Closing the Gender Gap in Pensions? Pension accrual for unpaid care work and household behavior after retirement

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Abstract

I provide a comprehensive analysis of the impact of a pure change in pension wealth on retirement behavior. I exploit a 2010 Norwegian policy reform that retroactively extended childcare-related pension credits to mothers of children born between 1967 and 1991. I quantify the resulting increase in pension benefits and assess the policy's potential to narrow the gender pension gap, along with any distortionary effects on labor supply and pension claiming. Using population-wide administrative data from Norway, I estimate pension benefits for all beneficiaries had the policy not been adopted and implement a difference-in-differences design, leveraging the variation in the credits' impact on final pension benefits. My findings show that the policy increased pension benefits by an average of 2.5%, contributing to a 1.5 percentage point reduction of the gender gap in lifetime pension benefits. I find small, negative effects on employment, earnings, and take-up of other benefits driven by a decrease in the claiming age, along with preliminary evidence of spillovers within the household.

1 Introduction

Gender gaps in many dimensions throughout working life have been extensively studied in the academic literature. To the extent to which past earnings and employment histories determine future pension benefits, the gender gaps present in the labor market result in a substantial gender pension gap. In 2021, the gender wage gap relative to median earnings of men was 11.4% on average for the OECD member countries, compared to a 25.6% gender pension gap (OECD, 2021)[1]. While this number partly reflects the increase in female labor force participation from recent decades, it also highlights that there is scope for policy to compensate for gender imbalance as part of the numerous pension reforms implemented to tackle population aging.

The fact that women have shorter working lives on average has been suggested as one of the drivers of the gender pension gap. There are two main avenues through which pension policy can address

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this: first, by setting incentives to postpone retirement, as suggested by previous research on the differential impact by gender of early retirement schemes or changes in the retirement age. Second, by introducing policies that ensure a certain level of pension entitlements during women's career breaks. According to a survey of the legal framework in 190 countries, 109 countries account for periods of absence due to childcare in the final calculation of pension benefits (World Bank, 2024)[2]. This corresponds to 81% of high-income countries and 47% of low- and middle-income countries.

However, this second set of policy tools may have unintended consequences for women's working lives. If women are forward-looking enough, knowing that they will have a higher future pension may lead them to reduce their current labor supply. Then, the increase from the pension credits needs to be weighed against the decrease in pension entitlements from a shorter working life and/or lower lifetime earnings. As a result, the policy may even have a negative impact on women's pension benefits, thus widening the gender pension gap.

The retroactive extension of pension accrual for unpaid care work in Norway, introduced in 2010 for mothers who gave birth between 1967 and 1991, allows me to identify the labor supply response to a change in pension wealth. Introduced for the first time in 1992, pension accrual for unpaid care work ensures that individuals who provide care for children have their pension rights calculated relative to a fixed amount whenever it would have been lower if calculated relative to their actual income. This fixed amount is around 80% of the average wage and operates as an income threshold. Policy coverage lasts up to 6 years after birth, well beyond the coverage of maternity leave payments, and does not require the individual to be unemployed during that period, provided they earn below the income threshold. The policy is gender neutral in principle, but most of the beneficiaries are women, since pension accrual is allocated to the lower earner of the couple. The 2010 retroactive extension grants similar support for children born before 1992, and affects beneficiaries' retirement and/or occupational pensions depending on their birth cohort.

Although there is a large body of literature studying the employment effects of various pension reforms, we have very few examples of policies that only target the benefits level. The cohorts born between 1948 and 1953 had already made their employment and fertility decisions at the time of the extension: for them, this shock is in fact more akin to a windfall gain. The fact that pension calculation rules take into account the whole employment and earnings history generates variation in the final impact of the policy in monetary terms upon retirement. This allows me to compare the retirement behavior of policy beneficiaries for whom the policy had a non-zero impact on their pension benefits to those who were equally eligible but experienced no income shock. I estimate the retroactive extension of pension accrual for unpaid care work to account for an average 2.5% (USD 601[1]) increase in pension benefits for the whole sample, that is, an average 5.0% (USD 1,357) increase for the beneficiaries for whom the policy had a non-zero impact. The present value of the average lifetime increase in pension benefits is thus USD 10,992, or USD 21,566 for the beneficiaries for whom the policy had a non-zero impact.

[1] All monetary values are in 2015 NOK. 1 NOK = 0.1244 USD, average exchange rate for 2015.

The beneficiaries' proximity to retirement naturally limits the potential negative effect of the policy on future pension accrual. Therefore, this setting constitutes a best-case scenario to measure its potential to close the gender pension gap. For the cohorts born between 1948 and 1953, I find that pension accrual for unpaid care work led to a 1.54 pp reduction in the gender gap in lifetime pension benefits with sufficiently small employment effects: beneficiaries anticipate pension claiming by around 1.6 months and drop out of the labor force 3.8 months earlier for the average increase. Women who were never married by 2009 and those below the 25th percentile of the household income distribution for all beneficiaries respond more. The labor supply response is equivalent to an elasticity of 0.52 and a marginal propensity to earn out of pension wealth (MPE) of -0.27. The policy leads to a 10% decrease in full-time employment (conditional on working), and to a decrease in take-up of unemployment benefits and sick leave that can be fully explained by the decrease in the claiming age. The government saves NOK 374 (47 USD) per capita on unpaid unemployment benefits, a magnitude similar to the average unemployment benefits paid out to the women for whom the policy had no impact. However, the extra 1.6 months of pension benefits, absent any effect on longevity, imply an extra expenditure of NOK 35,220 (4,381 USD) per capita.

Following Eika, Mogstad and Vestad (2020)[3], I can approximate consumption expenditure from the accounting identity that consumption expenditure equals disposable income minus the change in wealth plus capital gains. To impute the market value of real estate prior to 2010, the suggested approach combines administrative records with transaction data. For the moment, I use price indices for 11 regions in the 2005 - 2010 period, combined with a measure of the distance between the previously assessed value and the actual market value of housing in 2008. This will allow me to study the effect of an increase in pension wealth on consumption expenditure at the individual and household level, that is, the marginal propensity to consume (MPC). Other potential outcomes of interest include marriage stability, likelihood to move[2], the children's labor supply and the beneficiaries' and their partners' longevity.

Finally, I aim to extend the marginal value of public funds (MVPF) framework (see Hendren and Sprung-Kayser (2020)[4]) to be able to compare the array of policies that have an impact on the current vs. future gender pension gap - or, equivalently, the gender gap in lifetime earnings -: (1) reforms of the pension system itself, i.e., changes in the retirement age or benefit calculation rules, (2) pension supplements and credits, such as the one I evaluate in this paper, and (3) childcare-related policies that intend to address the child penalty in female labor force participation and earnings, e.g., changes in maternity leave or childcare subsidies.

This paper makes four key contributions. First, it provides comprehensive evidence on the effectiveness of childcare-related pension credits, quantifying their impact on the gender pension gap, labor supply, and consumption expenditure. Previous studies (see e.g., Cordova, Grabka and Sierminska (2022)[5], Bonnet and Rapoport (2020)[6], Halvorsen and Pedersen (2019)[7]) have focused on

[2]By comparing price levels across municipalities, changes in municipality provide additional information on the value of real estate.

studying how pension credits can narrow the gender pension gap, without estimating the magnitude of the behavioral response. In particular, I am interested in studying the consequences of narrowing the gender pension gap for individuals and households.

Second, it contributes to a large literature on the labor supply response to pension reforms (see e.g., Krueger and Meyer (2002)[8], Brown (2013)[9], Giesecke and Jäger (2021)[10], or Carta and De Philippis (2024)[11]). This paper is among the few that are able to isolate a pure change in pension wealth, including Thiemann (2015)[12], Becker et al. (2023)[13] and Pesner (2024)[14]. Artmann, Fuchs-Schündeln and Giupponi (2024)[15] use a similar policy change in Germany to study forward-looking female labor supply responses to a change in pension wealth. This paper focuses on women who are close enough to retirement so that working vs. claiming is the relevant trade-off and provides evidence on the beneficiaries' response once the future income shock is realized.

Third, it contributes to the literature studying how individuals and households react to changes in pension wealth. There is a body of research focusing on savings and consumption expenditure (see e.g., Lachowska and Myck (2018)[16], Lindeboom and Montizan (2020)[17] and Etgeton, Fischer and Ye (2023)[18]). Others have analyzed the impact of an increase in pension wealth on health outcomes, including longevity (see e.g., Malavasi and Ye (2024)[19]). This paper combines the impact on labor supply and earnings, household income, consumption expenditure, and health into a welfare analysis of childcare-related pension credits.

Fourth, since the pension credits are granted retroactively and close to retirement, the conceptual proximity to a windfall gain allows me to compare my findings to the literature studying the labor supply effects of winning the lottery (see e.g. Imbens, Rubin and Sacerdote(2001)[20], Cesarini et al (2017)[21], or Golosov et al (2024)[22]). In fact, this paper follows a similar structure to the series of papers from the Unconditional Cash Study (see Vivalt et al (2024)[23], Bartik et al (2024)[24] and Miller et al (2024)[25]). Note, however, that the pension credits change the amount of pension benefits instead of being a separate source of income, and they are explicitly labeled as compensating for "unpaid care work".

However, my estimate of the labor supply elasticity is in line with the findings from Picchio, Suetens and van Ours (2018)[26]. This suggests that the fact that childcare-related pension credits are perceived as *earned* income, compared to winning the lottery or receiving a cash transfer, may not significantly influence the employment response.

The paper is structured as follows. Section 2 outlines the 2010 reform to pension accrual for unpaid care work and how its fit within the Norwegian pension system. Section 3 describes the data used in the analysis and how the sample is defined. Section 4 discusses the identification strategy. Section 5 presents the estimates of the pension wealth effect on the beneficiaries' retirement decision, and its implications for household consumption and welfare during old age. Section 6 concludes.

2 Institutional setting

2.1 Pension accrual for unpaid care work

Pension accrual for unpaid care work ensures that individuals who provide care for children under 7 years of age are entitled to pension rights relative to a fixed amount set by the government whenever their pension accrual would have been lower if calculated relative to their actual income. As a result, it does not translate into any cash transfers immediately after or at the moment of birth, but may result in a higher future pension.

