.016) | (0.010) | (0.024) |
| N | 1154 | 1783 | 1575 | 1417 | 1867 | 1589 |

**Notes:** Additional controls: change in expected pension wealth, year and cell $q$ fixed effects, region and sector fixed effects, time fixed effects, marital status. The sample consists of individuals that are not eligible for a public pension either before and after the reform and have accrued a number of years of contribution greater than 9 for women or 19 for men, and smaller than 40. Robust standard errors clustered at the cell $q$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Effects of the longer working horizon on working status, controlling for cohort trends

| | Women | | | Men | | |
|---|---|---|---|---|---|---|
| | 55-59 | 50-54 | 45-49 | 55-64 | 50-54 | 45-49 |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | *Participation* | | | |
| T*post2011 | 0.040*** | 0.041*** | 0.021*** | -0.004 | -0.004 | 0.005 |
| | (0.008) | (0.006) | (0.006) | (0.004) | (0.003) | (0.003) |
| | | | *Unemployment* | | | |
| T*post2011 | 0.009 | 0.013** | 0.008* | 0.002 | 0.001 | -0.004 |
| | (0.006) | (0.006) | (0.004) | (0.008) | (0.007) | (0.012) |
| | | | *Employment* | | | |
| T*post2011 | 0.030*** | 0.027*** | 0.013* | -0.006 | -0.005 | 0.009 |
| | (0.009) | (0.007) | (0.007) | (0.009) | (0.007) | (0.013) |
| | | | *Full-time employment* | | | |
| T*post2011 | 0.028*** | 0.040*** | 0.026*** | -0.006 | 0.000 | 0.012 |
| | (0.010) | (0.009) | (0.008) | (0.009) | (0.008) | (0.017) |
| | | | *Part-time employment* | | | |
| T*post2011 | 0.001 | -0.013 | -0.016* | -0.000 | -0.000 | -0.008 |
| | (0.008) | (0.009) | (0.009) | (0.003) | (0.004) | (0.009) |
| | | | *Permanent employment* | | | |
| T*post2011 | 0.020** | 0.018** | 0.009 | -0.003 | -0.004 | -0.015 |
| | (0.009) | (0.008) | (0.007) | (0.008) | (0.008) | (0.014) |
| | | | *Temporary employment* | | | |
| T*post2011 | 0.009* | 0.009 | -0.000 | -0.003 | 0.004 | 0.020* |
| | (0.005) | (0.006) | (0.004) | (0.005) | (0.006) | (0.010) |
| N | 2287 | 3263 | 3054 | 3470 | 3843 | 3191 |

**Notes:** Additional controls: change in expected pension wealth, year and cell $q$ fixed effects, region and sector fixed effects, time fixed effects, marital status, age specific trends. The sample consists of individuals that are not eligible for a public pension either before and after the reform and have accrued a number of years of contribution greater than 9 for women or 19 for men, and smaller than 40. Robust standard errors clustered at the cell $q$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Effects of the longer working horizon on working status by education level

| | Women | | | Men | | |
|---|---|---|---|---|---|---|
| | 55-59 | 50-54 | 45-49 | 55-64 | 50-54 | 45-49 |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | *Participation* | | | |
| T*post2011 | 0.061*** | 0.040*** | 0.026*** | -0.003 | -0.006 | 0.006 |
| | (0.011) | (0.009) | (0.009) | (0.007) | (0.004) | (0.006) |
| T*post2011*high edu | -0.034*** | -0.011 | -0.009 | 0.006 | 0.005 | -0.001 |
| | (0.011) | (0.009) | (0.009) | (0.009) | (0.005) | (0.008) |
| | | | *Unemployment* | | | |
| T*post2011 | 0.019* | 0.023*** | 0.012* | -0.003 | 0.000 | -0.008 |
| | (0.011) | (0.008) | (0.007) | (0.012) | (0.010) | (0.019) |
| T*post2011*high edu | -0.010 | -0.017** | -0.005 | 0.007 | -0.001 | 0.001 |
| | (0.012) | (0.007) | (0.007) | (0.012) | (0.012) | (0.021) |
| | | | *Employment* | | | |
| T*post2011 | 0.042*** | 0.016 | 0.015 | -0.000 | -0.006 | 0.015 |
| | (0.013) | (0.010) | (0.012) | (0.013) | (0.010) | (0.021) |
| T*post2011*high edu | -0.025* | 0.006 | -0.004 | -0.000 | 0.006 | -0.002 |
| | (0.014) | (0.010) | (0.012) | (0.015) | (0.011) | (0.022) |
| N | 2287 | 3263 | 3054 | 3470 | 3843 | 3191 |

