Working Horizon and Labour Supply: the Effect of Raising Minimum Retirement Age on Middle-aged Individuals *

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Abstract

This paper analyzes the effects of raising the minimum retirement age on the labour force participation of middle-aged individuals and their partners. Identification relies on a difference-in-differences setting that exploits the large heterogeneous increase in the minimum retirement age induced by an unexpected Italian pension reform. We detect a sizable increase in the participation rate of middle-aged women which spills over into their their husbands' labour supply, who postpones his retirement decision.

Keywords: Family economics; Labour Supply; Retirement

JEL Classification: J16; J22; J26

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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 has been a widely adopted policy, with the ultimate effects of lowering the number of pension recipients and of enlarging the tax base through higher employment rates among older workers (OECD, 2015). Estimating the labour supply response to these reforms is therefore crucial to evaluate their success.

An active area of current research explores whether, and by how much, an increase in the mandated retirement age translates into higher labour supply of older workers, who otherwise would have been eligible to retire (we call it the *direct effect*). However, the existing studies tend to neglect that the response to variations in the eligibility requirements may actually take place also when individuals are relatively younger - not only when they are approaching retirement (we call it the *perspective effect*). For non-myopic individuals, the mechanisms through which postponing retirement eligibility can affect the participation decision at relatively younger ages, far away from retirement, can be manifold. First, the postponed access to retirement, by reducing the number of periods over which the benefit is collected, decreases life-time income when the benefit is not strictly linked to the contribution history, with positive effects on participation and employment. Second, delayed retirement raises the opportunity cost of leisure at older ages, inducing individuals to work more in the future but less when they are younger; however, if the likelihood of facing negative health shocks or the disutility from working are expected to be higher when they are older, they may prefer to anticipate their labour supply. Finally, when looking for a job is costly, search effort increases with the the expected duration of a job. Since delayed retirement age lengthens individuals' working horizon and their expected working life, they will become more willing to pay the cost and start searching more actively under the new eligibility rules.

In this paper we empirically investigate the perspective effect, by evaluating the labour supply response of middle-aged individuals to changes in the pension eligibility rules. Moreover, since there is increasing evidence that within household interactions may amplify or nullify the individual response, we enrich the individual-level analysis by investigating the existence of cross-partners spillovers. Leisure complementarities may amplify the individual effect, with both partners participating more in the labour market. Changes in the household income may operate in the opposite direction, since the higher labour supply of one partner will allow the other to withdraw from the job.

Our analysis takes advantage of a pension reform implemented in Italy in 2012, which sharply and unexpectedly increased the pension eligibility requirements. The policy raised the minimum retirement age (from now on MRA)[1] by four years on average. Since the mandated increase in the 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 of MRA within narrowly defined cells. We separately estimate the effects by gender and by age, since labour supply elasticity and its determinants typically differ along these characteristics.

Moreover, to evaluate the magnitude of the perspective effect, relative to the more extensively studied direct effect, we estimate the latter for the Italian context, using a difference-in-discontinuity approach. In particular, we study changes before and after the reform in the labour supply of individuals around the pre-reform eligibility threshold.

We find that an increase in the working horizon set by a delayed MRA has positive effects on labour supply for middle-aged women, far away from retirement, but not for middle-aged men. For women, the increase in the probability of participating in the labour market is different across ages, being larger for relatively older women (3.3 percentage points for 55-59 year-olds, 1.5 p.p. for 50-54 and 1.1 p.p. for women in their late 40s). While the higher participation translates into an increase in the employment probability for older women (55-59 years old), it mostly feeds the unemployment probability for younger women (45-55 years old). The effect, moreover, is mostly concentrated on lower educated individuals, and only slightly larger for individuals whose expected pension wealth decreased, that is, those whose pension benefit is not linked to the length of the working activity. No effects are found for middle-aged men, typically characterized by higher participation rates than women, thus with less room to respond on the extensive margin of labour supply.[2]

Finally, we find that the effect on women's labour supply has significant spillovers within the household. A one year increase in the wives' working horizon increases their husbands' labour supply by 2.9 percentage points, mostly because they postpone the retirement decision. Indeed, the response is concentrated on already-eligible-to-retire husbands, whose labour supply is very elastic, since they are older and at the margin of

[1] This is the age at which individuals can claim for the first time their pension benefit, either under the old age or the seniority scheme. See Section 2 for further details.

[2] Notice that these estimates reflect short-run responses to the MRA increases; longer-term effects may differ since earlier labour supply increases can be compensated by later reductions approaching to the end of the career. Moreover, despite we interpret these as labour supply effects, we do not exclude that they are equilibrium outcomes, since the reform may have generated labour demand responses as well (see Bovini and Paradisi (2019); Carta and von Wachter (2019)).

choosing when to retire.[3]

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 20% of the increase in the share of unemployed women observed in the same period.

When comparing these estimates with the magnitude of the direct effect, we find that the perspective effect is non-negligible and it represents about one eight of the direct one. At the aggregate level, however, the perspective effect accounts for a larger part of the increase in the participation rate observed in Italy after 2012, as it involves a wider share of the overall population.

There is limited literature investigating the effects of pension reforms on the labour supply of middle-aged individuals, far away from retirement, who would not have been eligible to retire even under the pre-reform rules. Most of the existing studies analyze the response of older individuals, who would have been eligible to retire before the reform and need eventually to find an alternative source of income (direct effect). These papers find that individuals react to both changes in benefit generosity (Krueger and Pischke, 1992; Song and Manchester, 2007; Liebman et al., 2009; Manoli and Weber, 2016a) and, more recently, increases in the legal retirement age (Mastrobuoni, 2009; Staubli and Zweimüller, 2013; Manoli and Weber, 2016b). Overall, the latter studies find that employment responds positively; the magnitude of the effect mainly depends on the subgroup of the population studied (men or women) and on the country-specific institutional setting (for instance, the existence of a well-developed second pillar or of a generous unemployment or disability subsidy program, which can crowd-out public pension benefits).[4] These analyses typically identify the effects by adopting a regression discontinuity approach and comparing the first cohort affected by the pension reform with the cohort who retired just before the new policy was implemented.

Studying the labour supply response of middle-aged individuals, who would not have been eligible to retire even before the reform, is more demanding since usually all individuals younger than a certain age are affected by the changes in the MRA and there is no obvious control group. Moreover, individuals must be informed about the variations in the pension rules to trigger their labour supply response. To our knowledge, few papers study similar anticipatory effects. Hairault et al. (2010) provide some evidence of the effects of changes in the MRA on individuals' labour supply quite before retirement. They

[3]The contrary does not hold: wives do not respond to changes in their husbands' labour supply, because there is no effect on middle-aged men in the first place.

[4]Lalive et al. (2017) and Cribb et al. (2016) explore the mechanisms behind the employment response; they both look at women and they find that their employment decisions depend not only on the presence of financial incentives linked to retiring when reaching the legal retirement age, but also on the fact that workers consider the legal retirement age a focal point for the end of the working activity.

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 and compare two cohorts of slightly younger individuals before and after the reform. Their analysis restricts to men older than 50 y.o. and shows some positive - but barely significant - effects on employment of individuals older than 56. The relatively small magnitude of the reform, together with the small sample size and the absence of some useful information in their data - like previously accrued years of contribution, necessary to compute the age eligibility for seniority pension -, does not allow them to find large (and precise) effects. Following Hairault et al. (2010),[5] also Sabatier and Legendre (2017) analyze the eligibility effect on middle-aged individuals using a different French data source, which contains information also on health status. They show that the poor health status nullifies the perspective effect, which however is small on average. Geyer and Welteke (2019), by using administrative data for Germany, do not find any anticipatory effect as for 58-59 y.o. women in response to a 3-year increase in the ERA. Finally, a longer working horizon, defined by the minimum retirement age, seems to positively affect also other outcomes well before pension eligibility, like participation in training programs (Montizaan et al., 2010; Brunello and Comi, 2015) and healthy behavior of (Bertoni et al., 2018), as workers try to take advantage of the increased returns to their job.[6]

Additionally, our paper speaks to the strand of the literature evaluating how the effects of reforms are amplified by partners' interactions in retirement and labour supply decisions. As for pension reforms, also in this case the previous literature has focused on older individuals, looking at partners' joint retirement decisions (Coile, 2004; Hospido and Zamarro, 2014; Bloemen et al., 2015; Lalive and Parrotta, 2017) and at changes in their time allocation after retirement (Stancanelli and Soest, 2012; Ciani, 2016).[7] These papers tend to find large positive within-household interactions, which importantly amplify the individual direct effects, consistently with models in which partners share leisure complementarities; there is mixed evidence on whether wives or husbands tend to respond more to their partner's decisions. While there exist a quite extensive literature

[5] Hamermesh (1984) finds a positive effect of the life horizon on labour supply.

[6] A more extensive literature studies the effect of changes in expected pension wealth or in future pension benefits on private wealth and savings over the entire life cycle (see, among the others, Attanasio and Rohwedder (2003); Attanasio and Brugiavini (2003); Bottazzi et al. (2006); Aguila (2011)) or on workers' mental health before retirement (Grip et al., 2011). 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 the effect of delaying the legal retirement age, since the reform they exploit only introduced monetary disincentives for early retirement but did not change eligibility rules. The anticipation effect for women aged 55-59 is positive on employment and negative on unemployment. Differently from us, they do not estimate the effects for younger age brackets.