This policy was introduced in Norway by law FOR-1993-06-09-439 and applied to all births from January 1st, 1992. Individuals must be between 17 and 69 years old and members of the National Insurance scheme [3] to be eligible.

Although the text of the law explicitly refers to unpaid care work, there are no specific requirements in terms of hours spent on childcare: a caregiver is someone who performs day-to-day care and has the parental responsibility of a child.

The pension accrual granted corresponds to an income of up to 4.0G[4]. For reference, 4.0G was equivalent to NOK 474,480 (USD 43,674) in 2023, 0.71 times the average annual wage. This means that, for eligible individuals who earn below 4.0G from the year when they give birth and up to 6 years afterwards, their pension accrual for those years will be calculated relative to 4.0G, and it will be calculated relative to their earned income otherwise. Note that an individual can be employed full-time and still earn below 4.0G, thus being eligible to receive care accrual. As a result, 4.0G is in practice an income eligibility threshold.

Finally, pension accrual is granted to only one of the parents. Before the introduction of childcare allowance in 1998, individuals had to apply to receive pension accrual, and this was awarded to the partner with lower income. From 1998, pension accrual is automatically granted to the recipient of childcare allowance, which is typically the mother, provided they are below the income threshold. As a result, while the text of the law is gender neutral in principle, women are more likely to be both below the income threshold and the lower earner in the couple, which is why the policy indirectly addresses gender inequality in pension benefits.

From January 1st, 2010, the generosity and duration of pension accrual for unpaid care work are reformed. The policy now covers up to five years after birth, down one year compared to the original rules, and raises the income threshold to 4.5G (for reference, 0.8 times the average annual wage in 2023). Furthermore, it states that all individuals who gave birth between 1967 and 1991 will be automatically granted pension accrual for unpaid care work provided they fulfill the above

[3] In Norway, membership to the National Insurance scheme is defined by employment or residence.

[4] A G or *grunnbeløpet* is the National Insurance basic amount. It is used to calculate the level and income thresholds of several welfare benefits, and is updated each year according to expected national income growth. More information is available at `https://www.nav.no/grunnbelopet` [in Norwegian].

requirements[5]. The retroactive extension of the 1992 policy is the reform of interest for this paper.

To the extent to which the recipients are forward-looking enough to trade away current labor earnings for future pension benefits, the policy is a disincentive to work. If the employment response is large enough, or if it happens early enough to have a persistent, negative impact on earnings, this may decrease pension accrual until it offsets, or even reverses, the positive effect of the policy. As a result, pension accrual for unpaid care work may result in lower, instead of higher, pensions for caregivers.

The retroactive extension of the policy offers a natural experiment to study the effect of the policy in the best scenario possible. The older cohorts affected were between 57 and 62 years old at the time the policy was introduced - at this point, these women had made most of their fertility and employment decisions, especially those that will be pension-relevant, and only have to choose when to drop out of the labor force and start claiming their pension benefits. As long as the employment effects are small enough close to retirement, there is no possibility for these mothers to offset the potential increase in pension benefits as a result of the policy. For them, it is almost equivalent to a pure income shock. While it is not feasible for policymakers to constantly implement such retroactive policies, it provides a benchmark on what the maximum potential for such a policy to close the gender gap in pensions would be. Furthermore, given the increase in pension benefits materializes during retirement, it is possible to study how the beneficiaries allocate the extra income, and whether it leads to improved health and welfare outcomes in old age.

However, to determine the elasticity of labor supply with respect to an increase in pension benefits, and to map said increase to any potential increases in consumption, it is necessary to know the pension benefits each individual would have received had the policy not been implemented. There is no direct correspondence between the pension accrual for unpaid care work and the final pension benefits, since these depend on the individual's whole employment and earnings trajectory, as well as their marital status. Section 2.2 discusses where pension accrual for unpaid care work fits in the Norwegian pension system and what this means for quantifying the income shock.

2.2 The Norwegian pension system

The Norwegian pension system can be divided into three pillars: (1) the National Insurance scheme, which determines the retirement pension, (2) the early retirement scheme and other occupational pension schemes, and (3) private pension savings. The retroactive extension of pension accrual for unpaid care work is introduced only through the second pillar - in particular, AFP in the private sector - for beneficiaries born between 1948 and 1953, and through the first and second pillars for beneficiaries born from 1954.

The retirement pension is composed of a fixed amount, the basic pension, and an earnings-based

[5]See Section II, Chapter 3, article 3-16 and Section VI, Chapter 20, article 20-21 of the National Insurance law, LOV-1997-02-28-19. These modifications were introduced by LOV-2009-06-05-32.

supplement that takes into account the 20 years with the highest earnings. All individuals for whom their pension benefits are below the minimum pension level set by the government will be awarded an additional amount until they reach this threshold.

The National Insurance scheme was substantially reformed in 2011. A flexible retirement age was introduced, allowing individuals to work and claim from the year they turn 62. A life expectancy adjustment is introduced in the main components of the retirement pension and the calculation rules change to further stimulate labor supply: pension benefits are now linked to the whole earnings history via a pension portfolio, instead of using the 20 years with the highest income. In order to smooth implementation, the new rules apply in full only to cohorts born from 1963. Pension benefits for cohorts born before 1954 will be calculated based on the old rules. Pension benefits for the cohorts born between 1954 and 1962 are calculated as a combination of old and new rules: 90% old rules and 10% new rules for the 1954 cohort, 80% old rules and 20% new rules for the 1955 cohort, 70% old rules and 30% new rules for the 1956 cohort, and so on [6].

Occupational pension schemes were made mandatory in 2006 and require that the employer saves at least 2% of the employee's income for their future pension. The contractual early retirement scheme, *avtalefestet pensjon* or AFP, is effective from age 62 under certain income requirements. In the private sector, it is composed of a savings portfolio of 0.314% of annual income, an annual AFP supplement, and a compensation supplement. The detailed rules to calculate pension benefits in the first and second pillars, and the way in which I incorporate them to estimate the impact of the policy in monetary terms, are described in Appendix A.

From the above description, it follows that the impact of the policy on the final pension benefits, abstracting from any behavioral responses, may be zero or positive. For example, some individuals may have accumulated too low pension entitlements throughout their working life, such that they would be below the minimum pension level even with the additional support from the policy. In this case, their final pension will be equal to the minimum pension both with and without the policy. Note, however, that these women are equally eligible in the eyes of the policy, i.e., they were the lower earner in the couple and below the income requirement up to 5 years after birth.

3 Data and sample definition

I combine population-wide administrative data from different registries at Statistics Norway from 1967 to 2021. First, I use the population registry to identify all women born between 1948 and 1956 who gave birth to at least one child between 1967 and 1991. I collect information on their country of birth, marital status, education level, and place of residence. Second, I use the matched employer-employee registry to obtain information on employment, work hours, occupation, and industry. Third, I use the different income and social security registries to obtain information on

[6]Note that, for cohorts born between 1954 and 1962, the retroactive extension of pension accrual only affects pension benefits in the first pillar through the share that is determined by the new rules

their earnings, date and degree of early retirement, date and degree of old-age retirement, and the total amount of pension benefits received. Using the unique family identifier, I can link all married or cohabiting individuals to their partners. As a result, I am able to build a panel dataset with comprehensive data on the mothers' earnings, employment, retirement behavior, and demographic characteristics, together with that of their spouses.

The sample is restricted to the 1948–1956 cohorts due to data availability and a later pension reform. First, to study retirement behavior, individuals must turn 62 before 2021, with older cohorts providing more informative post-retirement outcomes. Second, the 2011 pension reform changed the pension calculation rules and increased work incentives by allowing retirees to work and claim flexibly. I limit the main analysis to the 1948 - 1953 cohorts because their pension is entirely calculated according to the old rules, and I estimate the effect on labor supply within the occupational pension groups defined by Hernæs et al. (2016)[27]. While this ensures that the impact of the 2011 reform does not confound my estimates, it reduces both the sample size and the magnitude of the income shock, which affects them only through their occupational pension.

I perform the same analysis for the 1954 - 1956 cohorts, where the outcome variable of interest will be early retirement at age 62. Additionally, I carry out an alternative analysis under the assumption that employers would internalize the policy change and incorporate pension accrual for unpaid care work into their occupational pension schemes for these cohorts in the same way the state does for the younger ones. In practice, this means that I only take into account the policy support for the years when the individual was eligible *and* employed.

Using the pension rules described in Section 2.2 and Appendix A, I estimate the counterfactual pension benefits had the policy not been implemented for all mothers in my sample. Since I cannot incorporate all elements of the National Insurance constellation into my exercise, I estimate the pension benefits including the policy coverage, and define the impact of the policy as the difference between these two values. Because the policy does not enter the calculation formulas for any of the elements left out, the impact should be the same if taken with respect to actual pension earnings. However, using estimated benefits instead allows me to calculate the impact of the policy for individuals who haven't retired yet, which is useful to illustrate the analysis given that the retirement age is an outcome variable in my setting.

Descriptive statistics

There are 230,356 women born between 1948 and 1953 in the Norwegian population registry. Of them, 170,718 gave birth at least once between 1967 and 1991. This is 74% of the total population, ranging between 75.5% for the 1948 and 72.1% for the 1953 cohort. I restrict the sample to women who were alive by age 60 to ensure they were affected by the reform, and only keep women who had their last child before 1992 so they were not affected by the original introduction of pension accrual for unpaid care work. This reduces the sample to 159,493 women, 69.4% of the total population. Finally, 150,086 women in the sample, 65.2% of the population, had claimed pension benefits by

2021.

The policy had no impact on the final pension benefits for half of the sample (see Table 1 in Appendix B) only due to the restrictions on how the pension credits enter the pension calculation. Table 1 shows that 87.16% of the sample were eligible for pension credits for at least one year of the first five after each birth. In fact, 63.81% of the sample were the lower earner of the couple and below the income threshold for all 5 years after each birth. If the pension credits had been applied to the 1948 - 1953 cohorts in the same way they apply to the mothers born after 1963, over 95% of mothers would have had a positive impact on their final pension benefits as a result of the policy.

