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SPOUSES' RETIREMENT AND THE TAKE-UP OF DISABILITY PENSION

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Abstract: This paper studies the effect of one spouse's retirement on the retirement of the other using a Norwegian early reform, which reduced the retirement age for workers in selected firms. The findings indicate that after the reform, the spouses of those who could retire earlier were less likely to remain in the workforce compared to the spouses of those who were not included in the early retirement scheme. This finding is compatible with preferences for shared spousal leisure. Contrary to previous findings, wives respond to husbands' early retirement decisions. However, the findings are less conclusive with respect to husbands' response to wives' early retirement decisions. An investigation of the responding wives' labor market exit strategy reveals that the reform increased their likelihood of retiring with a disability pension, representing a cost to public finance incurred in addition to the general retirement costs. This study contributes to other recent evidence on the influence of of non-health-related factors on the use of disability benefits among older workers.

Keywords: Joint retirement; disability pension; older workers
JEL codes: J26, H55, J14, D04

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1 Introduction

The elderly make up a large and increasing share of the population in many countries, and the OECD (2011) has warned that to cover the cost caused by ageing populations, older workers must be incentivized to postpone retirement. In particular, retirement financed through social security systems threatens the sustainability of current welfare policies, exemplified by the worrying increase in the share of disability retirees in most OECD countries (OECD, 2010). To guide public policy on this important issue, further understanding is needed about the determinants of retirement behavior and the effects of different retirement policies.

The vast majority of the literature on retirement has focused on individual behavior[1], not taking into account that most workers are part of households with several members. For couples, it is reasonable to assume that retirement decisions are influenced by the spouse, which has probably been strengthened during the last decades with the increasing share of dual-working couples. If one spouse (e.g., the husband) retires, household income will decrease, but his leisure time will increase. Basic economic theory predicts two separate effects on the wife's decision to retire: The income effect will increase her labor supply. The substitution effect will lead to a decrease (increase) in the labor supply of the wife if husband and wife's leisure are complements (substitutes).[2] The timing of retirement tends to be positively correlated, and each spouse's retirement appears to be affected by the retirement incentives of the other spouse (Blau, 1998; Coile, 2004; Gustman and Steinmeier, 2004; Schirle, 2008; Zweimüller, Winter-Ebmer, and Falkinger, 1996). This suggests that spouses' leisure are complements and the substitution effect dominates the income effect. However, the observed empirical pattern is asymmetric: Husbands respond to their wives' retirement incentives, but not the other way round.[3]

This study moves beyond the previous literature by using an early retirement reform that lowered the public pension retirement age of workers in some firms to identify the causal effect of spouse's retirement. Because joint retirement can be financed in several ways, we also extend the perspective relative to earlier research by looking at one of the most obvious early retirement strategies: Disability pension. Hence, we investigate whether one spouse's early retirement increases the probability

[1] See Lumsdaine and Mitchell (1999) for an overview.

[2] To this effect, the added worker effect literature (Layard, Barton, and Zabalza, 1980; Lundberg, 1985; Maloney, 1987, 1991; Cullen and Gruber, 2000) studies the wife's labor market response to a household earnings drop due to the husband's unemployment. The empirical evidence suggests that the effect on the wife's labor supply is small.

[3] The one exception to this is An, Christensen, and Gupta (2004), who report symmetrically significant substitution effects between husbands and wives.

that the other spouse retires with a disability pension if (s)he is not eligible for early retirement. Therefore, this study adds to the literature on the determinants of disability insurance take-up. The mandatory disability insurance of many Western-European welfare states is mainly intended for people whose self-support is prevented because of substantial and permanent health problems, and applications must be certified by a physician. But asymmetric information is a problem, and there is opportunity for moral hazard because, in many cases, health cannot be observed objectively.[4] Recent papers by Bratsberg, Fevang, and Røed (2013), Kostøl and Mogstad (2014), and Dahl, Kostol, and Mogstad (2015) find that the take-up of disability insurance is influenced by factors other than health. If preferences for shared leisure increase the take-up of disability insurance, this results in an efficiency loss in addition to general retirement costs. In spite of the apparent possibility of (mis-)using disability insurance as a means for shared leisure, and the high and increasing share of elderly on disability benefits in many countries, we know of no other studies examining these mechanisms, let alone within a quasi-experimental framework.[5]

The public early retirement (ER) reform introduced in Norway in 1989-1998 offers a natural setting to explore the causal mechanisms of joint retirement. For our purposes, an important point is that the reform does not include all employees. Individual exposure to the reform is based on firm affiliation, and we separate between participating firms (ER firms) and firms not participating in the ER scheme (non-ER firms). Workers in ER firms are eligible to retire with public pensions at the age of 62, rather than the standard public pension retirement age of 67. Workers in non-ER firms were not given the opportunity to retire early with public pensions. We make use of the ER reform in a difference-in-differences identification strategy, comparing spousal probability of working before and after the worker reaches the ER eligibility age, for both treated and control workers. To account for the potential endogeneity between working in an ER firm and other determinants of joint retirement, we assign treatment based on the pre-reform firm affiliation of workers. In addition to the difference-in-differences approach, we make use of the ER reform as an instrument for one spouse's employment, and estimate the effects of employment on spouse's probability of working and spouse's likelihood of receiving disability benefits.

[4]In Norway, roughly two-third of disability pensioners are diagnosed with health problems that are hard to verify, such as light or moderate mental disorders and musculoskeletal disorders.

[5]Hesselius (2009) studies a related phenomenon, namely spousal spillover from retirement to sickness absence. However, the study does not involve an experiment and the reported effects cannot be given a causal interpretation. Kapur and Rogowski (2007) study the role of health insurance in joint retirement among couples, but from the opposite angle: Here, retirement is explained (partly) by the variation in occupational health insurance. No causal interpretation is offered.

We estimate a negative causal effect of early retirement on spouse's probability of working. Contrary to the findings of previous studies on the interrelationship in spouses' retirement, wives respond to husbands' retirement: Husbands' eligibility for ER retirement decreases wives' probability of working by 4.1 percentage points. The results from the IV model show that husband's employment increases wife's probability of working by 18.7 percentage points. Some of our results suggest a negative effect of wife's retirement on husband's probability of working, but here the overall results are inconclusive, partly due to the limited sample size. Our second set of results investigate the potential existence of spill-over effects of early retirement on spousal take-up of disability pension. We find that husbands' eligibility for ER retirement increases the likelihood of wives' take-up of disability pension by 2.9 percentage points. Using the reform as an instrument, we estimate that husbands' employment decreases the likelihood of wives' take-up of disability pension by 13.2 percentage points. No evidence is found of an effect of wives' employment or eligibility for ER retirement on husbands' likelihood of take-up of disability pension. The parallel trends assumption required of difference-in-differences designs seems satisfied for the outcomes we examine.