[7] Other papers look at how eligibility for pension benefits affects other family members rather than partners; Battistin et al. (2014); Bratti et al. (2016) look at children's labour supply and the availability of informal childcare provided by grandmothers. Manacorda and Moretti (2006) investigate children's probability to leave parents' home; Duflo (2000) looks at how pension income, depending on the gender of the recipient, is spent towards granddaughters or grandsons and its impact on their health.

estimating the magnitude of cross-partners labour supply elasticity also at younger ages (see, for instance, Goux et al. (2014); Blau (1998)), to our knowledge there is no evidence of how middle-aged partners interact when hit by some pension shocks. It is not obvious that the effect, if any, would be the same as the one acting at older ages: different mechanisms might be at play, depending on the presence of other family members or because different needs (or preferences) arise with age.

Our paper contributes to the above literature in several ways. First, the Italian setting allows us to overcome many of the reasons why the effect of an increase in the mandated retirement age on labour supply of middle-aged individuals is rarely estimated in practice. The increase in the MRA induced by the 2012 pension reform in Italy was sizable and unexpected. It was also very 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, was considered too onerous for the population. Moreover, since the increase was largely heterogeneous, mainly depending on one dimension that we can observe in our data - which is the continuity of individuals' previous working life -, there exist a suitable control group. This allows us to extend the analysis to women, the group with the highest expected elasticity to the policy change, and to individuals in a broad set of age classes (in particular those in their 40s and 50s). Moreover, we study how individuals' behaviour changes, also looking at household earnings and different income sources. Furthermore, 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 reactions; we show that participation and retirement decisions depend not only on partners' pension eligibility, but also on how far they are from it. Finally, to our knowledge, we are the first to provide a comprehensive assessment of the relevance of the perspective effect, compared to the more studied direct effect; we also estimate the latter and assess the relative magnitude of both effects.

From a policy perspective, our results support the effectiveness of policies aimed at postponing retirement and at boosting labour market participation, especially for those population groups less attached to the labour market - like low educated women. We find evidence that a higher MRA increases the labour supply well beyond the more obvious effect on older workers, who need to find an alternative source of income because not eligible to retire anymore. Also middle-aged individuals (and their partners) respond when informed about the extension of their working horizon. Furthermore, the overall characteristics of employment improve, there is higher probability to be employed full-time and a lower likelihood of relying on other forms of welfare programs, with overall positive implications for the public finance.

The remainder of the paper is organized as follows: Section 2 introduces the Italian

pension system and describes the reform exploited in the empirical analysis for the identification of the estimated effects; Section 3 provides a short description of the data and explains our empirical strategy; in Section 4 we report the results of the empirical analysis both at the individual and at the family level, and the estimates of the direct effect on older workers, in order to assess the magnitude of the perspective effect. Section 5 concludes.

2 The Italian pension system

As many OECD countries, the Italian pension system is characterized by a large first pillar (public pension funds) and by almost negligible second and third pillars (respectively, compulsory and voluntary[8] private pension funds).

The public pension system offers two schemes under which claiming full retirement: the old age and the seniority pension schemes. Under the first, individuals retire after having achieved a certain minimum age; under the second, individuals retire after having accrued a given number of years of contribution. An early retirement scheme is available only for women; the cost of opting for it corresponds, on average, to a 35% reduction of the full pension benefit (INPS, 2016). There is not mandatory retirement and working after retirement is not prohibited. However, the implicit tax on continuing to work after having reached eligibility[9] is rather high (Di Nicola et al., 2017), and individuals have strong incentives to stop working after having reached pension eligibility.

Starting in the early 1990s, the Italian pension system was dramatically revised through a long reform process aimed at improving its financial sustainability. All these reforms aimed at increasing the retirement age and at curtailing pension benefits, by adopting benefit calculation methods that are more actuarially fair (that is, linking the life-time paid contributions to total future pension benefits). Indeed, in 1995 the calculation of pension benefits moved from a defined-benefit (DB) basis to a notional defined-contribution (NDC) basis, but only for those who had less than 18 years of paid contribution before January 1, 1996. Under the DB method the benefit is an average of the worker's last five years' gross earnings, while according to the NDC regime the

[8]The legislative decree n. 252/2005, implemented in 2007, introduced an automatic enrolment mechanism for voluntary pension funds: if an employee does not make an active choice after a six-month period (counting from 1 January 2007 for old employees and from their hire date for new employees), the TFR (severance payment) will be automatically paid into an occupational pension plan (typically, the industry-wide occupational plan). However, according to COVIP (2018), in 2017 less than 30% of the Italian working population has signed a contract with a private pension fund; however, private pension benefits are conditional on the eligibility for a public pension.

[9]The implicit tax rate on continuing working activity is the average effective tax burden on labour income once the individual is eligible for a public pension. The same labour income will be taxed at a marginal and average tax rates that are higher for an individual receiving a pension benefit than for an individual not eligible for it. Both OECD and Eurostat provide estimates for implicit tax rates at older ages; historically Italy has had very high implicit tax rates on labour income for 60+.

benefit is a fraction of the average earnings over the entire working life of an individual.

2.1 The pension reform

At the end of 2011, at the utmost of the sovereign debt crisis when the tensions in sovereign debt markets reached unprecedented levels, a substantial pension reform, which affected both the seniority and the old age pension schemes by introducing stricter eligibility rules, was announced and then implemented only a few days later (Law 22 December 2011 n. 201, known as "Fornero Reform").[10] 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.

To reach eligibility for the old age pension scheme before the reform, the retirement age was 60 for women and 65 for men, and individuals must have had accrued a minimum number of years of contribution.[11] The Fornero pension reform smoothly increased the retirement age for all workers up to 67 by 2020, both for men and for women, once they have accrued 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 paid contribution.

To be eligible for the seniority pension scheme before the reform, individuals must have accrued either 40 years of paid contribution (irrespective of their age) or a mix of age and years of contribution, the so called "quota system" (for instance the sum of age and years of paid contribution should have been 96 in 2006, with at least 59 years of age and 36 years of contribution; see Table 1). Rules were different depending on the sector of employment (i.e. depending on whether individuals were public or private sector employees or whether they were self-employed). The Fornero reform abolished the "quota system" and raised the minimum number of years of paid contribution from 40 to 42 for men, to 41 for women in 2012.[12]

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 in any other year, either before or after 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 for those who were still covered by

[10] At the end of 2010 another pension reform was implemented only for public sector workers (Law 30 July 2010 n. 122, known as "Sacconi Reform"). Since we do not have data for 2011, we do not separately identify the two reform; our estimates compare the labour market outcomes in 2010 with those observed in 2012 and onward, after the Sacconi and the Fornero reform.

[11] They must have accrued 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.

[12] 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.

the defined-benefit method of calculation (individuals with at least 18 years of accrued contribution by January 1996), moving them to the notional defined-contribution method for working years after 2011.

The reform left unaltered the early retirement scheme for women that was introduced in 2008 (the so-called *women's option*); however, this option has very rarely been used even after the Fornero reform (see INPS (2016) for more details).

The different mandated retirement age by gender, cohort, sector and, mostly, by previously accrued years of contribution implies that individuals have been differently affected by the reform in terms of how much the length of the residual working period before retirement did increase. To understand how, let's 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 have worked continuously throughout their working life, 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 the seniority scheme (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 most exposed were the ones who would have retired under the old age or the quota scheme, thus those with less continuous working lives (groups 2 and 3). Most affected men were those with an "intermediate" continuity of their working life (group 2): those hit by the abrogation of the "quota" scheme.

A simple example illustrates the source of variation in the increase in the MRA induced by the reform (Table 2) that we exploit in the empirical analysis. Consider three women, Maria, Antonia and Valeria (group 1, 2 and 3, respectively), all aged 58 and working as employees in the private sector; they differ in the number of total accrued years of contribution, respectively 38, 32 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 (group 2), her MRA corresponded to the mandated retirement age for the old age pension before the reform (60); after the reform, with the abolishment of the quota system, she will have to wait 7 years to become eligible again. Valeria faces the same shock of Antonia, she would have retired at 60 - under the old age system - before the reform and she has to wait to be 67 to retire afterwards, given her small number of previously accrued years of contribution. The reform increases the length of the working horizon differently for Maria, Antonia and Valeria, depending on the continuity of their previous working life.

The source of variation in the shock for men is different: those who experience a larger shock are men who would have retired under the quota system before the reform (Antonio in the example of Table 2); those who experience a smaller shock are instead men who would have retired under the old age system (like Valerio in the example, whose MRA increases from 65 to 67) and men who started to work very early and could retire with 40 years of paid contribution before the reform, and 43 after the policy change (like Mario in Table 2).

3 Empirical strategy

3.1 Data

In our analysis, the information on labour market 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. 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).

The 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 in place each year (as shown in Table 2). Moreover, there is an explicit question about the age at which the individual expects to retire, a crucial piece of information to support our identifying assumptions and the soundness of our approach. Furthermore, it provides information on the labour market status of both spouses within a household, necessary to test for within family interactions and not usually available in administrative data. Finally, thanks to the very rich and detailed information on earnings and welfare transfers, it is possible to evaluate the effect on different income sources.

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

3.2 Identification strategy

Our identification strategy aims at evaluating the magnitude of the perspective effect, it therefore studies the labour supply response of individuals who would not have been eligible to retire even under the pre-reform rules but whose MRA increased, due to the 2011 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, whether public or private employee and whether self-employed).[13] We then create a time invariant measure of exposure to the shock, by taking the difference between the expected MRA under the post-reform and under the pre-reform rules ($T_q = MRA_{q,2014} - MRA_{q,2010}$, which determines the cross sectional variation of our shock). We refer to MRA under the rules in place in 2014 since in that year the reform became fully effective.