Table 1: Eligibility of the mothers in the sample

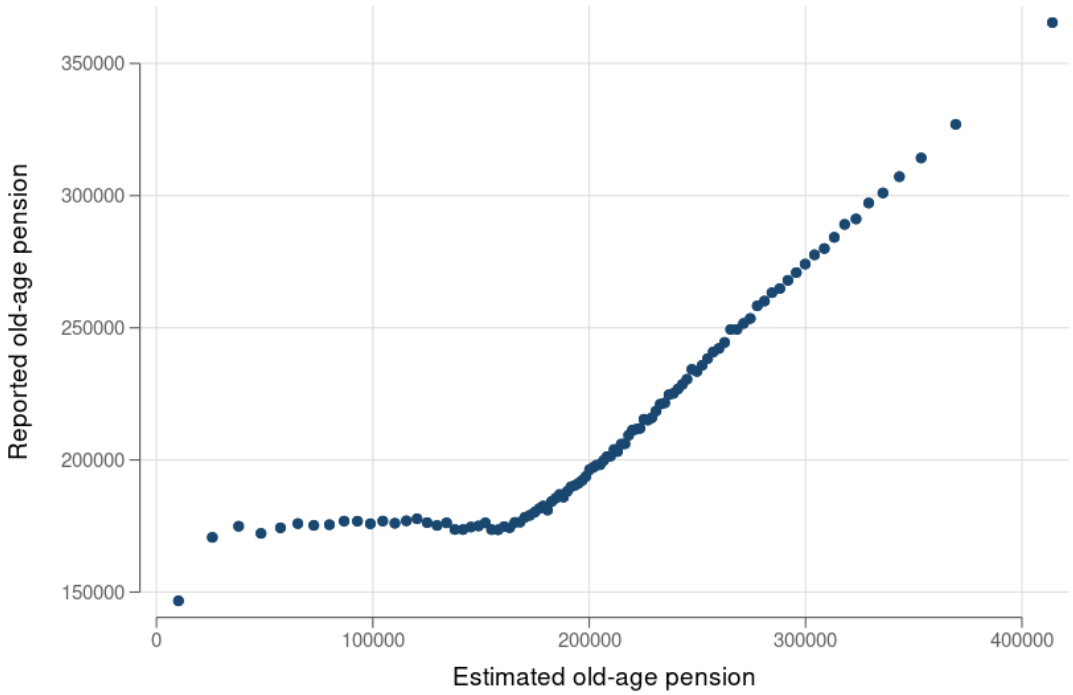
	Mean	SD	Share with value 0	Share with value 100
Lower earner of the couple (%)	92.09	17.97	0.96	72.07
Below the income threshold (%)	93.75	17.68	0.87	82.35
Eligible for pension credits (%)	87.16	24.09	2.26	63.81
N	163,140			

Share of all years with policy coverage (up to 5 years after each birth, between 1967 and 1991) where the individual meets one or both of the eligibility criteria.

Results from the pension calculation

Figure 1 shows how the old-age pensions estimated following the rules outlined in Section 2.2 map to the pension benefits perceived by the beneficiaries as reported in their income declarations. The estimated pension benefits are calculated for the year when the individual claims pension benefits for the first time. Reported pension benefits are measured at the same point in time, and a "full annual value" is obtained by adjusting for the number of months claimed by the end of the year and the degree (from 0 to 100) to which they withdraw their accumulated pension benefits.

Figure 1: Estimated vs. reported pension benefits



All values in Norwegian kroner (NOK).

The estimation for Figure 1 does not incorporate the minimum pension policy, which explains the flat line until NOK 175,000. Since the minimum pension level for each individual depends on characteristics available in my sample, I replace the estimated pension benefits with the minimum pension level where applicable for the rest of the analysis. For the individuals not affected by the minimum pension, the regression coefficient is 0.78, with an R-squared of 0.61.

Impact of the policy

In principle, childcare-related pension credits lead to higher pension benefits by (1) increasing the number of years contributed to the Social Insurance scheme, and (2) increasing the contributions per year. However, membership in the Norwegian Social Insurance scheme in Norway is determined by employment or residence. This means that, although the policy coverage applies during unemployment, it cannot increase the number of contribution years. As a consequence, the impact of the policy happens only through the second channel.

Table 2 shows the final pension benefits and average pension points for all mothers born between 1948 and 1953. The mothers that were higher earners during policy coverage - that is, the non-eligible mothers - are also earning substantially higher pensions by the time of retirement. Eligible mothers from these cohorts have 3.19 final pension points on average. For them, the policy applies to the second pillar only, so it does not change the final pension points. If the policy applied to

the first pillar for these cohorts, it would increase final pension points to 3.37. This difference is equivalent to NOK 6,782 (USD 855), a 3.65% increase [7] in pension wealth.

Table 2: Pension entitlements of the mothers in the sample, by policy eligibility

	Non-beneficiaries	Beneficiaries	Difference
Old-age pension	230,985	183,498	47,487***
	[55,165]	[48,205]	(848)
Final retirement (incl. occupational) pension	337,885	240,704	97,812***
	[158,629]	[98,106]	(1,769)
Years in the National Insurance scheme	39.31	34.17	5.14***
	[2.88]	[10.34]	(0.17)
Final average pension points	5.30	3.19	2.12***
	[1.07]	[1.54]	(0.03)
N	3,688	159,452	163,140

Figures for the birth cohorts 1958 - 1953. Pension amounts are the full-retirement equivalent for the year when the individual claims pension benefits for the first time. Eligibility is defined as having been the lower earner of the couple and below the income threshold for at least one year during the period covered by the policy

The impact of the policy at the individual level is measured by the difference between the estimated pension benefits with and without the policy. Taking advantage of the linked employer-employee data, I can identify the beneficiaries who were employed at an AFP firm in the public or private sector and eligible to claim an occupational pension through this scheme. Following this approach, the policy leads to an average NOK 4,831.81 (USD 601), or a 2.5% increase at the time of retirement. For the women in the sample who are retired by 2021, the policy had a non-zero impact for 51.26% of them. Without the beneficiaries for whom the policy had no impact, the policy led to a NOK 10,904.43 (USD 1,357, or a 5.02%) average increase.

Tables 4, 5 and 6 in Appendix B show the impact of the policy by country of origin, education level, and marital status at retirement, respectively. Since the retirement age is potentially endogenous, I also report the same figure measured at age 62. The changes in magnitude between the two can be explained by (1) the accumulation of years of membership to the Social Insurance scheme, (2) the yearly updates of the National Insurance basic amount, and (3) the fact that the annuity divisors change with the retirement age.

Beneficiaries born outside Norway and other Western countries experience a smaller impact on pension wealth from the policy. Since policy support is channeled through occupational pensions, groups with lower labor force participation benefit from the policy the least, even though they are also the ones with the lowest overall pension benefits.

The policy's impact varies by education level in both relative and absolute terms. Higher-educated mothers are more likely to be near the income threshold during policy coverage years, reducing the difference between pensions calculated using the threshold versus actual earnings. Additionally, their steeper earnings trajectories result in higher final pensions, diminishing the policy's relative

[7] Note that this value is different from the average increase reported above because it only includes the beneficiaries for whom I observe their final retirement date and realized pension benefits.

effect on pension wealth.

The impact of the policy is very similar across marital status, except for women who had never married / registered as cohabitant by age 62. This can be partly explained by other policies supporting single mothers' earnings, which count toward pension entitlements, and pension supplements for single mothers.

Finally, Table 3 shows a selection of demographic characteristics for the mothers in the sample, split between mothers who were never eligible for the policy (non-beneficiaries), mothers who were eligible for the policy and in the relevant occupational pension group but for whom it had no impact on their final pension benefits (beneficiaries with zero impact), and mothers in the relevant occupational pension group who received higher pension benefits as a result of the policy (beneficiaries with non-zero impact). Table 2 in Appendix B documents the demographic characteristics for the whole sample of beneficiaries.

Table 3: Demographic characteristics of the mothers in the sample, by policy eligibility and impact within the relevant occupational pension group

	Non-beneficiaries	Beneficiaries		
		Zero impact	Non-zero impact	Difference
Share born in Norway (%)	93.63	90.60	93.02	-2.41{***}
	[24.43]	[29.18]	[25.49]	(0.39)
Share married (%)	56.16	65.29	74.85	-9.55{***}
	[49.63]	[47.61]	[43.39]	(0.65)
Share with college education (%)	68.17	33.10	12.38	20.73{***}
	[46.59]	[47.06]	[32.93]	(0.59)
Number of children	1.62	2.05	2.31	-0.26{***}
	[0.72]	[0.74]	[0.83]	(0.01)
Share working (%)	98.13	98.64	98.59	0.05{***}
	[13.55]	[11.58]	[11.77]	(0.17)
Average annual earnings (NOK)	520,475	483,173	310,821	172,352{***}
	[325,426]	[193,311]	[115,590]	(2,338)
Age difference with partner	-1.73	-2.21	-2.18	-0.03
	[4.66]	[3.89]	[3.60]	(0.06)
Share whose partner is retired (%)	9.36	11.01	11.45	-0.45
	[29.13]	[31.30]	[31.85]	(0.51)
N	3,688	11,174	8,751	19,925

Demographic characteristics in 2009, for the birth cohorts 1948 - 1953. Eligibility is defined as having been the lower earner of the couple and below the income threshold for at least one year during the period covered by the policy.

Present value of pension accrual for unpaid care work

The beneficiaries for whom the policy had a non-zero impact will receive a higher pension every year until death. I calculate the present value of the pension increase as follows

$$PV = WP \times \frac{1 - \frac{1}{(1+r)^n}}{r} \tag{1}$$

where WP is the difference in pension benefits with and without the policy measured at age 62 (at

the age of retirement). n is the difference between age 62 (age of retirement) and the age of death, when applicable. Otherwise, it is the difference between age 62 (age of retirement) and the life expectancy measured at that point in time for the individual's birth cohort, gender, and education level. Life expectancy data are estimated by the Norwegian Institute of Public Health. Finally, r is the net interest rate and takes value 1.96%, following common practice for calculating present values of contributions and benefits in Norway (Fredriksen and Stølen, 2017)[28].