**Notes:** Additional controls: change in expected pension wealth, year and cell $q$ fixed effects, region and sector fixed effects, time fixed effects, marital status. The sample consists of individuals that are not eligible for a public pension either before and after the reform and have accrued a number of years of contribution greater than 9 for women or 19 for men, and smaller than 40. High edu is a dummy equal to 1 if individuals obtained at least the secondary school degree. Robust standard errors clustered at the cell $q$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Effects of the longer working horizon on employment characteristics by education level

| | Women | | | Men | | |
|---|---|---|---|---|---|---|
| | 55-59 | 50-54 | 45-49 | 55-64 | 50-54 | 45-49 |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | *Full-time employment* | | | |
| T*post2011 | 0.040*** | 0.024* | 0.025* | -0.003 | -0.015 | 0.019 |
| | (0.015) | (0.012) | (0.014) | (0.014) | (0.012) | (0.024) |
| T*post2011*high edu | -0.023 | 0.006 | -0.002 | 0.000 | 0.033** | -0.002 |
| | (0.018) | (0.014) | (0.015) | (0.016) | (0.013) | (0.024) |
| | | | *Part-time employment* | | | |
| T*post2011 | 0.003 | -0.011 | -0.017 | 0.001 | 0.007 | -0.008 |
| | (0.012) | (0.012) | (0.012) | (0.006) | (0.005) | (0.012) |
| T*post2011*high edu | -0.002 | 0.005 | 0.002 | -0.002 | -0.014* | -0.001 |
| | (0.012) | (0.013) | (0.013) | (0.007) | (0.008) | (0.011) |
| | | | *Permanent employment* | | | |
| T*post2011 | 0.039*** | 0.004 | 0.008 | 0.009 | -0.015 | -0.012 |
| | (0.014) | (0.011) | (0.013) | (0.013) | (0.013) | (0.022) |
| T*post2011*high edu | -0.030** | 0.008 | 0.000 | -0.013 | 0.027* | 0.003 |
| | (0.015) | (0.012) | (0.013) | (0.015) | (0.016) | (0.025) |
| | | | *Temporary employment* | | | |
| T*post2011 | 0.004 | 0.008 | 0.001 | -0.010 | 0.008 | 0.023 |
| | (0.009) | (0.008) | (0.008) | (0.008) | (0.010) | (0.015) |
| T*post2011*high edu | 0.005 | 0.002 | -0.001 | 0.012 | -0.009 | -0.006 |
| | (0.009) | (0.008) | (0.009) | (0.009) | (0.013) | (0.013) |
| N | 2287 | 3263 | 3054 | 3470 | 3843 | 3191 |

**Notes:** Additional controls: change in expected pension wealth, year and cell $q$ fixed effects, region and sector fixed effects, time fixed effects, marital status. The sample consists of individuals that are not eligible for a public pension either before and after the reform and have accrued a number of years of contribution greater than 9 for women or 19 for men, and smaller than 40. High edu is a dummy equal to 1 if individuals obtained at least the secondary school degree. Robust standard errors clustered at the cell $q$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Cross effects among partners of the longer working horizon on labour force status

| | Shock to wife MRA | | Shock to husband MRA | |
|---|---|---|---|---|
| | on wife | on husband | on husband | on wife |
| | (1) | (2) | (3) | (4) |
| | | *Participation* | | |
| T wife*post2011 | 0.038*** | 0.029** | | |
| | (0.005) | (0.015) | | |
| T husb*post2011 | | | -0.004 | 0.007 |
| | | | (0.003) | (0.041) |
| | | *Unemployment* | | |
| T wife*post2011 | 0.014*** | -0.003 | | |
| | (0.004) | (0.012) | | |
| T husb*post2011 | | | -0.003 | -0.012 |
| | | | (0.006) | (0.025) |
| | | *Employment* | | |
| T wife*post2011 | 0.024*** | 0.032 | | |
| | (0.005) | (0.021) | | |
| T husb*post2011 | | | -0.001 | 0.019 |
| | | | (0.007) | (0.046) |
| N | 5142 | 5142 | 3646 | 3646 |