In order to obtain the expected MRA before and after the reform for younger individuals ($MRA_{q,2010}$ and $MRA_{q,2014}$), we need to make assumptions about the expected amount of accrued years of contribution at the end of their 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 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.[14]

The left panel of Figure 1 describes the distribution of the shock in MRA (and therefore in distance to 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. Figure 1 shows that roughly 30% of women experienced a 7-year shock. About 15% of women experience a 2-year shock. The right panel of Figure 1 reports the distribution of the shock for men. The Figure 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

[13] We obtain information on occupation by using the usual sector of employment.

[14] 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 the age of 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). To minimize the possible error generated by this assumption on future contribution years, we therefore 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.

status in year t within the same cell q. The reduced form specification for individual i's labour force status is:

$$Y_{iqt} = \beta_1 T_q * post2011_t + \beta_2 X_{iqt} + \alpha_t + \alpha_q + \epsilon_{iqt} \tag{1}$$

where T_q is the change in the distance to retirement imposed on the cell q by the reform ($MRA_{q,2014} - MRA_{q,2010}$, described in Figure 1), a time invariant measure of exposure to the policy;$post2011_t$ is a dummy that indicates the post reform period; X_{iqt} is a vector of controls at the individual level (marital status, region of residence, usual sector of employment); α_t are year fixed effects, absorbing long term or cyclical developments that affect all individuals in the same way, and α_q are the fixed effects for each cell q, absorbing cross sectional variation in labour supply that depends on years of experience, age or sector of employment. Moreover, α_q absorb all pre-reform differences in distance to MRA. Finally, ϵ_{iqt} is an error term. Standard errors are clustered at the cell q level.

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 distance to retirement (defined as $MRA_{qt} - age_{qt}$) is negative even before the reform.[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 well as individuals younger than 45. Our results are robust to changes in the considered sample.

Our coefficient of interest is β_1, which estimates the average labour supply differences between cells that experienced a larger or a smaller increase in MRA, exclusively depending on their degree of exposure to the policy, around its implementation.

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 $s \neq s'$. In particular, we run the following linear probability model, for both partners:

$$Y^s_{jq_sq_{s'}t} = \beta^s_1 T_{q_{s'}} * post2011_t + +\beta^s_2 X_{jt} + \alpha^s_{q_{s'}} + \alpha^s_t + \alpha^s_{q_st} + \epsilon^s_{jq_sq_{s'}t} \tag{2}$$

[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.

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; X_{jt} is a vector of controls at the individual and at the household level (region of residence, the difference in distance to retirement and age among partners); α^s_t are year dummies and $\alpha^s_{q_{s'}}$ are fixed effects for the cell q based on the characteristics of partner s'. In order to absorb changes in s's labour supply induced by variation in her own MRA, we include among our controls $\alpha^s_{q_st}$ fixed effects, which absorb partner s's shock to distance to retirement. Finally, $\eta^s_{jq_{s'}t}$ is an error term. The coefficient β^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.

3.3 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. Section 2 already explains why this is likely to be the case; Figure 2 provides some other 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 Battistin et al. (2009), Ciani (2016) and Manacorda and Moretti (2006)).

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 more exposed to the reform increased more after 2011 than the expected retirement age of women less affected by the shock. Figure 3 supports this second assumption; it shows that, in our sample, most exposed individuals expect their retirement age to increase more after 2011 than least exposed ones. It seems reasonable to conclude that individuals were indeed familiar with the consequences of the new pension system with respect to their

individual situations, also given the large public debate around the reform.

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 this assumption, we show that the difference in the labour supply behaviour of individuals more or less exposed to the shock was constant before 2012 and started changing exactly after the introduction of the new pension rules, in 2012. We estimate the following equation for men and women separately:

$$Y_{iqt} = \sum_{r=2004}^{2016} \gamma_r \left(T_q * \delta_r\right) + \gamma Z_{iqt} + \delta_q + \delta_t + \eta_{iqt} \tag{3}$$

where all variables are defined as in equation (1) and δ_r are year dummies.

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

$$Y^s_{jq_sq_{s'}t} = \sum_{r=2004}^{2016} \zeta^s_r \left(T_{q_{s'}} * \alpha^s_r\right) + \beta^s Z_{jt} + \alpha^s_{q_{s'}} + \alpha^s_t + \alpha^s_{q_{st}} + u^s_{jq_sq_{s'}t} \tag{4}$$

where again all variables are defined as in equation (2) and α^s_r are year dummies.

The coefficients γ_r and ζ^s_r of equations (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 4 displays the coefficients γ_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 exposed to the reform increased relative to that of less exposed women, while that of men did not change differently. In the same way, the figure displays the coefficients ζ^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 reform.

3.4 Descriptive statistics

The top panel of Table 3 shows descriptive statistics for the groups of women and men, more and less exposed to the changes in the pension rules.[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 with at least 10 years of contribution). Individuals in our sample are slightly younger and display higher participation rates that the overall population, as we are excluding those eligible to retire (and those already retired). 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 there is no large difference in term of previously accrued years of contributions for most affected men, as the least affected among men are the ones who started to work very early and could retire with 40 years of contribution before the reform (very continuous working lives), or the ones with very discontinuous working lives, that would retire under the old age system. 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 average 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.

4 Results

4.1 Individual level analysis

Table 4 reports the results obtained from estimating equation (1) on activity, employment and unemployment. We also study the nature of the changes in employment, by looking at the probability of being employed in a part-time or a full-time job. We choose to split

[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 ≥ 7 years and most exposed men are those whose change in MRA was ≥ 4 years.

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 display results for men 55-64, 50-54 and 45-49. [17]

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 have less time to adjust their labour supply. In particular, we find that if the length of the working life increases by one year, the probability of participating in the labour market increases by 3.3 percentage points for women aged 55-59, by 1.5 ppt. for women between 50 and 54 and by 1.1 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: women are more likely to switch 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. Finally, the positive labour supply response of women shifts to higher labour and disposable income.[18] In line with the idea that individuals are responding to a negative wealth shock, we observe a positive response as for households savings (or maybe for precautionary reasons).

In line with the existing literature which underlines that labour supply is much less elastic for men than for women, men do not seem to react much to changes in their working horizon. 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 aged between 56 and 59.[19]

Note that such an important pension reform has probably generated some general equilibrium effects on wages and on labour demand. However, as long as these general equilibrium responses do not impact individuals differently depending on the length of their working horizon, our estimates of β_1 capture the results of changes in labour supply response only, net of general equilibrium effects.

Overall, we estimate that the increase (by 4 years on average) in the working horizon

[17] We do not look at even younger individuals, on the one hand, because for them the working horizon effect is less likely to be at work, or it is probably very small; moreover, it is more difficult to make assumptions about their expected years of contribution at the end of their working life, as they still have to make almost entirely their labour supply choices.

[18] We consider only employees since self-employed measures of income are rather not reliable in SHIW data (Brandolini, 2000).

[19] Table B.1 in Appendix B shows that our results are robust also 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 education and cultural changes.

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 20% of the increase in the share of unemployed women.

4.2 Mechanisms and heterogeneous effects

In Tables 5, 6 and 7 we consider several relevant dimensions of heterogeneity across individual and labor market characteristics to shed light on the mechanisms driving our results.

First, we consider differences in local labor demand. While the effect of higher MRA on participation of middle-aged individuals is unambiguously positive, that on employment or unemployment is ambiguous. In particular, on one side the longer distance to retirement increases the probability of working at younger ages - because of changes in expected pension wealth or because individuals with higher disutility from working at older ages may prefer to increase labour supply when younger, since retirement has been postponed. On the other side the effect on unemployment is ambiguous, since a longer distance to retirement may also reduce the cost of waiting for a better offer, implying a prolonged unemployment status. Our estimates across age classes seem to suggest that for older individuals prevails the first effect, as they increase their employment probabilities, while for younger individuals prevails the second channel, which leads to an increase in unemployment. In the attempt of validating this interpretation and of excluding that the unemployment effects are driven by the scarcity of jobs for relatively younger individuals (i.e. that the effect on unemployment is actually driven by changes in the job acceptance rule and not by the lack of jobs), we study the effect in Italian regions where labour demand is high. Table 5 distinguishes between regions with a vacancy rate above or below the year-specific median.[20] It shows that the effect on unemployment for women aged 45-49 persists even in the presence of high labour demand. The effect supports the mechanism according to which the distance to retirement enhances the incentives to look for a job and for a better offer, by modyfing the job acceptance rule.

The second dimension of heterogeneity we explore is whether and by how much the labour supply response generated by the reform was driven by possible reductions of life-time income associated to the delay of pension benefits. The entity of the loss mainly depends on how pension benefits are calculated: as long as the benefit determination is actuarially fair, that is when total contributions to social insurance are equal to total retirement benefits received, the delayed retirement does not generate any loss in net pension wealth; instead, the loss is increasing in the difference between total benefits and total social contributions. Before the 2011 reform, pension benefits were

[20] 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.

computed under different regimes, either defined-benefit or notional defined-contribution, depending on some observable characteristics. The notional defined-contribution creates a stronger link between social contributions and pension benefits than those implied by the defined-benefit methods. Thus, those individuals within the defined-benefit regime, whose benefits were computed on the basis of the last five years' gross earnings before the reform and according to NDC rules after the reform, were those who experienced the largest drop in net wealth. Table 6 distinguishes the effect for individuals who were under the defined benefit system, for whom the wealth effects are larger. It suggests that wealth effects are not the only mechanisms behind the positive labour supply response, since the results are significant also for the group for whom pension wealth did not (or only slightly) decrease.