Table 4 shows the present value of policy impact, for the whole sample of beneficiaries and for those beneficiaries for whom the policy had a non-zero impact. At the age of retirement, childcare-related pension credits amount to a discounted value of NOK 88,360 (USD 10,992). For comparison, this is equivalent to 2.03% of the average lifetime pension benefits.

Table 4: Present value of the final increase in pension benefits as a result of the policy

	All beneficiaries	Beneficiaries with non-zero impact
At age 62 (NOK)	64,565.48	125,634.72
	(108,002.9)	(122,577.5)
At retirement (NOK)	88,360.39	173,363.64
	(148,401.0)	(168,738.3)
N	143,870	73,328

Mean coefficients; sd in parentheses

Figures for the birth cohorts 1948 - 1953. Policy impact is defined as the difference between the estimated pension benefits with and without the policy. Note that annuity divisors exist only from age 62. This is also the earliest possible age to retire.

4 Identification strategy

I want to identify the effect of the increase in pension wealth on the beneficiaries' behavior around retirement. This includes a number of different decisions, namely (1) when to start claiming pension benefits, (2) how to combine pension and work, and (3) when to fully withdraw from the labor market.

Identification will rely on the possibility that the policy has a zero effect for some of its beneficiaries due to their employment and earnings history outside the period covered by the policy and prior to the announcement of the retroactive extension. For illustration, consider two women, A and B, born in 1950, who gave birth in 1980 and were both below the income threshold and the lower earner in their respective couple between 1980 and 1985. In 2010, they are 60 years old, covered by AFP in the private sector, and will be able to retire from age 62. Throughout her working life, Woman A earned above the income threshold for 15 years after 1985. As a result, the 5 years of policy support count towards her 20 best income years, and thus determine (increase) her pension benefits. On the other hand, Woman B earned above the income threshold for 22 years after 1985. Then, the 5 years of policy support will not enter the equation to determine her final pension points: she is a

beneficiary of pension accrual for the childcare she provided between 1980 and 1985, but this will not translate into higher final pension benefits. This means that, to study the employment effects caused by the policy, what matters is not whether the individual is a beneficiary, but whether the policy had a non-zero impact on their pension wealth. I will use the variation in the increase in final pension wealth relative to a no-policy counterfactual across beneficiaries to identify this effect.

The causal relationship of interest is:

$$\begin{aligned} Y_{it} &= \alpha + \beta P_{it} + \boldsymbol{X_i'}\boldsymbol{\gamma} + \varepsilon_{it} \\ &= \alpha + \beta(NP_{it} + WP_{it}) + \boldsymbol{X_i'}\boldsymbol{\gamma} + \varepsilon_{it} \end{aligned} \tag{2}$$

where Y_{it} is the outcome of interest for individual i at time t, $\boldsymbol{X_i'}$ is a vector of individual characteristics and ε_{it} is the error term. P_{it} are the pension benefits individual i is entitled to at time t. Note that P_{it} can be decomposed into NP_{it}, the pension benefits that individual i would receive had the policy not been implemented, and WP_{it}, the amount in final pension benefits from the policy. Note that NP_{it} includes old-age pension benefits, not affected by the policy, and the counterfactual occupational pension benefits. I instrument P_{it} with its exogenous component, WP_{it}, for the sample of policy beneficiaries. Then, I estimate β by two-stage least squares.

For the estimate to have a causal interpretation, my instrument must satisfy the relevance and exclusion restrictions. Note that the relevance of the instrument is equivalent to the impact of the policy for final pension benefits, and the exclusion restriction requires that the impact of the policy is not correlated with the change in pension wealth from the broader 2011 pension reform. I discussed in Section 3 how the cohorts for whom the policy has the highest impact (i.e., more relevance) are also the cohorts that are more exposed to the 2011 reform (which does not in principle, but may violate the exclusion restriction). As a result, the trade-off identified previously is, in fact, a trade-off between relevance and exclusion. To the extent that the 1948 - 1953 cohorts, for whom the old pension rules apply, are sufficiently affected by the policy, as shown previously, both restrictions are satisfied.

A potential concern is that the instrument takes value 0 for a non-negligible share of the sample. An alternative strategy is to implement a difference-in-differences design within the relevant occupational pension group, where the beneficiaries for whom the policy had a non-zero impact are assigned to the treatment group, and those for whom the policy didn't affect final pension benefits are the control. This allows me to retrieve the dynamic treatment effects in the following specification:

$$Y_{ict} = \Big(\sum_{t=2006[t\neq 2009]}^{t=2021} \beta_t \cdot D_{it}\Big) + \alpha + \lambda_c + \delta_t + \boldsymbol{X_i'}\boldsymbol{\gamma} + \varepsilon_{it} \tag{3}$$

where the estimates for β_{2006}, β_{2007} and β_{2008} will allow me to test the parallel trends assumption, and the estimates for β_{2010}, β_{2011}, ..., β_{2021} are the relevant treatment effects. λ_c are cohort fixed

effects, δ_t are year fixed effects and $\boldsymbol{X_i'}$ includes region of origin, education level, marital status, municipality of residence, industry and occupation, full vs. part-time employment, number of children, total household income, partner's employment status and partner's age. For all time-varying characteristics, the value for 2009 is the one that enters the regression.

I will use both approaches to study retirement behavior. First, I estimate the effect of the policy on the age at which the individual starts to claim any pension benefits (claiming age), the age at which the individual starts to claim their full pension (100% claiming age) and the age at which the individual drops out of the labor market (retirement age). Given the nature of the outcome variables, the reduced-form specification for 2SLS is now:

$$Y_{ic} = \alpha + \beta WP_{ic} + \theta FP_{ic} + \boldsymbol{X_{ic}'}\boldsymbol{\gamma} + \lambda_c + \varepsilon_{ic} \tag{4}$$

where WP_{ic} is the increase from the policy measured at age 62 and FP_{ic} are estimated old-age pension benefits (the part of NP_{it} not affected by the policy). The variables in $\boldsymbol{X_{ic}'}$ are the same as in the DiD specification. For the individual characteristics that are time-varying, the regression includes the value for 2009.

Next, I use the 2SLS and DiD strategies to estimate the effect of the reform on employment, retirement and labor earnings at time t. I define employment as having non-zero labor earnings. To consider the effect on employment in the intensive margin, I use both the registered working hours and an earnings-based measure of full vs part-time employment. Note that, under this definition, not being employed is not equivalent to dropping out of the labor force. This is measured instead as a binary variable that takes value 1 in the time periods after the last employment spell. Finally, I define retirement as being registered as an AFP or an old-age pension claimant at time t.

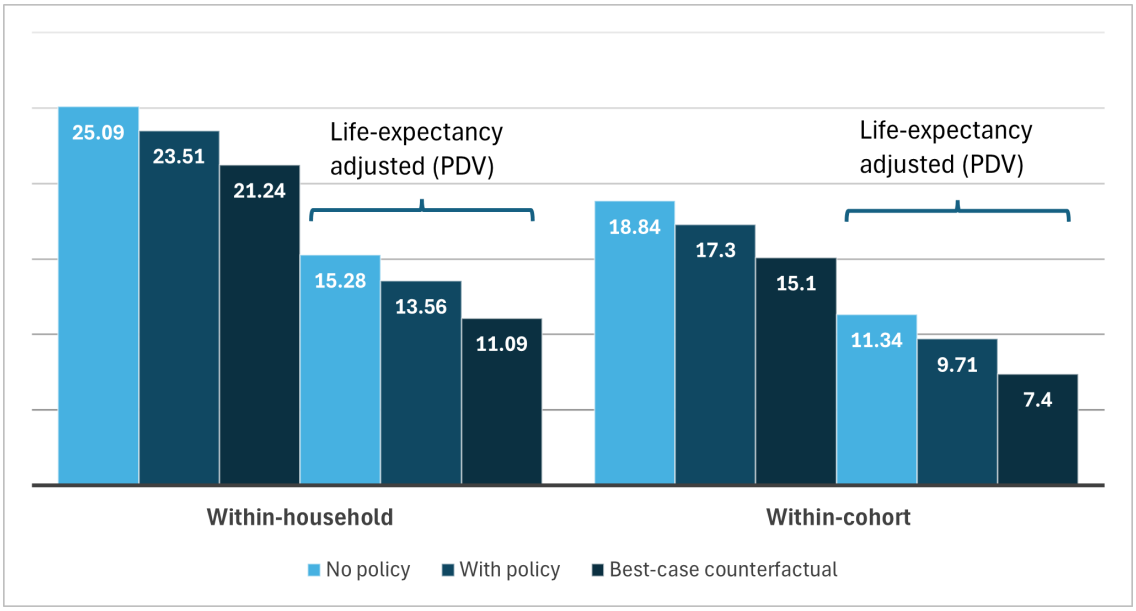
5 Results

5.1 Effect of the policy on the gender pension gap

To determine the extent to which the policy was successful in narrowing the gender pension gap, I will first assume that men's pensions were not affected by the reform. Considering the reported old-age and occupational pension benefits for all men and women in the Norwegian population registry born between 1948 and 1953 and retired by 2021, the gender pension gap is at 17.30%. On average, men's retirement pensions are NOK 55,250 (USD 6,873) higher than women's (see Table 7 in Appendix B).

Subtracting the impact of the policy for each beneficiary, I compute the gender pension gap had the policy never been implemented, at 18.84%. This implies that the policy narrowed the gender pension gap by 1.54 pp. Without the policy, men's average retirement pensions would be NOK 60,185 (USD 7,847) higher; that is, the policy contributes to an average per capita increase in

Figure 2: Impact of the policy on the gender pension gap, summary



pension benefits of NOK 4,935 (USD 974).