In studying the causal effects of spouses' retirement, this study is related to the recent working papers by Selin (2012) and Stancanelli (2012). Selin makes use of a Swedish pension reform that decreased the incentives to retire early and was implemented differently across various sectors of the economy. He finds no evidence that the spouse responded to the change in retirement incentives of the other spouse. Because the Swedish reform was implemented in female-dominated occupations, it only facilitates studying the effects of wife's retirement on husband's retirement, and not the other way round. Stancanelli makes use of French retirement age legislation and a retirement policy change. She finds that wives' retirement increases husbands' probability of retirement, but not the other way round. Our paper differs from Selin (2012) and Stancanelli (2012) in two main aspects. First, and most importantly, Selin (2012) and Stancanelli (2012) do not investigate the effect of spouse's retirement on the take-up of disability pension. Second, both the Swedish and French reforms increased the incentives to retire later, while the Norwegian reform reduced retirement age from 67 to 62. The difference is important because the spousal response to increases in retirement age is not necessarily symmetrical to the spousal response to decreases in retirement age. Also, the difference in eligible retirement ages between the treatment and control group is much larger in our setting than in those of Selin (2012) and Stancanelli (2012).

The remainder of the paper proceeds as follows. Section 2 discusses the Norwegian

early retirement reform, while Section 2.2 adds institutional details on alternative pathways to retirement, especially disability pension. We apply certain necessary selection criteria to the sample, and these are discussed along with the data presentation in Section 3.1. Section 3.2 presents the details of our empirical strategy. Section 4.1 presents our results on the effect of husband's eligibility for early retirement on wife's outcomes and Section 4.2 presents our results on the effect of wife's eligibility for early retirement on husband's outcomes. Section 4.3 shows that our results are robust to several robustness tests, including relaxing some of the sample selection criteria. 5 offers some concluding remarks.

2 Background and Institutional Setting

2.1 The Norwegian early retirement scheme

Norway is, and has been for several decades, a country with a high employment rate for elderly, including elderly women.[6] The standard retirement age is 67 for the majority of the workers.[7] However, an increasing number of older workers–approximately 30% of males and 40% of females above age 60–exits the labor market early through public mandatory disability insurance. The high share of disability retirees played an important part in the introduction of the voluntary early retirement (ER) scheme.

The scheme, "Avtalefestet pensjonsjonsordning", was launched in Norway on January 1, 1989. It was a result of central tariff negotiations in 1988 between employer and employee organizations, co-sponsored by the government. It was argued, particularly by the influential manufacturing sector union, that the purpose was to give worn out workers a dignified way of exiting the labour market. The ER scheme included the entire public sector from the onset and has gradually expanded into the private sector. It included all private firms covered by centrally negotiated tariff agreements (currently about 50% of the private sector). Even if firm ER affiliation is a result of tariff negotiations, entitlement does not depend on individual union membership. All workers in ER-firms are eligible for early retirement, subject to certain individual requirements related to work experience and earnings. Notably, individual eligibility requires three or more years of tenure in the firm the worker wants to retire from.[8] This requirement makes post-reform sorting into ER-firms more

[6] Approximately 70% men and 60% of women in the age group 55-64 were employed during the period of investigation (Statistics Norway, 2008).

[7] Some exposed groups, like police, firemen, and shift-workers, have lower standard retirement ages.

[8] In addition, 10 or more years of earnings above the National Insurance Scheme basic amount (1G) since the age of 50 is required. At present (2014), 1G amounts to NOK 88,370 ($14,700). Also, the average of top 10 yearly earnings since 1967 has to be at least 2G. Finally, yearly earnings of at

difficult for elderly workers. The scheme was introduced with an early retirement age of 66, but the age limit has since been gradually reduced to 62 through reforms implemented in 1990, 1994, 1997, and 1998.

Early retirement benefits are determined in a manner resembling that of standard old age pension.[9] It includes a fixed minimum benefit and an earnings-based supplementary benefit based on previous earnings. For the medium earner, the net replacement rate is approximately 65%.[10] For ER retirees, standard old age pension is calculated as if they were full earners in the early retirement period, providing a strong work disincentive for ER eligible workers. Benefits are conditional on no labor income; hence, it requires full withdrawal from employment.[11] Employers cover the full cost of early retirement pensions for retirees aged 62 and 63, and 60% of pensions for retirees aged 64 to 66. The remaining 40% is covered by public funding.

This study is not the first to make use of the Norwegian ER reform as a natural experiment. However, unlike the present analysis, they all study the impact of the reform on individual outcomes. Several papers have found that although there is significant individual substitution from disability benefits to ER retirement, the early retirement scheme led to a significant reduction in the retirement age of eligible workers (Røed and Haugen, 2003; Bratberg, Holmås, and Thøgersen, 2004; Vestad, 2013). In addition, Hernæs, Markussen, Piggott, and Vestad (2013) find that, accounting for the substitution effects, the reduced retirement age induced by the ER reform had no effect on mortality.

2.2 Other pathways to early retirement

The National Insurance Scheme (NIS) in Norway encompasses the old age retirement scheme, sickness benefits, disability benefits, unemployment insurance, and health insurance; cf. Figure 1. In principle, the NIS gives full population coverage, with defined benefits based on earnings histories. All workers who have been with the same employer for at least four weeks are covered by the mandatory sickness insurance scheme. Sickness benefits are paid by the employer for the first 16 days, and then by the NIS for a maximum of 50 weeks. The replacement ratio is 100% from day one. Individuals with permanent impairments may apply for disability benefits,

least 1G are required in the retirement and previous year.

[9]See Bratberg, Holmås, and Thøgersen (2004) or Hernæs, Sollie, and Strøm (2000) for institutional details.

[10]The net replacement ratio differs by sector affiliation (private or public) and, most importantly, earnings level. See Bratberg, Holmås, and Thøgersen (2004) for a more detailed discussion.

[11]In 2011, a major reform of the pension system was introduced, where flexible retirement from the age of 62 is an integral part. In addition, different programs are offered for the private and public sector. However, the 2011 reform does not affect our analysis because it was introduced after the period we study.

which must be certified by a physician. Disability benefits are, roughly speaking, calculated as the old age benefits the beneficiary would have been entitled to had (s)he continued working until the age of 67. Eligibility for disability benefits is dependent upon relevant rehabilitation being tried. The NIS supplies benefits for participants in medical and vocational rehabilitation, calculated roughly the same way as disability benefits. Older people are entitled to unemployment insurance for an extended period, covering approximately two-third of earnings the previous year. In addition to disability and rehabilitation benefits, unemployed workers aged 64 or higher are entitled to unemployment insurance without time limitation until they reach the standard retirement age of 67 years. Unemployment benefits from the age of 64 comes in addition to the standard 186 weeks of coverage, making it possible to receive unemployment benefits from the age of 60.5 to 67.

Norway has a high employment rate, even for older workers, implying that unemployment plays a minor role in early labor market exits. On the other hand, the fraction of the labor force on health-related benefits has been rising during the period of investigation. The entitlement conditions are liberal and labor market conditions appear to have been a factor in the assessment, particularly for disability pension (Bratsberg, Fevang, and Røed, 2013). Today, around 10% of the working age population receive disability benefits, and roughly the same share receive sickness and rehabilitation benefits. These shares increase sharply with age. Being an absorbing state, and by far the most frequent way of exiting the labor force, disability pension is the most important alternative path to early retirement in Norway. The percentage receiving disability pension in the age group 60-64 is approaching 45 for women and 35 for men.[12]

3 Data and Empirical Strategy

3.1 Data and sample selection criteria

We employ several administrative registers provided by Statistics Norway, linked by a unique individual identifier. These provide demographic and socio-economic data on the Norwegian population for 1986-2010. The Norwegian registry data is renowned for its coverage and reliability, as testified by it receiving the highest possible rating in a data quality assessment by Atkinson, Rainwater, Smeeding, et al. (1995).