As a further exercise, we evaluate how the effect differs by educational levels, in particular depending on whether individuals achieved at least a secondary school degree. The results in the top panel of Table 7 show that the effect is concentrated on individuals with lower levels of education. If we take education as a proxy for permanent income, consistently with the life-cycle theory, this implies that individuals with lower income are more affected by an anticipated increase in the length of their working horizon. Moreover, low-educated individuals might be also more borrowing constrained and more sensitive to changes in expected future income. To explore this mechanism, in the bottom panel of Table 7 we detect whether the presence of borrowing constraints, proxied by having net wealth above or below the year-specific median, makes the individuals more prone to increase their labour supply in response to the reform, as they are probably less able to obtain credit in order to smooth consumption over different time periods. The results suggest that borrowing constraints probably do not matter much, as the response is similar across different levels of net household wealth.

4.3 Within family interactions

Table 8 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. In this case we collapsed all age classes together, so to improve estimation power. 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 almost 3 ppt., supporting the hypothesis of leisure complementarities (similarly to some of the available literature on 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 may appear puzzling, is that husbands respond more to their wives' rather than to their own shocks (Column 2 against Column 3 of Table 8). 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 may respond by supplying more labour and postponing 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 very 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 their 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 non-employment time for women is less likely to be only devoted to leisure as women are usually more involved in household production (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 for men non-working time is more likely to be related to leisure.

Finally, Table 9 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 for wages. The results confirm what we found in Table 7: low educated individuals are the ones who respond the most to changes in their own and to their spouse's working horizon, because their marginal utility from working more is higher.

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

4.4 Magnitude: comparing the direct and the perspective effects

In the Introduction we distinguished between two effects associated to the delaying of minimum retirement age: the *direct effect*, on individuals who would have met eligibility requirements under the previous rules but who are not eligible anymore under the new rules; and the *perspective effect*, on individuals who would not have been eligible to retire

under any scenario, but whose working horizon increases. The direct eligibility effect has been quite extensively estimated by the previous literature, in different institutional settings and for different countries (Staubli and Zweimüller (2013), among many others). In this section we estimate for our setting, to better evaluate the magnitude of the perspective eligibility effect.

Our identification strategy for the direct eligibility effect is 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, 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 $d_{2010i} = MRA_{2010i} - age_i$ indicates the distance to retirement under the pre-reform rules, equal to the difference the between minimum retirement age, computed according to the 2010 pension rules, and actual age. We estimate the following equation:

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

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}; ψ_t represent year fixed effects and v_{it} is an error term, which we cluster at the individual level. The coefficient β is our parameter of interest, that indicates to what extent labour market participation is higher after the reform, around the pre-reform eligibility threshold.

Moreover, we know that, after the reform, women adjusted their labour supply, even if off the eligibility cut-off, due to the perspective eligibility effect. This would violate the identifying assumption of the difference-in- discontinuity estimator. Therefore, for the analysis of the direct eligibility effect we only consider women who previously belonged to the control group.

Our estimating equation compares the size of discontinuity in the probability of being active around E_i before and after 2012; more specifically it compares the probability of being active in the pre-reform and in the post-reform years of those 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 active individuals around the E_i. Figure 5 provides visual inspection of the variation we exploit. The blue (grey) dots are observations in years pre-2012 (post-2012). The top panel shows the evolution of the probability of being active in the labour market as a function of the distance to the MRA according to the 2010 pension rules, respectively for women and men. Individuals eligible to retire under the 2010 pension rules show a higher probability to participate in the post 2012 years than in the pre-2012 years. Moreover, while in the pre-reform years there is a clear discontinuity around 0 in the probability of being active, from 2012 onward this discontinuity does not longer exist.

Point estimates of equation (6) are reported in Table 10. We find that both women and men participate more in the labour market in response of the delay 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, larger for women, and about eight times larger than the perspective eligibility effects estimated in the previous sections.[21]

As for intra-household interactions, we do not find any significant effect. The bottom panel of Figure 5 displays the probability of being active as a function of the partner's distance to retirement according to the 2010 pension rules. It shows that, partners of individuals would have been eligible to retire according to the 2010 rules and are not eligible anymore under the new rules, do not have a higher probability of being active after 2012. The second panel of Table 10 confirms this result.

If husbands want to coordinate their retirement decisions with their wives, we would expect them to increase their participation in response to their wives higher retirement age. However, the vast majority of husbands in this sample have already made their retirement decision (85% were already eligible to retire or already retired). Indeed, we do observe some positive labour supply response among not yet retired husbands.

Finally, we show some standard robustness tests for the difference in discontinuity approach in Appendix A and B. In Figure A.1 we shed some light on the timing of the effect to provide evidence that individuals just above and just below the threshold E_i were on parallel trends before 2012. The evidence shows that the trend was parallel both at the individuals level and for the cross-partner analysis. Figure A.2 checks how our results are sensitive to the bandwidth chosen. It plots the estimated coefficient (and the corresponding 95% confidence intervals), when imposing different bandwidth around the threshold. The estimated coefficients are always similar, independently of the bandwidth. Finally, in Table B.3 we study whether observable characteristics are similar

[21]Note, however, that the perspective eligibility effect we elicited in the previous sections creates a downward bias in the estimation of the direct eligibility effect. Indeed, since it increases the participation rate of those who are slightly on the right of the E_i threshold for post-reform years in Figure 5, it reduces the difference in the probability of being active around the eligibility threshold before and after the reform. For this reason, in the case of women we estimate the direct eligibility effect only on those women who belong to our control group in our difference-in-differences analysis, for whom by construction the perspective eligibility effect is absent.

for individuals just above or below the threshold, before and after 2012. The Table shows that observable characteristics are quite balanced, especially when including a quadratic or a cubic polynomial of the running variable.

5 Conclusion

This paper challenges whether the labour supply response to reforms that increase the minimum retirement age (MRA, the age at which individuals can claim their pension for the first time) goes well beyond the intuitive effect on older workers, who would have been eligible to retire under the previous eligibility rules. More in details, this paper investigates if middle-aged individuals adapt their labour supply decisions when informed about the delayed pension eligibility. Moreover, following the growing evidence of the relevance of partners' interactions, we also explore the existence of labour supply spillovers among partners, which may amplify or nullify the individual-level response.

To answer these questions we exploit a pension reform that took place in Italy in 2012 and that increased the MRA by four years on average. We estimate a difference-in-differences model that compares the labour supply of otherwise similar individuals, with heterogeneous exposure to the policy because of differences in the continuity of their pre-reform working life. We find positive effects on participation and job search behaviour of middle-aged individuals, far from their pension eligibility threshold. The effect is concentrated on women, whose labour supply is more elastic. We find moreover that husbands respond to the higher labour supply of their wives by postponing their own retirement. Finally, we show that a longer working horizon induces families to rely on more stable sources of income: middle-aged women are more likely to be employed full-time and their families tend to rely more on labour income rather than on welfare transfers (either unemployment benefits or low income transfers).

Our findings have important policy implications, in the light of assessing the comprehensive labour supply effects of policies that increase the MRA. We stress the importance of not focusing only on older workers but of also studying the response of individuals who are further away from actual retirement but whose working horizon increases. According to our estimates, the labour supply response of middle-aged plays an important part - even larger than the effect on older individuals - in increasing the aggregate labour force participation rate.

Moreover, our findings point out that the usual way of estimating the labour supply responses of older workers to pension reforms - i.e. by evaluating their probability of being active after the reform, around the pre-reform eligibility threshold - may deliver biased estimates of the effect. Indeed, also individuals far away the pre-reform cut-off respond

to the new retirement rules, therefore violating the standard identifying assumptions in a regression in discontinuity framework.

Finally, we show how within household interactions may extensively amplify individual effects. We find that middle-aged men do not respond to an increase in their own working horizon, as their labour supply is not elastic. However, husbands of middle-aged women tend to be older and have much more elastic labour supply (since they are at the margin of deciding when to retire). We find that they do respond to an increase in their wives working horizon, by postponing their own retirement in order to enjoy leisure together.

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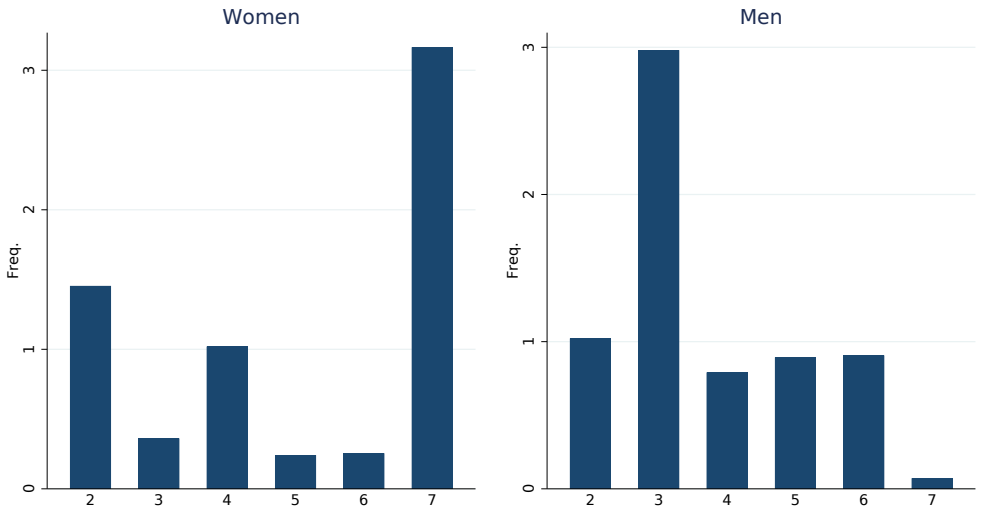
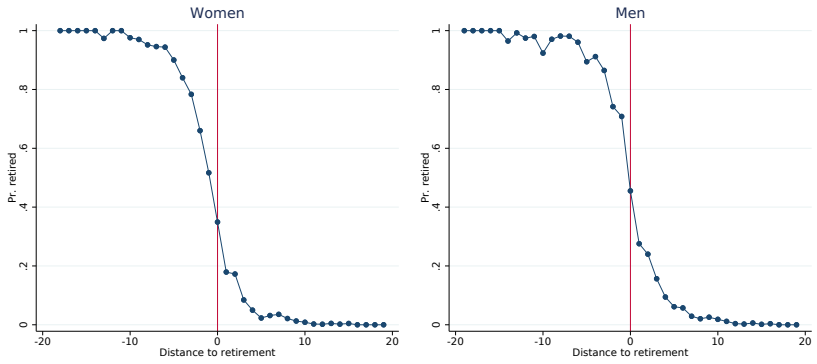
Figures and Tables