However, if we consider retirement as a time interval instead of a single period, the gender pension gap is smaller due to the fact that, on average, women have a higher life expectancy compared to men. Following the approach explained in Section 3, I calculate the gender gap in lifetime pension benefits at 9.71% (see Figure 2). This is a 1.63 pp decrease in the gender gap in lifetime pension benefits had the policy never been implemented. The policy comes at an average present cost of NOK 80,112 (USD 9,966) per person, a total of NOK 13.12 billion (USD 1.63 billion)[8].

I use the calculation rules for the first pillar to estimate how childcare-related pension credits could contribute to closing the gender pension gap if the policy coverage would apply in full to the old-age pension of the 1948 - 1953 cohorts. That is, I calculate the pension benefits of the mothers born in 1948 - 1953 as if the policy entered their final pension benefits in the way it does for the mothers born after 1963. Results are shown in Figure 2, see Table 8 in the Appendix for more detail. In the best scenario possible, pension accrual for unpaid care could narrow the gender pension gap by 3.74 pp, and the gender gap in lifetime pension benefits by 3.94 pp. However, this would require an extra average expenditure of NOK 113,810 (USD 14,158) per person, a total cost of NOK 18.66 billion (USD 2.32 billion).

Finally, I compare the total and lifetime pension benefits of the women born between 1948 and 1953 to those of the partners they had in 2009. While this approach only keeps 72.68% of the

[8]This figure is the sum of the increase in lifetime pension benefits for all beneficiaries. For now, I abstract from the impact of the policy on tax revenue: on the one hand, there is a mechanic increase in tax revenue from the taxation of pension benefits. On the other hand, pensions are taxed on average less compared to wages. If beneficiaries retire early as a result of the policy, the behavioral response may lead to a decrease in tax revenue

sample of potential beneficiaries, the "within-household gender pension gap" is informative from a household bargaining perspective. Indeed, the within-household gap is substantially larger than the within-cohort gap in all scenarios, which implies that the relative impact of the policy in narrowing the pension gap is smaller (see Figure 2 and Tables 9 and 10 in the Appendix for more detail).

5.2 Effect of pension wealth on female labor supply and retirement decisions

To evaluate the behavioral response to the policy, I estimate the effect of the increase in pension wealth on retirement behavior, including labor force participation. In the Norwegian setting, the fact that it is possible to work while claiming pension benefits demands a more nuanced definition of retirement. Table 5 show the age, by cohort, at which the women in the sample claimed (1) occupational or early-retirement and (2) old-age pension benefits for the first time. Column (3) takes the value of the earliest pension type chosen by each individual. Table 3 in Appendix B shows the age at which women in the sample started claiming their full pension.

Table 5: Claiming age for the mothers in the sample, by birth cohort

	Occupational pension	Old-age pension	First claiming age
1948 cohort	63.21	66.72	64.44
	(1.689)	(1.135)	(2.267)
1949 cohort	62.72	66.40	64.07
	(1.870)	(1.577)	(2.509)
1950 cohort	62.23	66.28	63.69
	(2.138)	(1.711)	(2.776)
1951 cohort	61.89	66.18	63.38
	(2.462)	(1.803)	(3.030)
1952 cohort	61.53	66.15	63.05
	(2.825)	(1.896)	(3.317)
1953 cohort	61.22	66.01	62.73
	(3.167)	(1.922)	(3.542)
N	93846	143873	146820

Mean coefficients; sd in parentheses

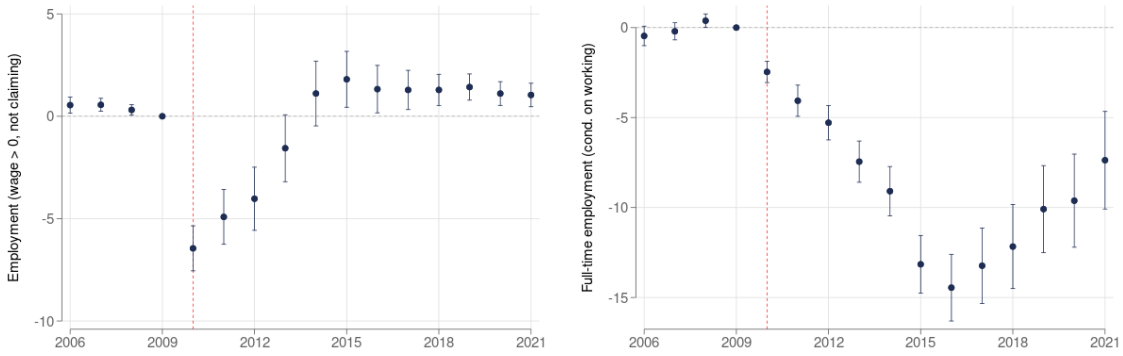
Table 6 shows the causal effect of a moderate increase in pension wealth on retirement behavior, obtained from the simulated instruments approach described in Section 4. For an average increase in pension benefits of NOK 4,831.82 (USD 601), policy beneficiaries anticipate pension claiming by 1.58 months. On the other hand, beneficiaries drop out of the workforce 0.31 years, i.e. 3.82 months earlier. Together with the very similar coefficients for first and full claiming age, these results suggest that individuals do not change their work - pension combination as a result of the policy (equivalent to an intensive margin response), but retire earlier altogether.

Tables 7, 8 and 9 show the impact of the policy on retirement behavior across groups. It is larger for women who were not married in 2009, for those who were below the 25th percentile of the household income distribution of all beneficiaries, and for those whose partner is around retirement age as well. I find no significant effect of an increase in pension wealth on the retirement age of women who were not employed in 2009, nor for those with compulsory education or less.

I will resort to the difference-in-differences approach, as described in section 4 , in what follows. This allows me to retrieve the effect of an increase in pension wealth on employment, earnings, and take-up of benefits.

Figure 3 summarizes the impact of the policy on employment in the extensive and intensive margins. The estimates, with a stronger and more persistent intensive margin response, suggest that the main dimension of adjustment for the beneficiaries is in the decision to fully retire. This would explain why the treatment effects on employment become 0 after 2014 (when everyone in the sample has reached retirement age), and why they are not significant and very close to 0 when restricting the sample to individuals who are in the labor force in each given year (see Figure 5 in Appendix B).

Figure 3: Impact of the policy on employment



(a) Employment (wage $>$ 0, not claiming) (b) Full-time employment (cond. on working)

Figure 4 shows that the beneficiaries for whom the policy had a non-zero impact drop out of the labor force sooner, with a shift in density from 2010 - 2014 to 2009.

Although the effects on employment and claiming suggest the opposite, it is possible that some of the women who drop out of the labor force increase take-up of other benefits until retirement. Understanding the impact of the policy on take-up of other benefits is important to quantify the cost of the policy. Figure 5 shows a negative effect of an increase in pension wealth on the likelihood of claiming unemployment benefits and being on sick leave in a given year. However, the decrease is fully explained by an anticipation of claiming: when restricting the sample to individuals who have not yet claimed pension benefits in each year (Subfigures 5b and 5d), the estimates are not significant and very close to 0. This means that the positive effect on government spending from unemployment insurance and sick leave will need to be weighed against the pension payments

Table 6: Retirement age: IV estimates

	(1)	(2)	(3)
Age (months) at which first claimed old-age pension benefits			
Increase in pension benefits (1000 NOK)	-0.194***	-0.193***	-0.328***
	(0.003)	(0.003)	(0.020)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes
Dependent variable mean	795.406	795.406	792.926
First-stage R-squared	0.069	0.093	0.332
First-stage F-statistic	7989.126	8262.352	487.827
First-stage p-value	0.000	0.000	0.000
Observations	136728	136728	77499
	(1)	(2)	(3)
Age (months) at which entered 100% retirement			
Increase in pension benefits (1000 NOK)	-0.194***	-0.192***	-0.379***
	(0.003)	(0.003)	(0.020)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes
Dependent variable mean	797.439	797.439	795.441
First-stage R-squared	0.069	0.093	0.332
First-stage F-statistic	7989.126	8262.352	487.827
First-stage p-value	0.000	0.000	0.000
Observations	136728	136728	77499
	(1)	(2)	(3)
Age (years) at which dropped out of the labor market			
Increase in pension benefits (1000 NOK)	-0.018***	-0.018***	-0.065***
	(0.000)	(0.000)	(0.003)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes
Dependent variable mean	64.330	64.330	64.080
First-stage R-squared	0.066	0.084	0.314
First-stage F-statistic	7855.030	7989.517	435.424
First-stage p-value	0.000	0.000	0.000
Observations	114576	114576	69815

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Heterogeneity by demographic characteristics

	(1)	(2)	(3)
Age at which claimed old-age pension benefits for the first time			
Born in Norway	-0.194***	-0.195***	-0.333***
	(0.003)	(0.003)	(0.011)
Born outside of Norway	-0.229***	-0.155***	-0.278***
	(0.043)	(0.030)	(0.037)
Not married	-0.317***	-0.312***	-0.513***
	(0.011)	(0.011)	(0.034)
Married	-0.164***	-0.161***	-0.325***
	(0.003)	(0.003)	(0.011)
Compulsory education or less	-0.070	-0.150**	-0.069
	(0.040)	(0.051)	(0.093)
Upper secondary	-0.346***	-0.353***	-0.427***
	(0.011)	(0.010)	(0.019)
Tertiary education	-0.300***	-0.303***	-0.325***
	(0.032)	(0.031)	(0.045)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes
Age at which entered 100% retirement			
Born in Norway	-0.194***	-0.194***	-0.355***
	(0.003)	(0.003)	(0.010)
Born outside of Norway	-0.189***	-0.118***	-0.275***
	(0.036)	(0.025)	(0.036)
Not married	-0.298***	-0.293***	-0.522***
	(0.010)	(0.010)	(0.034)
Married	-0.168***	-0.165***	-0.348***
	(0.003)	(0.003)	(0.010)
Compulsory education or less	-0.058	-0.134**	-0.101
	(0.036)	(0.045)	(0.102)
Upper secondary	-0.342***	-0.349***	-0.456***
	(0.010)	(0.010)	(0.019)
Tertiary education	-0.291***	-0.293***	-0.343***
	(0.028)	(0.028)	(0.040)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes
Age at which dropped out of the labor market			
Born in Norway	-0.019***	-0.019***	-0.041***
	(0.000)	(0.000)	(0.001)
Born outside of Norway	-0.012***	-0.008**	-0.030***
	(0.003)	(0.003)	(0.004)
Not married	-0.019***	-0.019***	-0.053***
	(0.001)	(0.001)	(0.003)
Married	-0.019***	-0.019***	-0.040***
	(0.000)	(0.000)	(0.001)
Compulsory education or less	-0.001	-0.015	0.075
	(0.012)	(0.014)	(0.136)
Upper secondary	-0.034***	-0.034***	-0.054***
	(0.001)	(0.001)	(0.002)
Tertiary education	-0.026***	-0.026***	-0.040***
	(0.003)	(0.003)	(0.005)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Heterogeneity by income and employment