A matched employer-employee sample provides each individual with a firm identifier, information on earnings (total gross pension qualifying earnings), and a

[12]Norwegian Ministry of Labour (2011).

crude measure of work hours.[13] We link the matched employer-employee register to data containing demographic information such as education, year and month of birth, annual post code of residence, and, importantly, annual marital status. Crucial to the analysis, all married individuals are linked to their partner through a unique spousal identifier. Complete information is available for 1992-2010 on the take-up of welfare or social security programs, most importantly on the receipt of early retirement and disability insurance payments. The registers provide the date of early retirement pension take-up, in addition to information on the type of early retirement (public or private), whether early retirement was partial or full (0-100 %), and the exact monetary amount of early retirement pension received. The registers contain similar information regarding the disability insurance scheme.

We identify firms' participation in the early retirement scheme through backward identification: When a worker starts receiving an early retirement pension, his or her last registered firm must be a participant in the early retirement scheme. Firms without workers leaving on early retirement are classified as not participating in the early retirement scheme. Our treatment variable, ER firm, therefore suffers from measurement error: All firms identified as ER firms will be correctly specified, but some firms identified as non-ER firms will be misclassified. The fewer the number of employees, the greater the potential for misclassifying a true ER firm as a non-ER firm. We therefore restrict the sample to workers in firms with a minimum number of employees. The choice of a minimum number of employees is a trade-off between reducing measurement error and increasing sample size. For our main results, we have used a minimum of 10 employees, but our results are robust to changing this threshold. It should also be noted that the direction of this measurement error will result in a downward bias as our control group includes some treated couples. Table A1 shows the differences in observable characteristics between ER and non-ER firms. The biggest difference is that ER firms have far more employees than non-ER firms, mostly because larger firms are more likely to participate in the ER scheme, but also partly due to our backwards identification of ER firms. Compared to non-ER firms, a larger share of ER firms are blue collar; this is not surprising given that the reform was intended for "worn out" workers. In terms of employees' characteristics, a larger share of workers in ER firms are female, and workers in ER firms are on average older, have more education, and earn less than workers in non-ER firms. But the differences between employees in ER and non-ER firms are mostly small in size.

We apply several necessary selection criteria on the main sample, all reducing the sample size. Table A2 shows sample size corresponding to each specific selection

[13] Four categories: No work, 1-20 h/pw, 20-29 h/pw, more than 29 h/pw.

criteria. As explained in Section 2.1, the ER age limit was gradually reduced. To ease interpretation of the findings, the period when the reform unfolded (1989-1997) is excluded, and cohorts exposed to the completed ER reform are focused on. The difference between early retirement age and standard retirement age was also the highest possible for these cohorts. The main sample consists of cohorts born between 1936 and 1941, who reached the age of 62 in 1998 (when the early retirement age was lowered to 62) or later. Second, to perform the intended analysis, the subsequent ER affiliation of the pre-reform firm of each spouse must be examined. To that end, we require that (i) both spouses work in identifiable firms in 1988 (the year before the first early retirement age reform), and (ii) the firms can be tracked during the 1990s and 2000s when we have data on early retirement take-up. We use the pre-reform affiliation because workers' post-reform choice of firm is potentially endogenous to preferences for joint retirement. As can be seen in Table A2, these initial sample selection criteria leave us with sample sizes of 16,175 for the sample on male workers and their wives, and 10,427 for the sample on female workers and their husbands.

We are mainly interested in the early retirement strategies of spouses who do not have the option of retiring early on the ER scheme. Matching in the marriage market could lead to workers in ER firms being more likely to have a spouse also working in an ER firm. This would imply a spousal retirement correlation stemming from correlations in firm affiliation within couples. If ER affiliated workers are more likely to have an ER affiliated spouse, this would lead to a correlation between early retirement of the worker and labor force withdrawal of the spouse based purely on pre-existing couple preferences for working in firms that became ER affiliated. Since we focus on early retirement strategies for spouses without the opportunity to retire on ER, the sample is limited to couples in which the spouse worked in a non-ER-firm in 1988, and, therefore, did not have the opportunity to retire early. This greatly reduces the sample size to 3,966 for the male workers and their wives and 3,781 for the female workers and their husbands.

Investigating spousal early retirement necessarily involves studying couples who have not already withdrawn from the labor force at a younger age. It is only possible to estimate the effect of retirement on spouse's retirement behavior for those who are actually working up until close to retirement age. Therefore, we require that the worker and his or her spouse is working when the worker is aged 57. This allows the examination of pre-trends for the five years before the workers reach ER eligibility age. This restriction leaves sample sizes of 2,312 for male workers and their wives and 2,462 for female workers and their husbands. Finally we include only couples in which the spouse is not older than the worker, so that the spouse can react to the

early retirement of the worker in all the years before the worker reaches the standard retirement age of 67. Because men are often older than their wife, this leaves a much smaller sample size when we study the effect of the wife's early retirement on the labor force participation of her husband. The final sample sizes are 1,990 for male workers and their wives and 603 for female workers and their husbands. Section 4.3 shows that our main findings are robust to relaxing the sample selection criteria.

Table A3 shows some key descriptive characteristics of the full sample of male workers born 1936-1941 and their wives compared to those of the selected sample. For the full and selected sample, husbands and wives have same levels of education. The age gap between husband and wife is larger in the selected sample, which is expected as couples in which the wife is at least as old has the husband are excluded. The table also shows that the male workers and wives in the selected sample have higher earnings than the full sample. The difference is probably due to the selection criteria that the wife has an identifiable firm in 1988 and that both spouses are required to work when the husband is aged 57. Table A4 shows the same key characteristics for the full and selected samples of female workers and their husbands. The selected sample has higher levels of education for both wives and husbands, potentially reflecting that couples in which the wife is at least as old as the husband tend to have higher levels of education. There is a significant difference between the full and selected sample in the age gap between the wife and husband, reflecting that in the population, wives tend to be younger than their husbands. With regard to this, the selected sample on female workers and their husbands is not representative of older working couples in general. Table A4 also shows that spouses in the selected sample have higher earnings, for the reasons explained above.