Figure 1: Distribution of the shock in the length of the working horizon by gender (variation in pension rules between 2014 and 2010)



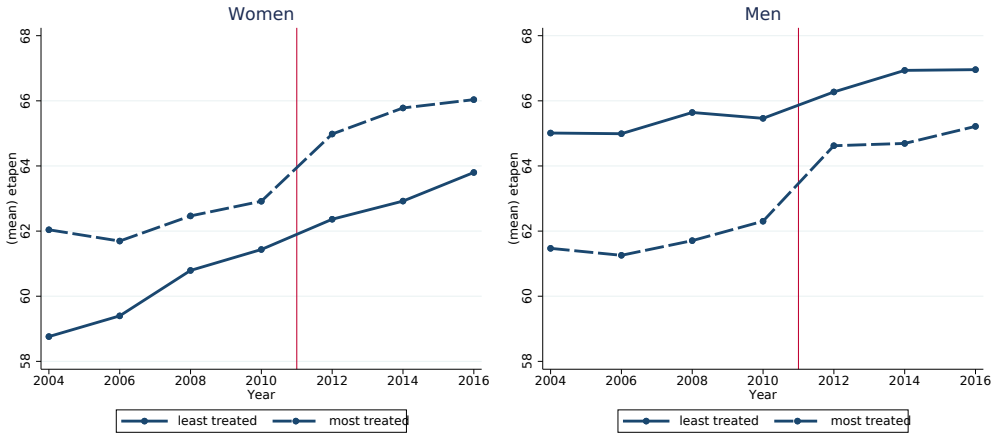
Source: SHIW, from 2010 to 2016.
Note: The Figure displays the distribution of the reform-induced shock to the working horizon by gender. It shows the distribution of the difference between the minimum retirement age (MRA, the age at which individuals can claim their first pension benefit, either old age or seniority) under the post reform pension rules ans the MRA under the pre-reform rules in our sample (women aged between 45 and 59, with at least 10 and less than 40 accrued years of contribution, eligible to retire neither before nor after the reform; men aged between 45 and 64, with at least 20 and less than 40 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 given value of shock. This is the variation used to compute the analysis.

Figure 2: Probability of retiring and distance to the minimum retirement age, by gender



Source: SHIW, from 2010 to 2016.
Note: The Figure plots the probability of being retired as a function of the distance to the minimum retirement age (MRA, the age at which individuals can claim their first pension benefit, either old age or seniority). Distance to MRA is the difference between the minimum retirement age according to the rules in place at the year of the interview and the individual's age in the same year. The Figure shows that individuals actually retire when they reach their MRA, i.e. when their distance to retirement approaches 0.

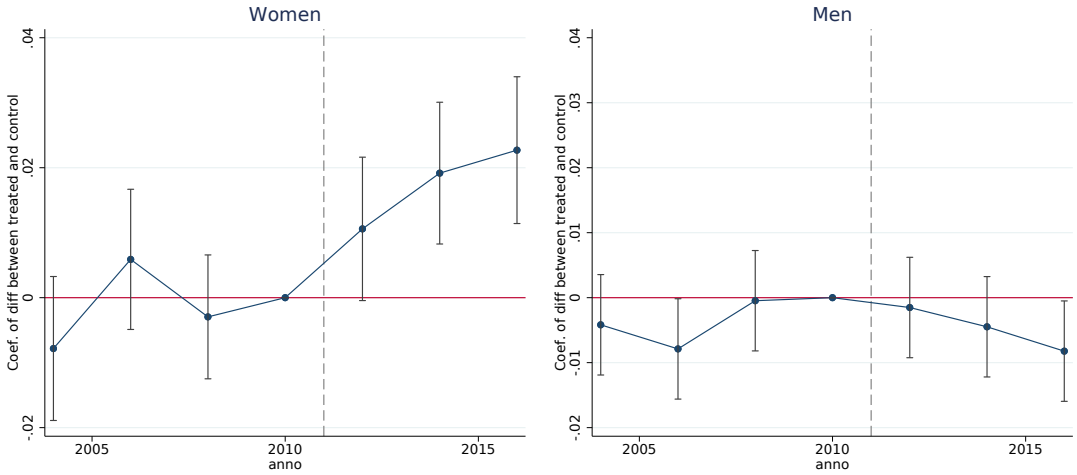
Figure 3: Declared expected retirement age over time, by gender and exposure to the policy shock



Source: SHIW, from 2004 to 2016, question on expected retirement age.
Note: The Figure shows that the declared expected retirement age increases more around the reform (2012) for women and men more exposed to the change in the minimum retirement age (most treated). We consider: only individuals with at least 10 (for women) or 20 (for men) and less than 40 accrued years of contribution; women aged 50-59; men aged 55-64, not eligible to retire either before or after the 2011 pension reform. The question on expected retirement age is asked only to employed individuals.

Figure 4: The effect of reform-induced changes in the working horizon: evolution of the difference in the probability of being active between more and less exposed individuals

(a) Prob of being active: individual effects

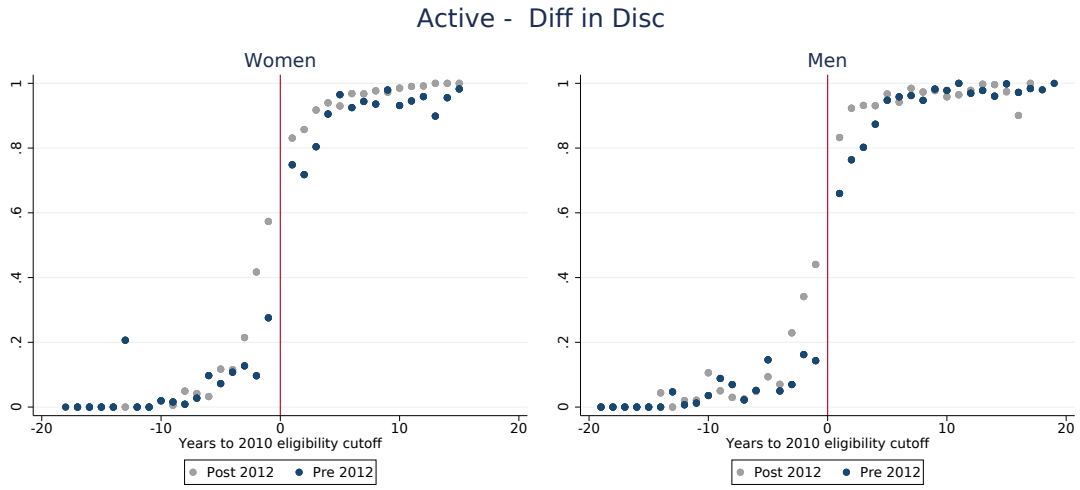


(b) Prob of being active: within family interactions

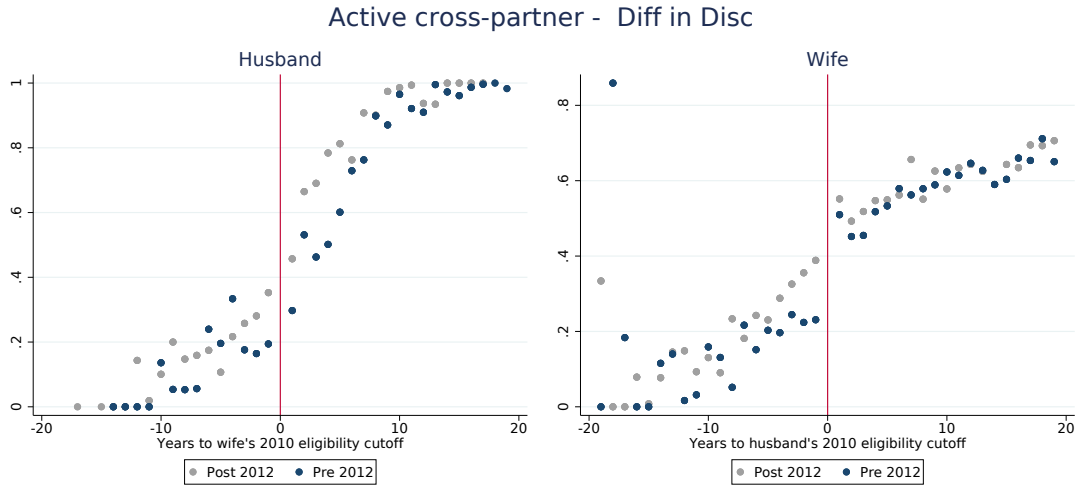
Source: SHIW, from 2004 to 2016.
Note: The graphs test the parallel trend assumption by plotting the coefficients γ_r and ζ_r^s (and the corresponding 5% confidence intervals) obtained from estimating equations 3 and 4. Pre-reform years: 2004-2006-2008-2010, post-reform years: 2012-2014-2016. The omitted year is 2010. Sample: individuals with at least 10 (for women) or 20 (for men) and less than 40 accrued years of contribution; women aged 50-59; men aged 55-64, not eligible to retire either before or after the 2011 pension reform.