	(1)	(2)	(3)
Age at which claimed old-age pension benefits for the first time			
Household income lower than 25th percentile	-0.429***	-0.387***	-0.491***
	(0.032)	(0.027)	(0.099)
Household income between 25th and 50th percentile	-0.186***	-0.191***	-0.405***
	(0.007)	(0.008)	(0.027)
Household income between 50 and 75th percentile	-0.218***	-0.227***	-0.385***
	(0.007)	(0.007)	(0.016)
Household income greater than 75th percentile	-0.148***	-0.150***	-0.294***
	(0.004)	(0.004)	(0.010)
Not employed in 2009	-0.018	-0.018	-0.019
	(0.033)	(0.033)	(0.101)
Employed in 2009	-0.087***	-0.087***	-0.114***
	(0.004)	(0.004)	(0.008)
Cohort FE	No	Yes	Yes
Controls	No	Yes	Yes
Age at which entered 100% retirement			
Household income lower than 25th percentile	-0.394***	-0.353***	-0.467***
	(0.029)	(0.024)	(0.094)
Household income between 25th and 50th percentile	-0.180***	-0.185***	-0.421***
	(0.007)	(0.007)	(0.026)
Household income between 50 and 75th percentile	-0.226***	-0.234***	-0.414***
	(0.007)	(0.007)	(0.015)
Household income greater than 75th percentile	-0.154***	-0.155***	-0.316***
	(0.004)	(0.004)	(0.010)
Not employed in 2009	-0.008	-0.008	-0.011
	(0.026)	(0.026)	(0.086)
Employed in 2009	-0.086***	-0.086***	-0.114***
	(0.004)	(0.004)	(0.007)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes
Age at which dropped out of the labor market			
Household income lower than 25th percentile	-0.025***	-0.024***	-0.043***
	(0.002)	(0.002)	(0.006)
Household income between 25th and 50th percentile	-0.020***	-0.021***	-0.065***
	(0.001)	(0.001)	(0.004)
Household income between 50 and 75th percentile	-0.022***	-0.023***	-0.047***
	(0.001)	(0.001)	(0.002)
Household income greater than 75th percentile	-0.014***	-0.014***	-0.034***
	(0.000)	(0.000)	(0.001)
Not employed in 2009	0.017	0.017	-0.013***
	(0.064)	(0.064)	(0.001)
Employed in 2009	-0.009***	-0.009***	-0.013***
	(0.001)	(0.001)	(0.001)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

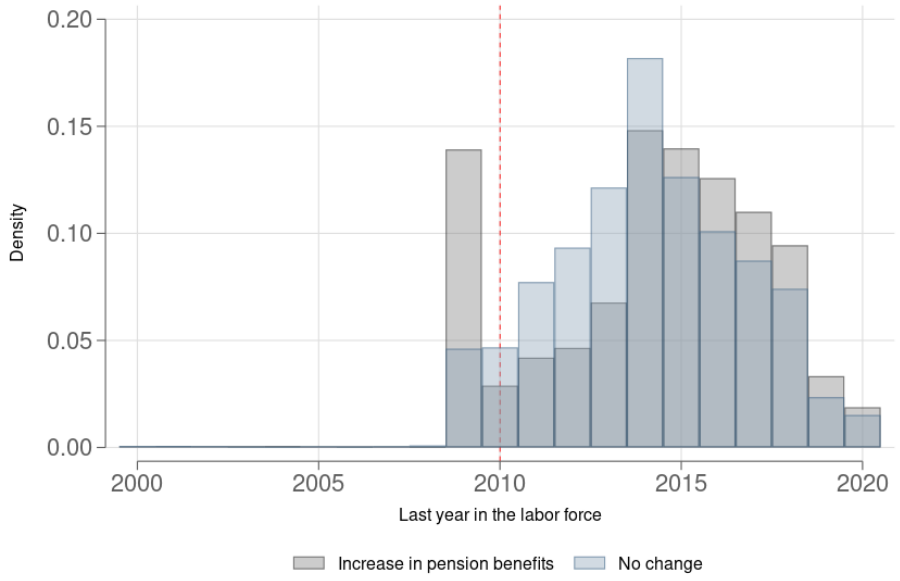
Table 9: Heterogeneity by partner characteristics

	(1)	(2)	(3)
Age at which claimed old-age pension benefits for the first time			
Partner is neither employed nor retired	-0.216***	-0.207***	-0.347***
	(0.030)	(0.029)	(0.044)
Partner is employed	-0.161***	-0.161***	-0.322***
	(0.003)	(0.003)	(0.010)
Partner is retired	-0.234***	-0.225***	-0.367***
	(0.011)	(0.010)	(0.018)
Partner younger than 56	-0.238***	-0.237***	-0.398***
	(0.015)	(0.015)	(0.025)
Partner is between 56 and 61	-0.182***	-0.180***	-0.341***
	(0.004)	(0.004)	(0.011)
Partner is between 62 and 63	-0.157***	-0.155***	-0.292***
	(0.007)	(0.007)	(0.013)
Partner is between 64 and 67	-0.144***	-0.142***	-0.294***
	(0.008)	(0.008)	(0.015)
Partner is older than 68	-0.169***	-0.164***	-0.314***
	(0.016)	(0.016)	(0.026)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes
Age at which entered 100% retirement			
Partner is neither employed nor retired	-0.223***	-0.214***	-0.382***
	(0.028)	(0.027)	(0.045)
Partner is employed	-0.167***	-0.167***	-0.345***
	(0.003)	(0.003)	(0.010)
Partner is retired	-0.223***	-0.214***	-0.381***
	(0.010)	(0.009)	(0.017)
Partner younger than 56	-0.237***	-0.236***	-0.422***
	(0.014)	(0.014)	(0.024)
Partner is between 56 and 61	-0.186***	-0.184***	-0.363***
	(0.004)	(0.004)	(0.011)
Partner is between 62 and 63	-0.162***	-0.160***	-0.317***
	(0.006)	(0.006)	(0.012)
Partner is between 64 and 67	-0.145***	-0.143***	-0.314***
	(0.007)	(0.007)	(0.015)
Partner is older than 68	-0.152***	-0.147***	-0.318***
	(0.015)	(0.014)	(0.025)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes
Age at which dropped out of the labor market			
Partner is neither employed nor retired	-0.025***	-0.025***	-0.051***
	(0.003)	(0.003)	(0.006)
Partner is employed	-0.018***	-0.018***	-0.040***
	(0.000)	(0.000)	(0.001)
Partner is retired	-0.023***	-0.022***	-0.044***
	(0.001)	(0.001)	(0.002)
Partner younger than 56	-0.021***	-0.020***	-0.043***
	(0.001)	(0.001)	(0.003)
Partner is between 56 and 61	-0.020***	-0.019***	-0.041***
	(0.000)	(0.000)	(0.001)
Partner is between 62 and 63	-0.020***	-0.019***	-0.039***
	(0.001)	(0.001)	(0.001)
Partner is between 64 and 67	-0.018***	-0.018***	-0.039***
	(0.001)	(0.001)	(0.002)
Partner is older than 68	-0.016***	-0.016***	-0.037***
	(0.002)	(0.002)	(0.003)
Cohort FE	No	Yes	Yes
Controls	No	No	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 4: Last year in the labor force, by policy impact, within the relevant occupational pension group



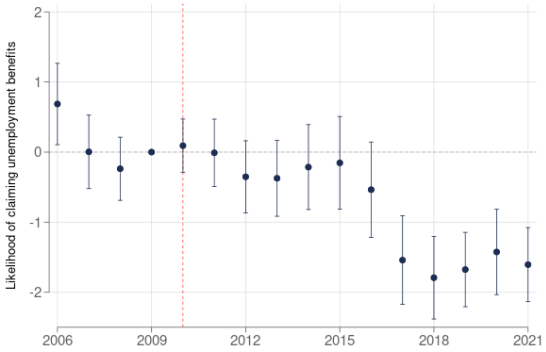
corresponding to the decrease in retirement age - approximately an average NOK 35,220 (4,381 USD) per capita.

Figure 6 shows preliminary evidence on spillovers from the policy to other household members. In particular, an increase in pension wealth leads to a decrease in the partner's employment, albeit smaller in absolute and relative terms. This suggests that there are leisure complementarities among spouses. Furthermore, it points to a potential negative effect of the policy on joint (household) income.

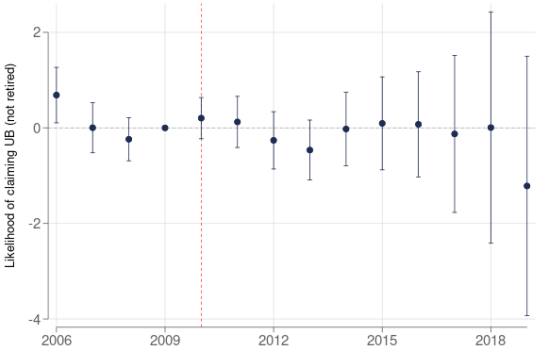
Table 10 summarizes the average difference-in-differences estimates for a selection of relevant outcomes. The 0.91 pp (1.97%) decrease in employment translates to an elasticity of labor supply of 0.52. Likewise, the NOK 19,858 decrease in wages implies a marginal propensity to earn (MPE) out of pension wealth of 0.27.