3.2 Empirical Strategy

The introduction of the voluntary early retirement scheme offers a natural experiment to identify the causal effect of spousal retirement. For the main strategy, we use the early retirement reform as a basis for a difference-in-differences strategy, comparing spouses of workers in ER firms (treated) to spouses of workers in non-ER firms (control). We compare outcomes of the spouses of treated and control workers before and after the workers reach ER retirement age of 62.[14] The difference-in-differences approach yields the intention-to-treat (ITT) effect of giving workers increased opportunities to retire early on the retirement behavior of the spouse. The ITT effect is smaller than the average treatment effect because not all ER

[14]We track workers from the age of 57 until 66, leaving a five year pre-period and a five year post-period. After reaching 67, all workers have the opportunity to retire on public pension.

eligible workers choose to retire early. The empirical reduced form model (Model I), estimated by OLS, takes the following form:

$$Y_{it} = \alpha_1 ERage_{jt} + \alpha_2 (ERfirm_j * ERage_{jt}) + \delta_i + \lambda_t + Age_{it} + \epsilon_{it}, \quad (1)$$

where j indexes the worker, i the spouse of the worker, and t time. Y is the outcomes we are interested in, which are i) a dummy for whether the spouse is working, and ii) a dummy for whether the spouse is on disability pension. ERfirm is the treatment variable, taking the value 1 for workers in ER affiliated firms and 0 for workers in non-ER affiliated firms.[15] ERage takes the value 1 when the worker is above early retirement age (62-66), and 0 when (s)he is below early retirement age (57-61). δ is an individual fixed effect to control for inherent differences between our treated and control workers and their spouses[16], λ is a year fixed effect, and *Age* is a linear control for the age of the spouse. α_2 is the ITT effect of the worker being eligible for early retirement on the spouse's labor market outcomes.

Next, we estimate the local average treatment effect (LATE) of a worker retiring on the spouse's retirement behavior by using eligibility for early retirement as an instrument for whether the worker has retired in a given year. Basically, this approach is comparable to scaling the ITT effects by the difference in retirement rates between the treatment and control group. The estimated LATEs are local in the sense that they are the effects for couples in which the workers choose to retire earlier because (s)he was eligible for ER, but would not have retired earlier had (s)he not been eligible for ER. In this alternative 2SLS setup, which uses eligibility for early retirement as an instrument for whether a worker is working in a given year, the empirical model (Model II) is defined by the following two equations:

$$Y_{it} = \beta_1 ERage_{jt} + \beta_2 \hat{work}_{jt} + \delta_i + \lambda_t + Age_{it} + \epsilon_{it}, \quad (2)$$

$$work_{jt} = \phi_1 ERage_{jt} + \phi_2 (ERfirm_j * ERage_{jt}) + \delta_i + \lambda_t + Age_{it} + \epsilon_{it}, \quad (3)$$

where the first-stage Equation (3) estimates the effect of the worker being eligible

[15]Because the choice of working in an ER firm could be endogenous to other determinants of joint retirement,treatment is assigned on the basis of the pre-reform firm of the worker in 1988. Treatment is, therefore, not endogenous to selection into ER firms by workers with spouses that are more likely to quit working at an earlier age. Treated workers from firms that later joined the ER scheme were eligible to retire at age 62, while control workers from firms that did not join the ER scheme were only eligible for retirement at the age of 67.

[16]In this setting, the individual fixed effect is a couple fixed effect, controlling for time-invariant characteristics of both husband and wife.

for early retirement on the worker's likelihood of working. The worker's predicted likelihood of working, $\hat{work}$, is then inserted into Equation (2). β_2 is the coefficient of interest in Equation (2) and gives the LATE effect of the worker being employed on the labor market outcomes of the spouse. Basically, model II is a way of scaling the ITT effect α_2 by the estimated first-stage effect ϕ_2 of Equation (3). The IV approach relies on two key assumptions. First, the instrument needs to have an effect on the endogenous variable. Second, the exclusion restriction requires that the instrument is conditionally independent of the potential outcomes and only affects the outcomes through the first-stage channel. We interpret the results based on the instrumental variable approach with caution, as spouses could respond not only to whether the worker retire early, but also to the opportunity the worker has to use the ER scheme to retire early. A spouse could withdraw from the labor force, believing that an ER eligible worker will make use of the ER scheme, and then the worker could decide to continue working. If so, the instrument has a direct effect on the outcome variables that works outside the first-stage channel. However, the IV results are useful in terms of scaling and interpreting the results from the reduced form Model I. The previous literature on spousal retirement decision has shown a gender asymmetry in the response to spouse's retirement; thus, we estimate Models I and II separately for male workers and their wives and female workers and their husbands.

Table A5 reports descriptive statistics for the sample of male workers and their wives. Treated husbands and their wives are similar to control husbands and their wives in terms of year of birth, education, and age gap between husband and wife. The treated spouses earn somewhat less than their control counterparts. Table A6 reports descriptive statistics for the sample of female workers and their husbands. Treated wives have slightly more education but earn much less than their control counterparts. This is possibly because the public sector workers are defined as treated wives. Their husbands are quite similar in observable characteristics. While there are differences between the treatment and control groups in both the sample of male workers and their wives and that of female workers and their husbands, the difference-in-differences methodology does not rely on random assignment to treatment. The identifying assumption is that the two groups follow the same trend in absence of treatment, which we will show to be observationally likely in our setting.

4 Results

4.1 Effects of husband's early retirement on wife's outcomes

Table 1 shows the estimated coefficients from Models I and II. The first column presents the ITT effect of the husband being eligible for ER on the likelihood that his wife is working. Husband's eligibility for ER is captured by the interaction term in Model I between the husband working in an ER firm in 1988 and the husband being of ER eligible age (62-66). Focusing on this interaction term, we see that the husband being eligible for ER has a negative and substantial effect of 4.1 percentage points on the likelihood that his wife is working. Turning to the results on wife's take-up of disability pension, the ITT effect is again substantial: The effect of the husband being eligible for ER is a 2.9 percentage points increase in the likelihood of the wife receiving disability pensions.

The results from Model II are presented in Columns (3)-(5). Here, we are interested in the effect of the husband working on wife's outcomes and instrument husband's likelihood of working with him being eligible for ER. The estimated coefficients can be interpreted as local average treatment effects. The first-stage effect is strong: Treated male workers are 21.8 percentage points less likely to work during early retirement ages 62-66. The LATE of the husband working is a 18.7 percentage points increase in the likelihood that his wife works, and a 13.2 percentage points decrease in the likelihood that his wife receives disability pensions. Note that the LATEs are approximately equal to scaling the ITT effects by the first-stage effect on the likelihood of the husband working.

The key identifying assumption of the difference-in-differences design is that the treatment and control groups share common trends in outcome variables. Figure 2 shows that treatment and control groups have almost identical trends in the outcome variables before the male workers reach ER eligibility age. Panel (a) shows that treated and control male workers have the same trend in the probability of working before they reach ER eligibility age. After they reach ER eligibility age, treated male workers have larger reduction in the likelihood of working. Panel (b) shows the share of treated and control wives that are working. When their husbands are below ER eligibility age, the trends of the two groups are almost identical. Panel (c) shows that this is also the case for the share of treated and control wives receiving disability pensions. After their husbands reach ER eligibility age, treated wives have a larger decrease in the probability of working and a larger increase in probability of receiving disability pensions. In sum, the observational evidence suggests that our treatment and control groups have common time trends in our outcome variables.

4.2 Effects of wife's early retirement on husband's outcomes

As explained in section 3.1, the sample selection criteria results in a small sample for studying the effect of wife's eligibility for ER on husband's labor supply. We require that the husband is not older than the wife to avoid including husbands that are already on standard old age retirement and, therefore, unable to respond to the wife's retirement. Since the majority of wives are younger than their husbands, only 603 couples are available to study the effect of wife's early retirement on husband's outcomes. This renders it difficult to detect potential effects.