Figure 5: The direct effect: the labour supply effect of postponing pension benefit eligibility

(a) Individual effect



(b) Cross partner effect



Source: SHIW, from 2010 to 2016.
Note: The top panel shows the evolution of the probability of being active in the labour market as a function of the distance to the minimum retirement age according to the 2010 pension rules (that is the difference between the minimum retirement age under 2010 rules and the age at the interview). The bottom panel displays the probability of being active as a function of own partner's distance to retirement according to the 2010 pension rules. The blue (grey) dots are observations in years pre-2012 (post-2012). The sample for women only includes those less affected by the change in the working horizon, in order to avoid estimation biased determined by the perspective effect. The top panel shows that after 2012 individuals eligible to retire under the previous pension rules have a higher probability of being active in the labour market than in pre-reform years, and that the discontinuity around zero (which means that the individual would have reached the pension eligibility according to the 2010 rules) does not longer hold. The bottom panel shows that after 2012 partners of those individuals who would have been eligible to retire according to the 2010 rules do not have a higher probability of being active.

Table 1: Seniority pension eligibility rules

	Private & Public		Self-employed	
Year	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 reach retirement eligibility. Independently from actual age, retirement eligibility is also granted when the number of accrued 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, employees in the private sector group

	2010		2014		Shock
	Seniority	Old	Seniority	Old	(2014 - 2010)
Women, 58 years old					
Maria, $C = 38$	**60**	60	**62**	67	2
Valeria, $C = 26$	67	**60**	73	**67**	7

Notes: This Table reports an example of individuals differently treated by the mandated extension of the MRA, because of heterogeneity on their previous working histories. The Table displays the age at which individuals can claim the old age and the seniority pension. The minimum retirement age takes the first age of eligibility among the two pension benefits. 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 implemented 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)
Married	0.762	0.718	0.729	0.710	0.830	0.840	0.836	0.845
High edu	0.497	0.616	0.663	0.582	0.484	0.538	0.467	0.636
If children	0.660	0.632	0.605	0.651	0.640	0.617	0.626	0.605
Active	0.583	0.881	0.976	0.812	0.795	0.979	0.973	0.989
Unempl	0.043	0.044	0.022	0.060	0.071	0.050	0.052	0.048
Part time	0.102	0.147	0.144	0.150	0.022	0.017	0.017	0.018
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	16156	9036	3852	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)
High edu w	0.486	0.603	0.672	0.545	0.501	0.664	0.615	0.729
High edu h	0.483	0.558	0.599	0.523	0.493	0.627	0.548	0.732
If children	0.705	0.690	0.665	0.712	0.678	0.654	0.654	0.654
Active w	0.523	0.841	0.971	0.733	0.508	0.859	0.838	0.886
Active h	0.768	0.777	0.820	0.741	0.794	0.987	0.984	0.991
Unempl w	0.035	0.039	0.019	0.055	0.037	0.037	0.037	0.036
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	11842	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, or 20 for men, and less than 40 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 minimum retirement age of ≥ 7 (≥ 4) years after 2011 reform). High edu is a dummy indicating whether individuals have at least secondary education. W stands for wives, h stands for husbands. For the bottom panel: the same above sample 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	0.033***	0.015***	0.011***	-0.002	-0.003	0.005*
	(0.006)	(0.004)	(0.004)	(0.004)	(0.002)	(0.003)
			Unemployment			
T*post2011	0.012**	0.009***	0.006**	-0.004	-0.001	0.009
	(0.006)	(0.004)	(0.003)	(0.006)	(0.005)	(0.008)
			Employment			
T*post2011	0.022***	0.006	0.004	0.001	-0.002	-0.004
	(0.006)	(0.004)	(0.005)	(0.007)	(0.006)	(0.009)
			Full-time employment			
T*post2011	0.024***	0.015**	0.018**	-0.000	0.004	-0.010
	(0.008)	(0.007)	(0.008)	(0.007)	(0.007)	(0.012)
			Part-time employment			
T*post2011	-0.003	-0.009	-0.016**	-0.001	0.000	0.004
	(0.007)	(0.006)	(0.007)	(0.003)	(0.004)	(0.006)
N	2456	3332	3091	3577	3856	3194
			For employees only			
			Labour income			
T*post2011	461.679***	-117.927	156.931	37.509	-133.892	-275.212
	(172.064)	(165.291)	(119.276)	(289.677)	(277.224)	(447.801)
			Total income			
T*post2011	578.846***	-17.615	138.773	-103.342	-275.824	136.327
	(219.123)	(190.717)	(143.599)	(335.452)	(406.235)	(597.895)
			Savings			
T*post2011	752.686*	273.928	139.661	382.444	-317.404	280.112
	(389.635)	(220.401)	(231.913)	(272.291)	(336.174)	(322.087)
N	1831	2730	2548	2708	2967	2470

Notes: T*post2011 is the estimated difference-in-differences coefficient of the longer working horizon. Additional controls: year and cell q fixed effects (each cell is defined by age, gender, number of years of accrued contribution and sector of employment), 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 of at least 10 for women or 20 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 working status by regional vacancy rate

	Women			Men		
	55-59	50-54	45-49	55-64	50-54	45-49
	(1)	(2)	(3)	(4)	(5)	(6)
			Participation			
T*post2011	0.037***	0.010	0.011	0.001	-0.000	0.005
	(0.010)	(0.008)	(0.008)	(0.006)	(0.004)	(0.005)
T*post2011*high lambda	-0.004	0.011	-0.000	-0.009	-0.006	0.000
	(0.013)	(0.011)	(0.009)	(0.009)	(0.005)	(0.007)
			Unemployment			
T*post2011	0.006	0.011	0.014*	-0.006	-0.007	0.000
	(0.009)	(0.008)	(0.008)	(0.009)	(0.008)	(0.014)
T*post2011*high lambda	0.002	-0.002	-0.011	0.007	0.011	0.016
	(0.012)	(0.009)	(0.010)	(0.010)	(0.012)	(0.013)
			Employment			
T*post2011	0.030***	-0.001	-0.003	0.007	0.007	0.004
	(0.011)	(0.011)	(0.009)	(0.010)	(0.009)	(0.016)
T*post2011*high lambda	-0.006	0.012	0.011	-0.016	-0.017	-0.015
	(0.014)	(0.013)	(0.011)	(0.012)	(0.012)	(0.014)
N	2453	3332	3090	3576	3856	3193

Notes: T*post2011 is the estimated difference-in-differences coefficient of the longer working horizon. High lambda is a dummy equal to one if the regional-year vacancy rate is above the median. Additional controls: year and cell q fixed effects (each cell is defined by age, gender, number of years of accrued contribution and sector of employment), 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 of at least 10 for women or 20 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 of individuals under the defined contribution system before the pension reform

	Women			Men		
	55-59	50-54	45-49	55-64	50-54	45-49
	(1)	(2)	(3)	(4)	(5)	(6)
			Participation			
T*post2011	0.020*	0.019**	0.017**	-0.006	-0.005	-0.001
	(0.011)	(0.009)	(0.008)	(0.009)	(0.004)	(0.008)
T*post2011*DB	0.053	-	-	0.001	0.001	-
	(0.040)	-	-	(0.008)	(0.013)	-
			Unemployment			
T*post2011	0.013	0.018**	0.010	0.001	0.003	0.006
	(0.014)	(0.008)	(0.006)	(0.016)	(0.015)	(0.019)
T*post2011*DB	-0.003	-	-	-0.011	-0.026	-
	(0.028)	-	-	(0.015)	(0.027)	-
			Employment			
T*post2011	0.006	0.002	0.007	-0.007	-0.008	-0.006
	(0.015)	(0.010)	(0.011)	(0.018)	(0.014)	(0.023)
T*post2011*DB	0.056*	-	-	0.012	0.027	-
	(0.032)	-	-	(0.016)	(0.029)	-
N	2453	3332	3090	3576	3856	3193

Notes: T*post2011 is the estimated difference-in-differences coefficient of the longer working horizon. In the defined contribution system the expected pension wealth is closely linked to the length of the working activity; in this scheme the expected pension wealth is not reduced by the delaying of the minimum retirement age. For some age classes we could not estimate the interaction because of very few middle-aged individuals under the defined benefit system (DB, i.e. those with at least 15 years of contribution in 1995). Additional controls: year and cell q fixed effects (each cell is defined by age, gender, number of years of accrued contribution and sector of employment), 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 of at least 10 for women or 20 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 by education level and household wealth