Finally, Table 11 summarizes the impact of the policy on each component of market income, one of the elements that will enter the accounting identity to study consumption expenditure.

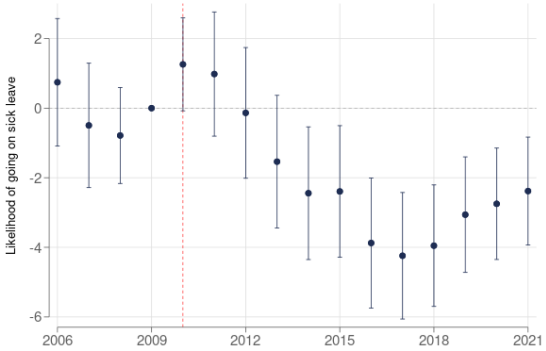
Figure 5: Take-up of benefits



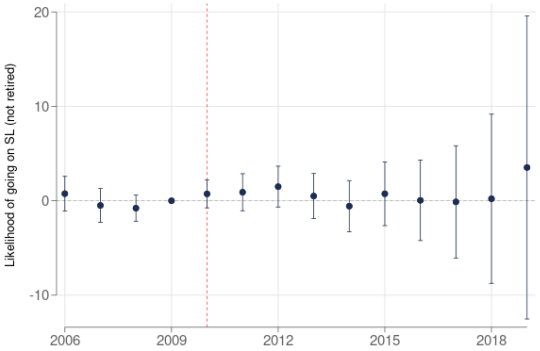
(a) Unemployment benefits



(b) Unemployment benefits (cond. on working)



(c) Sick leave



(d) Sick leave (cond. on working)

Figure 6: Spillovers to the partners

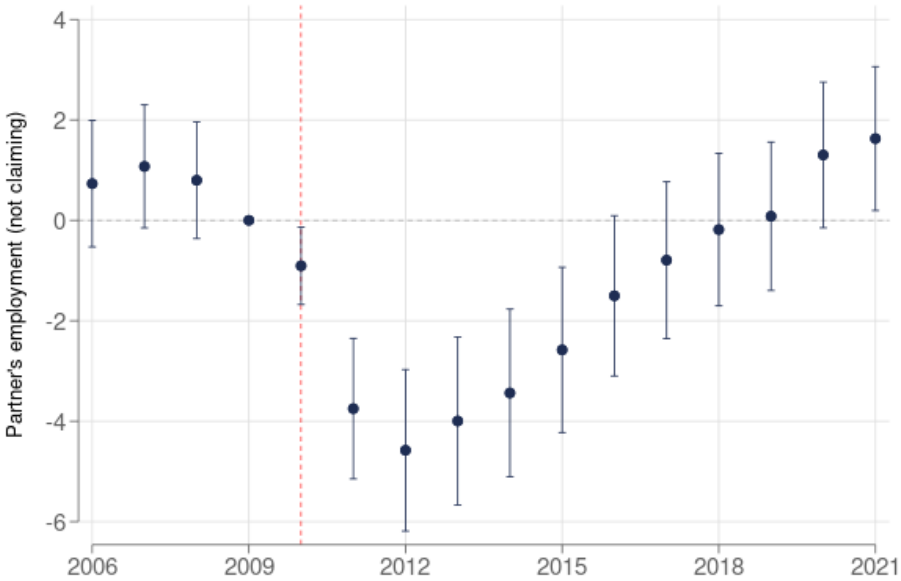


Table 10: Main results: DiD estimates

	Employment	Full-time employment
Increase in pension benefits	-0.913*	-8.298***
	(0.377)	(0.413)
Controls	Yes	Yes
Cohort FE	Yes	Yes
Dependent variable mean	46.363	82.645
N	235355	173630
	Earnings (incl. transfers)	Wages
Increase in pension benefits	-20725.882***	-19857.879***
	(1622.042)	(1632.686)
Controls	Yes	Yes
Cohort FE	Yes	Yes
Dependent variable mean	422002.390	412924.498
N	112490	112403
	Partner's employment	Household income
Increase in pension benefits	-1.009	-19481.987***
	(0.530)	(4295.733)
Controls	Yes	Yes
Cohort FE	Yes	Yes
Dependent variable mean	68.880	737022.760
N	221373	234679
	Sick leave payments (2015 NOK)	UB (2015 NOK)
Increase in pension benefits	486.894	-373.576***
	(298.312)	(82.476)
Controls	Yes	Yes
Cohort FE	Yes	Yes
Dependent variable mean	5089.532	363.057
N	235268	235268

" Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11: Income components: DiD estimates

	Labor income	Government transfers
Increase in pension benefits	54468.444***	-56008.249***
	(3933.492)	(1119.011)
Controls	Yes	Yes
Cohort FE	Yes	Yes
Dependent variable mean	498221.921	140143.436
N	234679	234679
	Other positive transfers	Other negative transfers
Increase in pension benefits	-4809.856*	148.557***
	(2125.719)	(31.134)
Controls	Yes	Yes
Cohort FE	Yes	Yes
Dependent variable mean	12475.732	2044.575
N	220581	234679
	Capital income	Capital gains
Increase in pension benefits	211.468	-635.305
	(1237.443)	(914.595)
Controls	Yes	Yes
Cohort FE	Yes	Yes
Dependent variable mean	25537.998	6207.744
N	234679	234679
	Taxes	
Increase in pension benefits	-14206.635***	
	(846.790)	
Controls	Yes	
Cohort FE	Yes	
Dependent variable mean	99576.869	
N	234679	

" Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6 Conclusion

This paper investigates the impact of the retroactive extension of pension accrual for unpaid care work in Norway. I quantify the increase in pension benefits from childcare-related pension credits, compare this magnitude to the gender pension gap, and study the behavioral response to the policy. My findings highlight that women are highly responsive to changes in pension wealth when close to retirement. For an average increase in pension benefits of NOK 4,831.81 (USD 601), the beneficiaries anticipate pension claiming by 1.6 months, and drop out of the labor force 3.8 months earlier. Since the retirement decision is one of the very few margins of adjustment for the women in my sample, the negative effects on employment and take-up of benefits are driven by the change in pension claiming behavior. In a scenario where the behavioral response is as limited as possible, childcare-related pension credits reduce the gender gap in lifetime pension benefits by 1.63 percentage points.

However, this also implies that the negative effect on employment is not strong enough to completely offset the increase in pension benefits from the policy. As a result, it is possible to study the effect of an increase in pension wealth on other outcomes, such as marriage stability, longevity, and consumption expenditure. This provides evidence of the welfare gains from narrowing the gender pension gap. Next steps include developing a theoretical framework to compare the costs and benefits of pension policies, which have an impact on the current gender pension gap, with past childcare policies, which may be less costly but take generations to have an impact on the then future gender pension gap.

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Appendix

A Detailed description of the Norwegian pension system

First pillar: retirement pension

The retirement pension consists of two main components. The first one is the basic pension, a fixed amount indexed annually by expected national income growth. The basic pension is awarded in full to all individuals with membership to the National Insurance scheme of 40 years or more, and reduced gradually for shorter contribution histories. For married or cohabiting individuals whose partner receives an old-age pension or has an income above 2G, the final basic pension will be 85% of the full amount. Finally, the basic pension is adjusted to the individual's annuity divisor at the time of withdrawal. The second component is the supplementary pension, paid out to individuals with at least 3 years of membership to the National Insurance scheme. Annual earnings above 1G and up to 12G are used to calculate the individual's pension points based on the following formulas:

$$\begin{cases} 0 & \text{if } pearn < G \\ \dfrac{pearn - G}{G} & \text{if } pearn < 6G \\ \dfrac{(6G + \frac{pearn - 6G}{3}) - G}{G} & \text{if } pearn >= 6G \ \& \ pearn < 12G \\ 7 & \text{if } pearn >= 12G \end{cases} \tag{1}$$

pearn refers to the earnings base used to calculate pension entitlements, and includes: wages for salaried workers, equivalent labor income for self-employed workers, sick leave and paternity / maternity leave benefits, unemployment benefits and other welfare benefits[1].

At the time of retirement, the 20 years with the highest pension points are used to calculate the final average pension points. Then, the supplementary pension amount is obtained by:

$$G * \overline{pp} * \frac{0.45 * y_1 + 0.42 * y_2}{40}, \tag{2}$$

where $\overline{pp}$ is the average pension points, y_1 is the number of years with non-zero pension points before 1992 and y_2 is the number of years with non-zero pension points from 1992. The supplementary pension is adjusted by the individual's annuity divisor at the time of withdrawal.

Note that there are other, smaller supplements that can be part of the retirement pension. These include survivor benefits and supplements for pensioner who are supporting a spouse or a child under the age of 18. They have not been included in my simulation exercise, which is one of the

[1] The full list of benefits and income sources counted under pensionable earnings is available at `https://www.nav.no/alderspensjon` [in Norwegian]

reasons why the estimated and the actual pension benefits do not correlate perfectly.

To ensure a certain standard of living to all pensioners, a pension supplement will be awarded to all those who have pension entitlements below the minimum pension level. The minimum pension is set each year by the government, and takes different values depending on the recipient's marital status and their partner's income. As with the basic amount, the minimum pension is paid out in full to those who have at least 40 years of membership, and it is otherwise reduced proportionally.

Second pillar: occupational pension

Occupational pension schemes are the second pillar of the Norwegian pension system, and are mandatory since 2006. This means that, while the occupational pension benefits for each individual depend on their contractual agreement with their employer, which I cannot observe, all employees are covered by an occupational pension scheme and certain minimum provisions apply. These include that employers must save at least 2% of the employees' income as part of their pension entitlements. The occupational pension agreement in the public sector guarantees gross pension benefits of at least 66% of their last salary before retirement. The full amount is paid out for those with at least 30 years of membership, and it is reduced proportionately otherwise. Finally, the occupational pension is adjusted by cohort - year life expectancy at the time of retirement.