Table 2 presents the effect of the wife's retirement on her husband. Column (1) shows that there is a negative ITT effect on the likelihood of the husband working, which is of a similar size as the ITT effect on likelihood of wife working reported in Section 4.1. Although the effect is statistically insignificant, the insignificance might be due to lack of power. The ITT effect on the likelihood of the husband receiving disability pensions, is zero and not statistically significant.

Turning to the results from the 2SLS Model, the first stage on the likelihood of the wife working is not statistically different to that reported for husbands. Treated wives are 22.1 percentage points less likely to work during the early retirement ages of 62-66. The first-stage effect is significant at the .01 level. In the second stage of Model II, the wife's employment has a positive effect of 15.6 percentage points on the likelihood that the husband is working. This LATE is significant at the .05 level. There is no statistically significant effect of the wife working on the likelihood that the husband receives disability pensions.

Both the reduced form Model I and the 2SLS Model II indicate no effect on the likelihood of the husband receiving disability pensions. Although there is no ITT effect on the likelihood of the husband working, the LATE on the same outcome is significant and of a similar size as the effect found on the likelihood of the wife working in the previous section. As discussed in Section 3.2, we evaluate the results from the 2SLS model with caution. However, because of the small sample size, the insignificant ITT effect might be due to lack of power.

Similarly as for treated and control male workers and their wives, treated and control female workers and their husbands share remarkably similar trends in the outcomes investigated. Panel (a) of Figure 3 shows that treated and control female workers have similar trends in likelihood of working when they are below ER eligibility age. Their husbands also have similar trends in likelihood of working during the same period, as shown in Panel (b). After the female workers reach ER eligibility age, they and their husbands have a larger decrease in the likelihood of working. Panel (c) shows the share of treated and control husbands receiving disability pensions.

Here, the trends are still similar, but there is no change in trend for the treated husbands after their wives reach ER age.

4.3 Robustness tests

We have performed a number of robustness tests to check whether the main findings are driven by ER eligibility, and not by any other inherent differences between our treatment and control groups that are correlated with ER age. Since the data is only from 1986 onward (ER and disability benefits only from 1992 onward) and the ER reforms started in 1989, we cannot perform a standard placebo test by duplicating the analysis on pre-reform years. Since we mainly find effects of husband's eligibility for ER on the wife's probability of working and take-up of disability pension, the discussion of the robustness tests focuses on whether these effects are robust. We have however also performed robustness test on the effect of wife's eligiblity for ER on husband's probability of working and take-up of disability pension.

One potential worry could be that spouses of workers in ER firms are more likely to stop working or going on disability pensions. However, this argument does not fit well with the figures showing similar trends prior to ER age but a marked difference around workers' early retirement eligibility age. Nonetheless, we attempt to account for potential differences in trends over time by including younger cohorts. Table 3 shows results from a triple difference-in-differences regression model. As before, the Model includes workers in ER firms and non-ER firms. In addition to the main difference-in-differences setup, younger cohorts born 1946-1951 are included and assigned a pre-period of ages 47-51 and a post-period of ages 52-56. In this difference-in-differences-in-differences design, the variable Post is included and interacted with ERfirm, ERage, and ERfirm*ERage. The coefficient on the triple interaction term Post*ERfirm*ERage gives the separate effect of being in the Post period for those workers in ER firms that have reached ER eligibility age, controlling for differential time effects between workers in ER firms and non-ER firms. The coefficients reported in Table 3 show that the findings on the effect of husband's eligibility for ER are robust to this specification. Also, when controlling for potential differential time effects between the treatment and control group, the negative ITT effect of the wife being eligible for ER on the likelihood of the husband working is significant at the .05 level. This is likely due to the extra power from the added sample size.

The treatment group consists of workers in both the public and private sector, while the control group consists of only private sector workers. There could be inherent differences between public and private sector workers (and their partners) that are correlated with being of ER eligibility age. However, this is not a concern

because the pre-trends line up rather well. In addition. Table A7 shows that the ITT effects of the husband's eligibility for ER on wife's outcomes are robust to dropping public sector workers from the analysis. There are still no statistically significant ITT effects of the wife being eligible for early retirement on husband's outcomes, although it should be noted that here the sample size is very small.

As mentioned in Section 3.1, the sample is chosen on the basis of several necessary selection criteria, potentially questioning the external validity of the results. We have performed a number of robustness tests to see if any of the selection criteria drive the main findings. Table A8 shows that the main findings are robust to choosing the minimum number of employees to be either 5 or 15. The ITT effects of husband's eligiblity for ER remain statistically significant at the .05 level, while those of wife's eligibility for ER remain statistically insignificant.

The main analysis focuses on workers born between 1936 and 1941 to ease interpretation, as explained in Section 3.1. We test the robustness of this cohort selection by including cohorts born between 1933 and 1935, who were eligible for ER from the age of 64. In this specification, we construct a new time variable: Instead of using the worker's age to construct the pre- and post-periods, we use a time variable that is 0 at the year the worker reached ER eligibility age (64 or 62, depending on year of birth), -1 the year before, 1 the year after, and so forth. The pre-period is when the worker was less than the ER eligibility age at the time and the post-period is when the worker was above the ER eligibility age. As shown in Table A9, the ITT effect of husband's ER eligibility on wife's likelihood of working remain statistically significant at the .05 level, while the ITT effect of the husband's ER eligibility on wife's likelihood of receiving disability pensions is statistically significant at the .10 level. Also, when more cohorts are included, the negative ITT effect of the wife being eligible for early retirement on husband's likelihood of working is now significant at the .10 level. There is still no significant ITT effect on the husband's likelihood of receiving disability pensions.

Another selection criteria is that both worker and spouse are working when the worker is aged 57, because if the spouse has already retired, there is no scope for a spousal retirement effect. Table A10 shows that the main findings are robust to including non-working spouses in the sample. The ITT effects of husband's ER eligiblity on wife's outcomes remain statistically significant at the .05 level. The ITT effects of the wife's eligibility for ER on husband's outcomes remain statistically insignificant.

The criterion that the spouse should not be older than the worker is to make sure that the worker is the one making the first decision of whether to retire so

that we can estimate the effect on the spouse's outcome. Spouses older than the worker could already have reached standard retirement age by the time the worker reaches ER age. The criterion that the spouse should not be older than the worker drastically reduces the sample size available to study the effect of wife's eligibility for ER on husband's outcomes, as the majority of husbands are older than their wives. Table A11 shows the effects of relaxing the age gap constraint, including spouses that are up to two years older than the workers. This more than doubles the sample size available for studying the effect of wife's retirement on her husband. The ITT effect of husband being eligible for ER on wife's probability of working and receiving disability pensions are statistically significant at the .01 and .10 levels, respectively. With the larger sample size, the ITT effect of the wife being eligible for ER on the husband's likelihood of working is significant at the .10 level. There is still no statistically significant effect on the likelihood of the husband receiving disability pensions.