	Women			Men		
	55-59	50-54	45-49	55-64	50-54	45-49
	(1)	(2)	(3)	(4)	(5)	(6)
By education level						
Participation						
T*post2011	0.053***	0.027***	0.017**	-0.005	-0.005	0.005
	(0.009)	(0.007)	(0.008)	(0.007)	(0.003)	(0.007)
T*post2011*high edu	-0.041***	-0.023***	-0.009	0.009	0.005	-0.001
	(0.010)	(0.009)	(0.009)	(0.009)	(0.005)	(0.008)
Unemployment						
T*post2011	0.020**	0.021***	0.010	-0.006	-0.001	0.008
	(0.010)	(0.007)	(0.006)	(0.011)	(0.010)	(0.018)
T*post2011*high edu	-0.011	-0.018**	-0.005	0.005	0.000	0.001
	(0.012)	(0.007)	(0.007)	(0.012)	(0.011)	(0.020)
Employment						
T*post2011	0.033***	0.006	0.007	0.001	-0.004	-0.004
	(0.012)	(0.009)	(0.010)	(0.012)	(0.009)	(0.020)
T*post2011*high edu	-0.029**	-0.005	-0.004	0.004	0.005	-0.001
	(0.013)	(0.011)	(0.012)	(0.015)	(0.011)	(0.022)
By household wealth						
Participation						
T*post2011	0.042***	0.025***	0.009*	-0.007	-0.006	0.005
	(0.010)	(0.007)	(0.005)	(0.006)	(0.004)	(0.006)
T*post2011*rich	-0.013	-0.012	0.002	0.008	0.005	0.000
	(0.010)	(0.009)	(0.006)	(0.008)	(0.005)	(0.006)
Unemployment						
T*post2011	0.013	0.012*	0.012**	-0.002	-0.007	0.014
	(0.011)	(0.006)	(0.005)	(0.010)	(0.010)	(0.010)
T*post2011*rich	-0.006	-0.005	-0.011*	-0.001	0.011	-0.011
	(0.012)	(0.007)	(0.006)	(0.012)	(0.014)	(0.011)
Employment						
T*post2011	0.029**	0.013	-0.002	-0.006	0.001	-0.010
	(0.013)	(0.008)	(0.006)	(0.011)	(0.011)	(0.013)
T*post2011*rich	-0.007	-0.007	0.013*	0.008	-0.005	0.011
	(0.014)	(0.011)	(0.008)	(0.013)	(0.016)	(0.013)
N	2456	3332	3091	3577	3856	3194

Notes: T*post2011 is the estimated difference-in-differences coefficient of the longer working horizon. High edu is a dummy equal to 1 if individuals obtained at least the secondary school degree. Rich is a dummy equal to 1 if the household wealth is above the yearly median. Additional controls: year and cell q fixed effects (each cell is defined by age, gender, number of years of accrued contribution and sector of employment), 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 of at least 10 for women or 20 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: Cross effects among partners of the longer working horizon on working 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	0.022***	0.018**		
	(0.003)	(0.007)		
T husb*post2011			-0.002	-0.011
			(0.003)	(0.010)
		Unemployment		
T wife*post2011	0.013***	0.006		
	(0.003)	(0.004)		
T husb*post2011			-0.001	-0.008
			(0.005)	(0.006)
		Employment		
T wife*post2011	0.010**	0.012		
	(0.004)	(0.008)		
T husb*post2011			-0.001	-0.003
			(0.006)	(0.011)
N	5326	5326	3819	3819

Notes: T wife*post 2011 is the estimated difference-in-differences coefficient of the wife's longer working horizon; T husband*post 2011 is the estimated difference-in-differences coefficient of the husband's longer working horizon. Additional controls: year and cell $q_{s'}$ and q_s fixed effects (separately for each dimension; each cell is defined by age, gender number of years of accrued contribution and sector of employment), 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 of at least 10 (20), and smaller than 40. The results for labour and pension incomes refer to the sample of employees only. Robust standard errors clustered at the cell $q_{s'}$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Cross effects among partners of the longer working horizon on working 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	0.034***	0.023**		
	(0.007)	(0.022)		
T husb*post2011			-0.005	-0.070
			(0.005)	(0.060)
T wife*post 2011*own high edu	-0.025***	-0.011		
	(0.007)	(0.012)		
T husb*post 2011*own high edu			0.002	0.026
			(0.006)	(0.048)
		Unemployment		
T wife*post2011	0.022***	0.009		
	(0.005)	(0.006)		
T husb*post2011			-0.007	-0.018
			(0.013)	(0.034)
T wife*post 2011*own high edu	-0.013**	-0.007		
	(0.006)	(0.008)		
T husb*post 2011*own high edu			0.010	0.007
			(0.014)	(0.035)
		Employment		
T wife*post2011	0.013*	0.014		
	(0.008)	(0.011)		
T husb*post2011			0.003	-0.020
			(0.014)	(0.047)
T wife*post 2011*own high edu	-0.012	-0.004		
	(0.009)	(0.013)		
T husb*post 2011*own high edu			-0.009	0.019
			(0.015)	(0.054)
N	5291	5291	3661	3661

Notes: T wife*post 2011 is the estimated difference-in differences coefficient of the wife's longer working horizon; T husband*post 2011 is the estimated difference-in-differences coefficient of the husband's longer working horizon. own high edu is a dummy equal to 1 if individuals, for which the labour supply effect is estimated, obtained at least the secondary school degree. Additional controls: year and cell $q_{s'}$ and q_s fixed effects (separately for each dimension; each cell is defined by age, gender, number of years of accrued contribution and sector of employment), 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 of at least 10 (20), 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 10: The direct effect of postponing pension eligibility

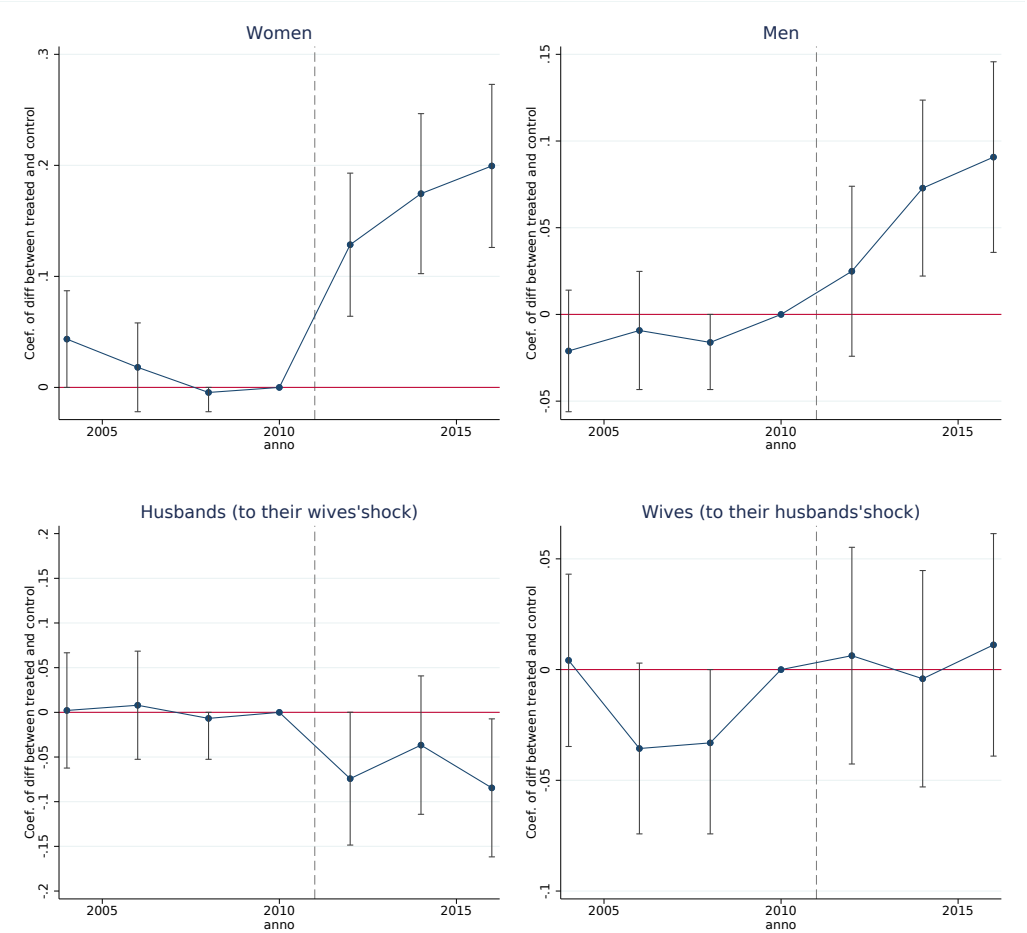
	Women			Men		
	linear	quadratic	cubic	linear	quadratic	cubic
	(1)	(2)	(3)	(4)	(5)	(6)
Individual effect						
			Participation			
E_{2010}*post2011	0.213***	0.273***	0.250***	0.105***	0.101***	0.081
	(0.037)	(0.052)	(0.068)	(0.027)	(0.039)	(0.051)
			Unemployment			
E_{2010}*post2011	0.027**	0.007	-0.021	0.002	0.006	-0.047
	(0.013)	(0.021)	(0.032)	(0.012)	(0.020)	(0.030)
			Employment			
E_{2010}*post2011	0.185***	0.266***	0.270***	0.103***	0.095**	0.128**
	(0.038)	(0.055)	(0.075)	(0.028)	(0.042)	(0.057)
N	9902	9902	9902	18784	18784	18784
Cross-partner effect						
	on husbands (wives' shock)			on wives (husbands' shock)		
			Participation			
$E^{s'}_{2010}$*post2011	-0.023	-0.044	-0.038	0.065**	0.012	-0.031
	(0.036)	(0.053)	(0.075)	(0.028)	(0.042)	(0.059)
			Unemployment			
$E^{s'}_{2010}$*post2011	0.005	-0.010	0.014	-0.011	-0.004	-0.011
	(0.016)	(0.023)	(0.031)	(0.010)	(0.015)	(0.021)
			Employment			
$E^{s'}_{2010}$*post2011	-0.029	-0.035	-0.052	0.076***	0.017	-0.020
	(0.037)	(0.055)	(0.077)	(0.029)	(0.042)	(0.057)
N	5924	5924	5924	14375	14375	14375

Notes: E_{2010}*post2011 is the estimated difference-in-discontinuity coefficient for pension eligibility according to the rules in place in 2010; $E^{s'}_{2010}$*post2011 is the estimated difference-in-discontinuity coefficient for partner s' pension eligibility according to the rules in place in 2010. Additional controls: year fixed effects, polynomial of the running variable (linear in columns 1 and 4, quadratic in columns 2 and 5, cubic in columns 3 and 6). The sample consists of individuals whose distance to retirement according to the pre-reform rules was between 20 and -20. Robust standard errors clustered at the individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