**Notes:** Additional controls: year and cell $q_{s'}$ and $q_s$ fixed effects (separately for each dimension), region and sector fixed effects, age difference across partners (also squared) and difference in distance to retirement across partners (also squared), partner $s$ change in distance to retirement. The sample in columns 1 and 2 (3 and 4) consists of individuals belonging to couples where the wives (husbands) are not eligible for a public pension either before and after the reform and have accrued a number of years of contribution greater than 9 (19), and smaller than 40. Robust standard errors clustered at the cell $q_{s'}$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Cross effects among partners of the longer working horizon on labour force status by education

| | Shock to wife MRA | | Shock to husband MRA | |
|---|---|---|---|---|
| | on wife | on husband | on husband | on wife |
| | (1) | (2) | (3) | (4) |
| | | *Participation* | | |
| T wife*post2011 | 0.047*** | 0.062*** | | |
| | (0.007) | (0.022) | | |
| T husb*post2011 | | | -0.005 | -0.070 |
| | | | (0.005) | (0.060) |
| T wife*post 2011*own edu | -0.023*** | -0.066** | | |
| | (0.008) | (0.030) | | |
| T husb*post 2011*own edu | | | 0.002 | 0.103 |
| | | | (0.006) | (0.069) |
| | | *Unemployment* | | |
| fe*post2011 | 0.023*** | 0.002 | | |
| | (0.006) | (0.016) | | |
| T husb*post2011 | | | -0.010 | -0.010 |
| | | | (0.013) | (0.035) |
| T wife*post 2011*own edu | -0.011* | -0.010 | | |
| | (0.006) | (0.023) | | |
| T husb*post 2011*own edu | | | 0.009 | -0.004 |
| | | | (0.014) | (0.039) |
| | | *Employment* | | |
| T wife*post2011 | 0.024*** | 0.060** | | |
| | (0.008) | (0.029) | | |
| T husb*post2011 | | | 0.005 | -0.060 |
| | | | (0.014) | (0.064) |
| T wife*post 2011*own edu | -0.012 | -0.056 | | |
| | (0.009) | (0.036) | | |
| T husb*post 2011*own edu | | | -0.006 | 0.107 |
| | | | (0.015) | (0.074) |
| N | 5142 | 5142 | 3646 | 3646 |

**Notes:** Additional controls: year and cell $q_{s'}$ and $q_s$ fixed effects (separately for each dimension), region and sector fixed effects, age difference across partners (also squared) and difference in distance to retirement across partners (also squared), partner $s$ change in distance to retirement. The sample in columns 1 and 2 (3 and 4) consists of individuals belonging to couples where the wives (husbands) are not eligible for a public pension either before and after the reform and have accrued a number of years of contribution greater than 9 (19), and smaller than 40. High edu is a dummy equal to 1 if individuals obtained at least the secondary school degree. Robust standard errors clustered at the cell $q_{s'}$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 12: The mechanical effect

| | Women | | | Men | | |
|---|---|---|---|---|---|---|
| | linear | quadratic | cubic | linear | quadratic | cubic |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | | | *Participation* | | | |
| $E_{2010}$*post2011 | 0.136*** | 0.166*** | 0.143* | 0.105*** | 0.101*** | 0.081 |
| | (0.036) | (0.057) | (0.080) | (0.027) | (0.039) | (0.051) |
| | | | *Unemployment* | | | |
| $E_{2010}$*post2011 | 0.014 | 0.008 | -0.004 | 0.002 | 0.006 | -0.047 |
| | (0.009) | (0.015) | (0.022) | (0.012) | (0.020) | (0.030) |
| | | | *Employment* | | | |
| $E_{2010}$*post2011 | 0.122*** | 0.158*** | 0.148* | 0.103*** | 0.095** | 0.128** |
| | (0.035) | (0.055) | (0.077) | (0.028) | (0.042) | (0.057) |
| N | 18784 | 18784 | 18784 | 22393 | 22393 | 22393 |

**Notes:** Additional controls: year fixed effects. The sample consists of individuals whose distance to retirement according to the pre-reform rules ($d_{i2010}$) was between 20 and -20. Robust standard errors clustered at the cell $q$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.