Our main findings are for spouses who do not have the opportunity to retire early through the ER scheme. Without the ER option, these spouses are more likely to use disability pensions as a means for retiring early. We have also studied the effects on spouses when we include those who worked in ER firms in 1988. The results are shown in Table A12. Including spouses working in ER firms in 1988 dramatically increases the sample size. The table shows that there is a negative and significant ITT effect of the worker being eligible for early retirement on the likelihood that the spouse is working. For this sample, this is true for both husbands and wives. The table also shows that when we include spouses from ER firms, no significant ITT effect is found on the likelihood that the wife (or the husband) receives disability pensions. This means that husband's eligibility for ER only affects the take-up of disability pension for wives who do not have the opportunity to retire early on the ER scheme.

5 Conclusion

We study causal effects of spousal retirement using an early retirement reform that was rolled out in Norway during the period 1989-1998. In line with previous research, we investigate whether the response to spousal retirement is different for husbands and wives. Also, the perspective of earlier research is extended by examining whether spousal retirement affects the take-up of disability pension.

Husband's eligibility for early retirement has a significant and negative effect on his wife's probability of working. Also, the analysis revealed a strong and positive

effect of husband's eligibility for early retirement on the likelihood that his wife receives disability pensions. The results are less conclusive when investigating the effects of the wife's eligibility for early retirement on husband's outcomes. In general, there is no measurable ITT effect on husband's probability of working. But the sample on female workers and their husbands is much smaller and possibly less representative than the sample on male workers and their wives. For some of our alternative specifications and robustness tests that yield increased sample sizes, there is a negative and significant effect of wife's eligibility for early retirement on her husband's probability of working. Also, when using the reform as an instrument for whether the wife works, the wife's employment has a positive and significant effect on the husband's probability of working. Therefore, we acknowledge that our main sample might lack power to properly study the effect on husband's labor supply. Note that none of the empirical strategies indicate that wife's early retirement has an effect on husband's take-up of disability benefits.

This paper underscores the importance of studying household effects when evaluating the implications of public policy. Interpreted in a basic economic model of income and substitution effects, the negative effect of spousal retirement on labor supply implies that older spouses have preferences for shared leisure and the substitution effect dominates the income effect. However, our analysis does not rule out the possibility that other mechanisms could be driving the results. From a policy perspective, the results are interesting regardless of the mechanisms at play. The Norwegian early retirement reform was originally intended for worn out workers. The negative effect on their spouses' labor supply was probably not anticipated. The effect on spousal retirement through disability pension comes in addition to spillover effects on regular (early) retirement schemes. For the latter, there is no moral hazard involved since entitlement to the schemes is determined simply by age. But the increased take-up of disability pensions represents a cost to public funding that comes in addition to the general retirement costs. Our findings imply that a cost-benefit analysis of any early retirement scheme (and possibly any scheme that affects leisure time of one spouse) must account for the potential effects on spousal labor supply, including early spousal retirement financed through the social security system. Our findings, along with the findings of other important studies such as Bratsberg, Fevang, and Røed (2013), Kostøl and Mogstad (2014), and Dahl, Kostol, and Mogstad (2015), show that non-health-related factors are influential in determining the take-up of disability benefits. If preferences for shared leisure is the main mechanism driving our results, the efforts in place across OECD countries to increase retirement age might have the extra effect of reducing the share of the

elderly disability retirees.

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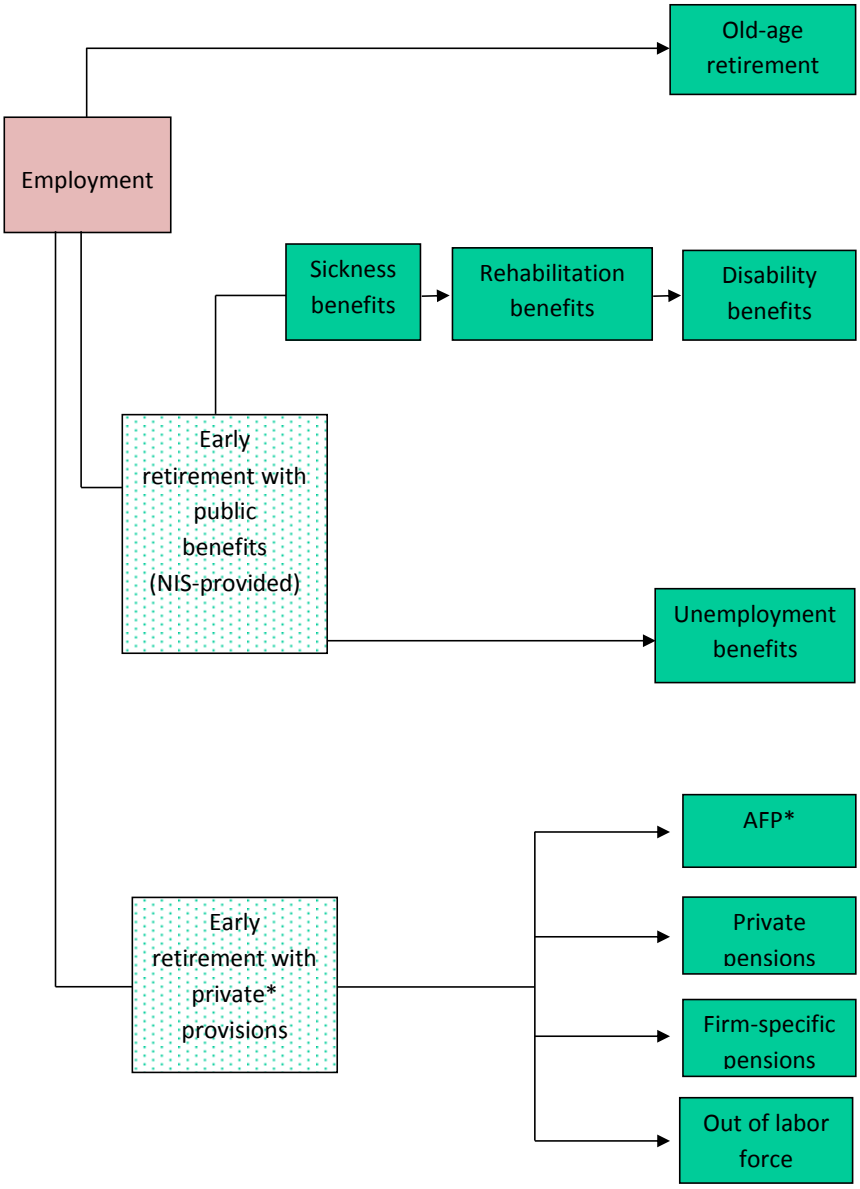
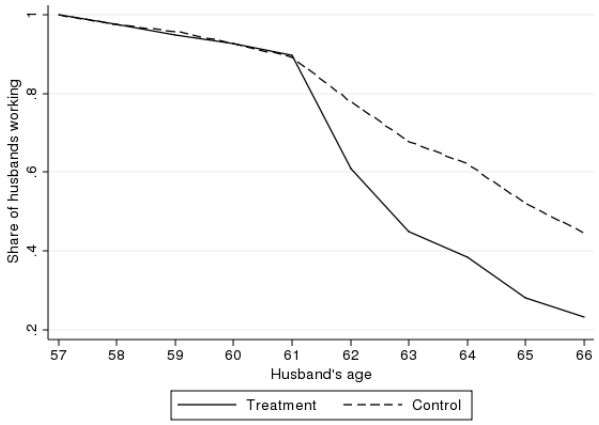


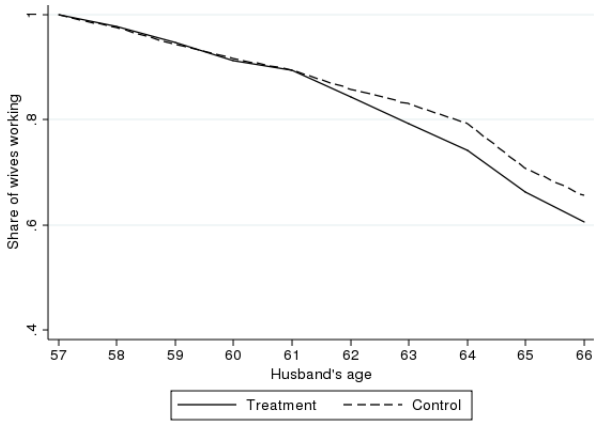
Figure 1. Exit routs from work to retirement

Notes: * AFP is the acronym for the Norwegian ER reform. It is a mix of public and private provisions, but the largest share is paid by the employers.