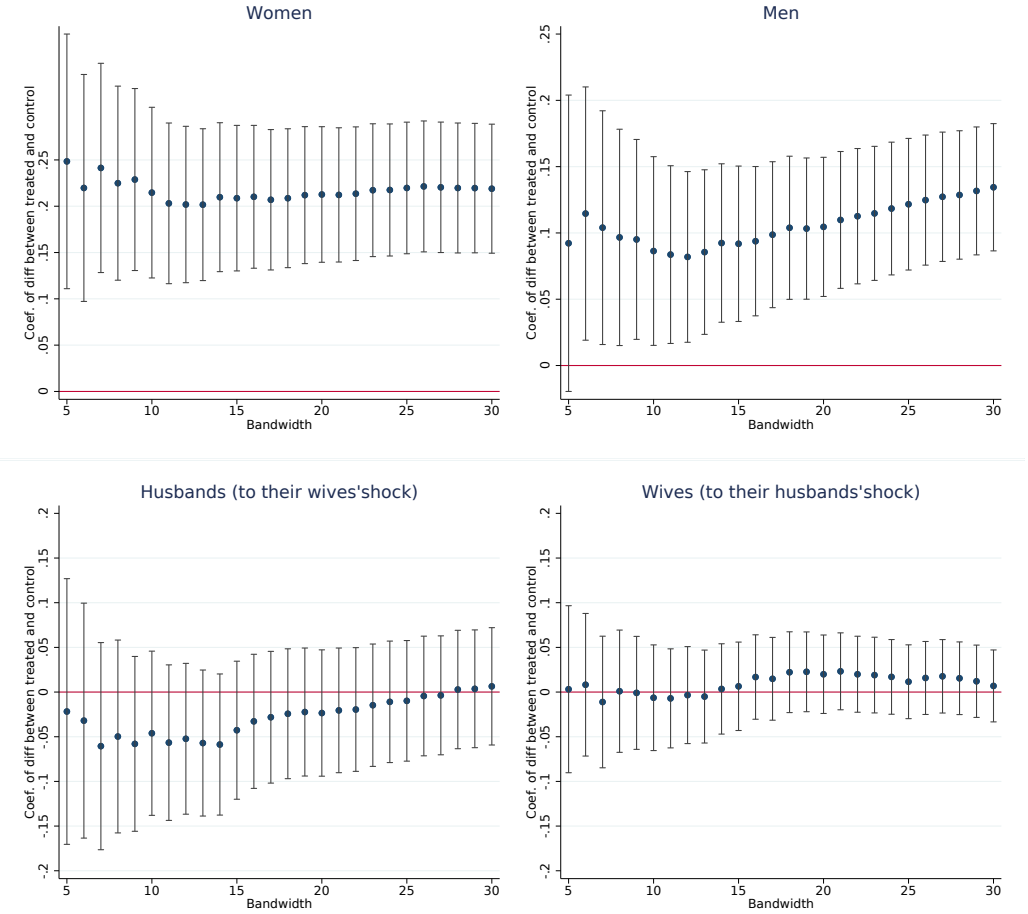
A Additional figures

Figure A.1: Parallel trend difference-in-discontinuity



Source: SHIW, from 2004 to 2016. Specification with linear running variable. The graphs test the parallel trend assumption by plotting the coefficients of the interaction between the treatment E_i and year dummies (and the corresponding 5% confidence intervals), omitting 2010. Pre-reform years: 2004-2006-2008-2010, post-reform years: 2012-2014-2016. The sample consists of individuals whose distance to retirement according to the pre-reform rules was between 20 and -20.

Figure A.2: Changing the bandwidth of the difference-in-discontinuity



Source: SHIW, from 2004 to 2016. The graph plots the coefficients (and the corresponding 95% confidence intervals) obtained from estimating equation 6, changing the bandwidth. Specification with linear running variable. The sample consists of individuals whose distance to retirement according to the pre-reform rules was between 20 and -20.

B Additional tables

Table B.1: 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	0.030***	0.015***	0.011***	-0.005	-0.003	0.004*
	(0.006)	(0.004)	(0.004)	(0.004)	(0.002)	(0.003)
			Unemployment			
T*post2011	0.010*	0.009***	0.006**	-0.001	-0.002	0.009
	(0.006)	(0.004)	(0.003)	(0.007)	(0.005)	(0.007)
			Employment			
T*post2011	0.020***	0.006	0.005	-0.005	-0.002	-0.005
	(0.007)	(0.004)	(0.005)	(0.008)	(0.006)	(0.008)
			Full-time employment			
*post2011	0.020**	0.015**	0.018**	-0.005	0.004	-0.011
	(0.008)	(0.007)	(0.007)	(0.008)	(0.007)	(0.012)
			Part-time employment			
T*post2011	-0.002	-0.009	-0.016**	-0.001	0.000	0.004
	(0.007)	(0.006)	(0.007)	(0.003)	(0.004)	(0.006)
			Permanent employment			
T*post2011	0.010	0.001	0.002	-0.002	-0.010	-0.020*
	(0.007)	(0.006)	(0.006)	(0.007)	(0.008)	(0.010)
			Temporary employment			
T*post2011	0.009**	0.004	-0.000	-0.005	0.014**	0.014**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)
N	2456	3332	3091	3577	3856	3194

Notes: T*post2011 is the estimated difference-in-differences coefficient of the longer working horizon. Additional controls: year and cell q - defined by age, gender, number of years of accrued contribution and sector of employment - 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 or after the reform and have accrued a number of years of contribution of at least 10 for women (20 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 B.2: Cross-partners and direct (perspective and mechanical) effects, distinguishing between eligible and non eligible husbands

Couples where:	**wives not eligible to retire 2010**			**husb. not eligible to retire 2010**		
	Active husb. (1)	Unemp. husb. (2)	Employed husb. (3)	Active wife (4)	Unemp. wife (5)	Employed wife (6)
T wife*post2011	0.015*	0.007	0.007	0.006	0.010**	-0.004
	(0.008)	(0.005)	(0.008)	(0.006)	(0.004)	(0.006)
T wife*post*elig husb	0.012	-0.005	0.016			
	(0.021)	(0.012)	(0.021)			
T husb*post2011	-0.011	-0.002	-0.009	-0.011	-0.008	-0.003
	(0.010)	(0.010)	(0.014)	(0.010)	(0.006)	(0.011)
T husb*post*elig husb	0.160***	0.054**	0.107**			
	(0.047)	(0.024)	(0.048)			
N	5326	5326	5326	3819	3819	3819

Notes: The Table shows that most of the husbands' response to their wives' perspective effect comes from husbands already eligible to retire, who decide to postpone retirement. T wife*post 2011 is the estimated difference-in-differences coefficient of the wife's longer working horizon (perspective effect); T husband*post 2011 is the estimated difference-in-differences coefficient of the husband's longer working horizon (both direct and perspective effect). Additional controls: year and cell $q_{s'}$ and q_s fixed effects (separately for each dimension; each cell is defined by age, gender number of years of accrued contribution and sector of employment), 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 of columns 1-3 (4-6) consists of all husbands (wives) older than 45, 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 of at least 10, and smaller than 40. Elig is a dummy equal to one if the husband is eligible at time t to a public pension. Columns 4 to 6 do not distinguish whether the wife is eligible for a public pension or not because there are too few wives eligible for a public pension whose husband is in the sample (is not eligible for a public pension). Robust standard errors clustered at the cell $q_{s'}$ level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B.3: Balancing tests around the discontinuity cut-off

	Women			Men		
	linear	quadratic	cubic	linear	quadratic	cubic
	(1)	(2)	(3)	(4)	(5)	(6)
			Individual effect			
			Household wealth			
E_{2010}*post2011	0.017	-0.045	-0.123*	0.014	0.064*	0.093*
	(0.034)	(0.049)	(0.068)	(0.026)	(0.038)	(0.053)
			N kids			
E_{2010}*post2011	-0.006	0.016	0.111*	-0.082***	0.003	-0.001
	(0.031)	(0.045)	(0.061)	(0.021)	(0.031)	(0.046)
			High education			
E_{2010}*post2011	0.046	-0.003	0.005	0.054**	0.087**	0.080
	(0.040)	(0.057)	(0.076)	(0.027)	(0.040)	(0.057)
N	9909	9909	9909	18807	18807	18807
			Cross-partner effect			
	on husbands (wives' shock)			on wives (husbands' shock)		
			Household wealth			
$E^{s'}_{2010}$*post2011	-0.024	-0.050	-0.178**	0.014	0.030	0.019
	(0.042)	(0.059)	(0.082)	(0.029)	(0.043)	(0.062)
			N kids			
$E^{s'}_{2010}$*post2011	-0.003	0.017	0.045	-0.068***	0.026	0.011
	(0.036)	(0.051)	(0.070)	(0.020)	(0.029)	(0.041)
			High education			
$E^{s'}_{2010}$*post2011	-0.037	0.004	0.036	0.047	0.061	0.061
	(0.046)	(0.063)	(0.081)	(0.030)	(0.044)	(0.063)
N	5933	5933	5933	14381	14381	14381

Notes: E_{2010}*post2011 is the estimated difference-in-discontinuity coefficient for pension eligibility according to the rules in place in 2010; $E^{s'}_{2010}$*post2011 is the estimated difference-in-discontinuity coefficient for partner s' pension eligibility according to the rules in place in 2010. Additional controls: year fixed effects, polynomial of the running variable (linear in columns 1 and 4, quadratic in columns 2 and 5, cubic in columns 3 and 6). The sample consists of individuals whose distance to retirement according to the pre-reform rules was between 20 and -20. Robust standard errors clustered at the individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.