(a) Male workers' probability of working



(b) Wives' probability of working



(c) Wives' probability of disability retirement

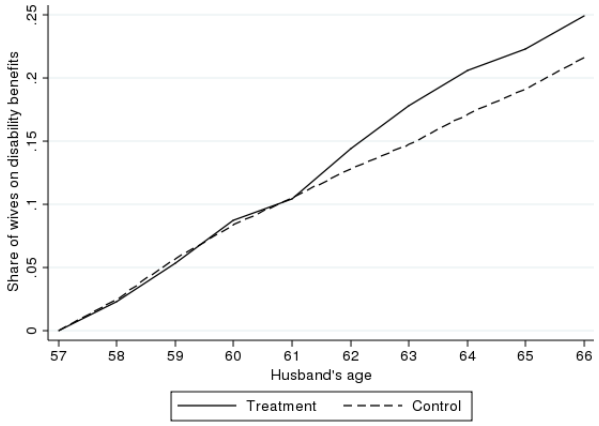
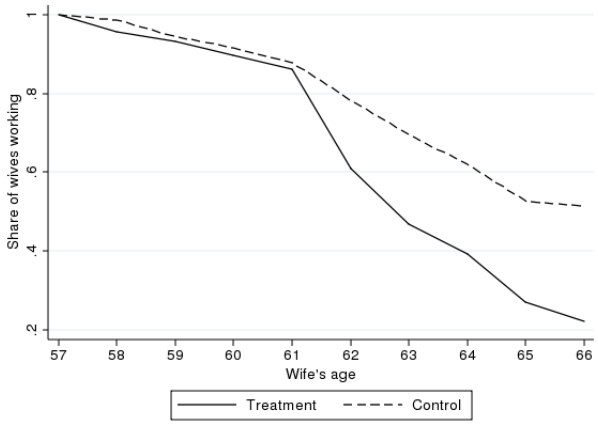
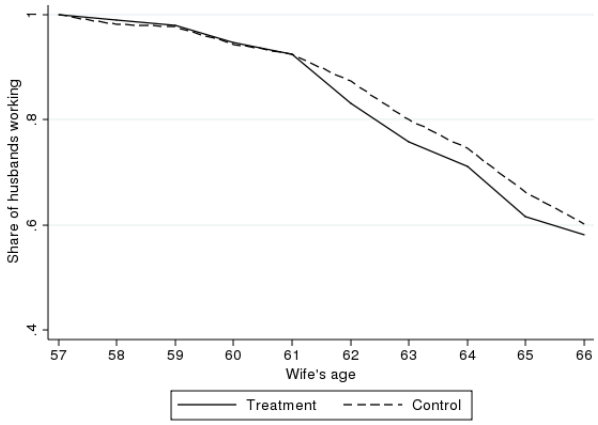


Figure 2. Trends in outcome variables for male workers and their wives

(a) Female workers' probability of working



(b) Husbands' probability of working



(c) Husbands' probability of disability retirement

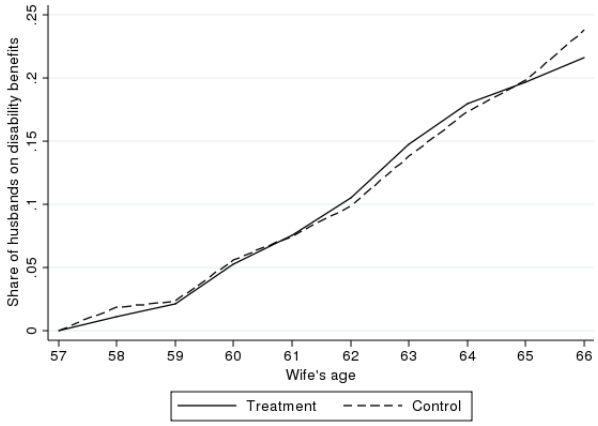


Figure 3. Trends in outcome variables for female workers and their husbands

Table 1. Effects of husband's retirement on wife's outcomes

	Model I		Model II		
	Intention-to-treat		First stage	Second stage	
	(1)	(2)	(3)	(4)	(5)
	Wife work	Wife DI	Husband work	Wife work	Wife DI
ERfirm * ERage	-.041***	.029**	-.218***		
	(.013)	(.012)	(.018)		
Husband work				.187***	-.132***
				(.032)	(.028)
N of obs			19606		
N of couples			1990		

Notes: Robust SEs in parentheses. Controls: Husband FE, year FE, and wife's age. *p<0.10, **p<0.05, ***p<0.01.

Table 2. Effect of wife's retirement on husband's outcomes

	Model I		Modell II		
	Intention-to-treat		First stage	Second stage	
	(1)	(2)	(3)	(4)	(5)
	Husband work	Husband DI	Wife work	Husband work	Husband DI
ERfirm * ERage	-.035	.001	-.221***		
	(.028)	(.024)	(.032)		
Wife work				.156**	-.005
				(.062)	(.051)
N of obs			5936		
N of couples			603		

Notes: Robust SEs in parentheses. Controls: Wife FE, year FE, and husband's age. *p<0.10, **p<0.05, ***p<0.01.

Table 3. DiDiD estimates from model including younger couples as control group

	ITT effect of husband's ER eligiblity		ITT effect of wife's ER eligiblity	
	Wife work	Wife DI	Husband work	Husband DI
ERfirm * ERage * Post	-.049***	.033***	-.045**	.005
	(.011)	(.011)	(.022)	(.019)
N of obs	68340		24266	
N of couples	6967		2472	

Notes: Robust SEs in parentheses. Controls: Worker FE, year FE, and spouse's age. *p<0.10, **p<0.05, ***p<0.01.

Appendix Tables

Table A1. Descriptive statistics for ER and non-ER firms

	ER firms		non-ER firms	
	Mean	SD	Mean	SD
Blue collar*	.434	.496	.350	.477
Number of employees	239.67	456.99	69.66	165.57
Average characteristics of employees				
Earnings (1000 NOK)	166.11	39.95	171.56	59.07
Years of education	11.17	1.65	10.93	1.40
Age	41.29	4.36	38.85	5.18
Female	.411	.284	.392	.257
N of firms	1164		797	

Notes: All variables are measured in 1988, the year before the introduction of the early retirement reform. * Blue collar = primary sector, manufacturing, construction, transport (white collar = trade, business, services)

Table A2. Selection criteria and sample size

	Male workers & their wives	Female workers & their husbands
Have info on worker's 1988 firm*	34811	31970
Have info on spouse's 1988 firm*	16175	10427
Spouse worked in non-ER firm in 1988	3966	3781
Worker employed at age 57	3657	3190
Spouse also employed	2312	2462
Spouse not older than worker	1990	603

Notes: Base sample is workers born between 1936 and 1941, * : at least 10 employees in 1988 firm

Table A3. Descriptive statistics for full and selected sample of male workers and their wives

	Full sample		Selected sample	
	Mean	SD	Mean	SD
Husband				
Year of birth	1938.60	1.69	1939.02	1.60
Years of education	11.35	3.27	11.36	3.02
Baseline earnings (1000 NOK)*	290.72	231.83	310.09	209.84
Age gap (husband-wife)	3.44	4.28	4.56	3.41
Wife				
Year of birth	1942.48	4.46	1943.64	3.39
Years of education	10.52	2.64	10.49	2.37
Baseline earnings (1000 NOK)*	165.20	88.56	183.74	91.95
N of couples	34811		1990	

Notes: The full sample includes husbands born between 1936 and 1941, with info on husbands' firm in 1988 (at least 10 employees), * Baseline = earnings in year when husband was aged 57 (five years prior to him reaching early retirement age)

Table A4. Descriptive statistics for full and selected sample of female workers and their husbands

	Full sample		Selected sample	
	Mean	SD	Mean	SD
Wife				
Year of birth	1938.62	1.68	1939.05	1.61
Years of education	10.27	2.67	11.00	2.81
Baseline earnings (1000 NOK)*	161.70	82.79	188.10	92.29
Age gap (wife-husband)	-3.44	3.92	1.65	2.66
Husband				
Year of birth	1935.23	4.45	1940	3.12
Years of education	10.87	3.18	12.00	2.90
Baseline earnings (1000 NOK)*	243.42	189.20	353.31	250.77
N of couples	31970		603	

Notes: The full sample includes wives born between 1936 and 1941, with info on wives' firm in 1988 (at least 10 employees), * Baseline = earnings in year when wife was aged 57 (five years prior to her reaching early retirement age)

Table A5. Descriptive statistics for male workers and their wives

	Treated		Control	
	Mean	SD	Mean	SD
Husband				
Year of birth	1939.04	1.63	1939.14	1.55
Years of education	11.34	3.09	11.40	2.90
Baseline earnings (1000 NOK)*	298.29	152.69	329.24	277.75
Age gap (husband-wife)	4.53	3.29	4.60	3.59
Wife				
Year of birth	1943.58	3.27	1943.74	3.58
Years of education	10.38	2.37	10.66	2.36
Baseline earnings (1000 NOK)*	178.26	86.57	192.66	99.52
N of couples	1226		764	

Notes: * Baseline = earnings in year when husband was aged 57 (5 years prior to him reaching early retirement age)

Table A6. Descriptive statistics for female workers and their husbands

	Treated		Control	
	Mean	SD	Mean	SD
Wife				
Year of birth	1939.08	1.62	1939.01	1.59
Years of education	11.29	2.92	10.49	2.55
Baseline earnings (1000 NOK)*	187.19	82.57	329.24	277.75
Age gap (wife-husband)	1.57	2.53	1.78	2.88
Husband				
Year of birth	1940.65	3.00	1940.79	3.33
Years of education	12.12	3.08	11.81	2.54
Baseline earnings (1000 NOK)*	351.01	226.52	356.83	289.26
N of couples	384		219	

Notes: * Baseline = earnings in year when wife was aged 57 (5 years prior to her reaching early retirement age)

Table A7. Robustness to using only private ER firms

	ITT effect of husband's ER eligiblity		ITT effect of wife's ER eligiblity	
	Wife work	Wife DI	Husband work	Husband DI
ERfirm * ERage	-.036**	.027*	.016	-.017
	(.021)	(.052)	(.046)	(.041)
N of obs	13158		2251	
N of couples	1336		232	

Notes: Robust SEs in parentheses. Controls: Worker FE, year FE, and spouse's age. *p<0.10, **p<0.05, ***p<0.01.

Table A8. Robustness to minimum number of employees

	ITT effect of husband's ER eligiblity		ITT effect of wife's ER eligiblity	
	Wife work	Wife DI	Husband work	Husband DI
At least 5 employees				
ERfirm * ERage	-.044**	.029***	-0.34	-.000
	(.010)	(.010)	(.023)	(.020)
N of obs	28864		8039	
N of couples	2931		821	
At least 15 employees				
ERfirm * ERage	-.033***	.025**	.002	-.014
	(.012)	(.011)	(.028)	(.023)
N of obs	14682		4449	
N of couples	1488		452	

Notes: Robust SEs in parentheses. Controls: Worker FE, year FE, and spouse's age. *p<0.10, **p<0.05, ***p<0.01.

Table A9. Robustness to including cohorts born between 1933 and 1935

	ITT effect of husband's ER eligiblity		ITT effect of wife's ER eligiblity	
	Wife work	Wife DI	Husband work	Husband DI
ERfirm * ERage	-.037**	.021*	-0.42*	.012
	(.012)	(.012)	(.025)	(.021)
N of obs	23213		7438	
N of couples	2429		788	

Notes: Robust SE in parentheses. Controls: Worker FE, year FE, and spouse's age. *p<0.10, **p<0.05, ***p<0.01.

Table A10. Robustness to including non-working spouses

	ITT effect of husband's ER eligiblity		ITT effect of wife's ER eligiblity	
	Wife work	Wife DI	Husband work	Husband DI
ERfirm * ERage	-.038**	.024**	-.030	-.001
	(.011)	(.010)	(.023)	(.019)
N of obs	29856		8407	
N of couples	3261		903	

Notes: Robust SEs in parentheses. Controls: Worker FE, year FE, and spouse's age. *p<0.10, **p<0.05, ***p<0.01.

Table A11. Robustness to including spouses that are at most two years older

	ITT effect of husband's ER eligiblity		ITT effect of wife's ER eligiblity	
	Wife work	Wife DI	Husband work	Husband DI
ERfirm * ERage	-.036***	.022*	-.036*	-.012
	(.013)	(.012)	(.019)	(.016)
N of obs	21727		13076	
N of couples	2232		1436	

Notes: Robust SEs in parentheses. Controls: Worker FE, year FE, and spouse's age. *p<0.10, **p<0.05, ***p<0.01.

Table A12. Robustness to including spouses working in 1988 ER firms

	ITT effect of husband's ER-eligiblity		ITT effect of wife's ER-eligiblity	
	Wife work	Wife DI	Husband work	Husband DI
ERfirm * ERage	-.021***	.006	-.038**	.003
	(.007)	(.007)	(.018)	(.013)
N of obs	88916		23620	
N of couples	9034		2415	

Notes: Robust SEs in parentheses. Controls: Worker FE, year FE, and spouse's age. *p<0.10, **p<0.05, ***p<0.01.

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