The contractual early retirement pension scheme, called "avtalefestet pensjon" or AFP, is part of the second pillar. AFP is the result of a bargaining agreement between the largest employers' and employees' associations in the country and applies to all workers employed in an establishment where AFP is included in its collective bargaining agreement. AFP covered 943,000 workers in 2023, 32.65% of the Norwegian workforce[2], with virtually 100% coverage in the public sector.

AFP allows employees between 62 and 67 years old to retire early, subject to some income requirements. For public sector employees born before 1963, the early retirement pension benefits are calculated with the same rules as the retirement pension, with an AFP supplement of NOK 20,400 (USD 1,882) per year. For private sector employees, the early retirement pension benefits are 0.314% of annual income up to 7.1G, a NOK 19,200 (USD 1,771) annual AFP supplement, and a cohort- and retirement age-specific compensation supplement. The years when the individual is in early retirement are counted towards their old-age retirement pension as if the individual were employed full-time; that is, it does not impact pension accrual negatively.

For individuals who receive pension benefits from the first and the second pillar simultaneously, coordination adjustments may take place. This implies that the retirement pension from the National Insurance scheme is paid out in its entirety, while the occupational pension is reduced based on what benefits the individual accrued through the first pillar. Life expectancy adjustments are included when calculating the deductions.

[2]The number of workers covered by AFP is available in the AFP joint board's 2023 annual report, and the employment figures for Norway come from the Labor Force Survey by Statistics Norway.

New rules post-2011 reform

For the cohorts born after 1963, each individual accumulates pension entitlements for all their years of membership in the National Insurance scheme. Each year, 18.1% of their income up to 7.1G is added to their pension portfolio. Upon retirement, the individual withdraws the balance in their pension portfolio, which is adjusted to cohort- and retirement age-specific life expectancy.

B Additional figures and tables

B.1 Descriptive statistics

Table 1: Sample size, by birth cohort

Year	Number of beneficiaries in the sample	Share claiming by 2021 (%)	Share with non-zero impact at retirement (%)
1948	27,087	92.68	52.48
1949	26,416	93.21	51.63
1950	26,194	92.70	51.73
1951	25,177	92.45	50.96
1952	25,745	92.03	49.92
1953	25,526	89.68	48.87

Beneficiaries are defined as having been the lower earner of the couple and below the income threshold for at least one year during the period covered by the policy. Policy impact is defined as the difference between the estimated pension benefits with and without the policy.

Figure 1: Share claiming pension benefits, by policy impact, within the relevant occupational pension group

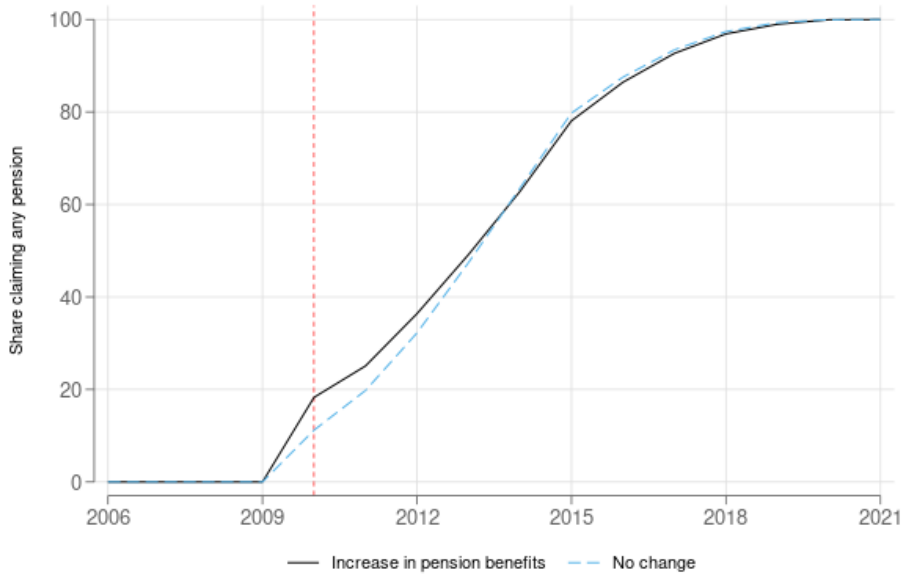


Table 2: Demographic characteristics of the mothers in the sample, by policy eligibility

	Non-beneficiaries	Beneficiaries	Difference
Share born in Norway (%)	93.63	90.66	2.97***
	[24.43]	[29.10]	(0.48)
Share married (%)	56.16	65.68	-9.52***
	[49.63]	[47.48]	(0.79)
Share with college education (%)	68.17	27.38	40.79***
	[46.59]	[44.59]	(0.74)
Number of children	1.62	2.30	-0.68***
	[0.72]	[0.93]	(0.02)
Share working (%)	98.13	89.98	8.15***
	[13.55]	[30.03]	(0.50)
Share working full-time (%)	97.18	85.46	11.72***
	[16.56]	[35.25]	(0.58)
Share employed in the public sector (%)	57.40	41.80	15.61***
	[49.46]	[49.32]	(0.82)
Share inactive (%)	10.17	24.94	-14.77***
	[30.23]	[43.27]	(0.72)
Average annual earnings (NOK)	520,475.22	265,720.61	254,754.61***
	[325,425.94]	[218,631.27]	(3,691.20)
Relative earnings difference with partner	-10.00	26.24	-36.24***
	[59.06]	[62.12]	(1.33)
Age difference with partner	-1.73	-2.24	0.52***
	[4.66]	[3.89]	(0.08)
Share whose partner is retired (%)	9.36	12.46	-3.11***
	[29.13]	[33.03]	(0.69)
N	3,688	159,452	163,140

Demographic characteristics in 2009, for the birth cohorts 1948 - 1953. Eligibility is defined as having been the lower earner of the couple and below the income threshold for at least one year during the period covered by the policy.

Figure 2: Share employed, by policy impact, within the relevant occupational pension group

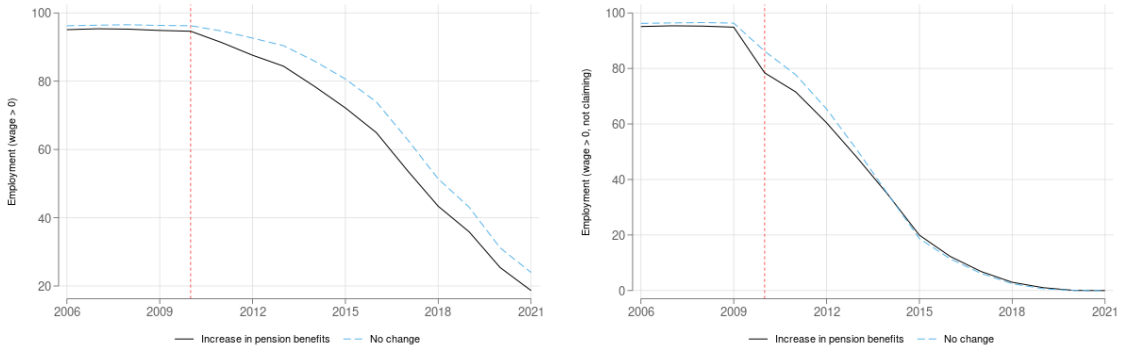


Table 3: Full claiming age for the mothers in the sample, by birth cohort

	Occupational pension	Old-age pension	Full claiming age
1948 cohort	64.77	66.83	65.12
	(2.863)	(1.020)	(2.162)
1949 cohort	64.58	66.57	64.86
	(3.029)	(1.426)	(2.384)
1950 cohort	64.13	66.46	64.54
	(3.133)	(1.567)	(2.619)
1951 cohort	63.76	66.38	64.29
	(3.204)	(1.649)	(2.823)
1952 cohort	63.32	66.36	63.99
	(3.331)	(1.761)	(3.083)
1953 cohort	62.82	66.19	63.67
	(3.407)	(1.865)	(3.296)
N	93846	143873	146820

Mean coefficients; sd in parentheses

Full claiming age is defined as the age at which an individual is claiming 100% of their pension benefits

B.2 Impact of the policy

Table 4: Impact of the policy by country of origin

	Norway	EU/EFTA, US, CA, AU and NZ	Rest of the world
Difference at age 62 (NOK)	4,407.05	1,896.87	1,431.09
	(7,042.4)	(4,795.7)	(4,096.5)
% change at age 62	2.80	3.41	1.97
	(5.280)	(9.469)	(6.422)
Difference at retirement (NOK)	5,666.39	3,718.40	2,390.35
	(9,187.8)	(7,624.4)	(6,060.7)
% change at retirement	2.57	2.29	1.78
	(4.841)	(5.770)	(5.484)
N	141,824	8,934	5,384

Mean coefficients; sd in parentheses

Figures for the birth cohorts 1948 - 1953. Policy impact is defined as the difference between the estimated pension benefits with and without the policy

Table 5: Impact of the policy by education level

	Compulsory education	Upper secondary or vocational	Undergraduate or higher
Difference at age 62 (NOK)	5,321.71	4,847.90	1,977.06
	(7,458.4)	(7,242.4)	(5,046.0)
% change at age 62	3.94	2.98	1.48
	(6.588)	(5.248)	(4.932)
Difference at retirement (NOK)	7,004.71	6,240.19	2,775.96
	(9,840.3)	(9,443.5)	(6,857.9)
% change at retirement	3.63	2.74	1.20
	(6.021)	(4.794)	(3.557)
N	33,116	80,205	42,287

Mean coefficients; sd in parentheses

Figures for the birth cohorts 1948 - 1953. Policy impact is defined as the difference between the estimated pension benefits with and without the policy. Education level measured as the highest obtained by age 62.

Table 6: Impact of the policy by marital status

	Not married	Married	Widow	Divorced or separated
Difference at age 62 (NOK)	2,913.28	4,450.04	4,772.55	3,454.53
	(5,325.5)	(7,216.5)	(7,141.8)	(6,081.0)
% change at age 62	1.81	2.78	3.01	2.88
	(3.767)	(5.261)	(5.265)	(6.448)
Difference at retirement (NOK)	3,719.45	5,736.42	6,183.10	4,870.21
	(6,898.1)	(9,412.5)	(9,371.5)	(8,177.0)
% change at retirement	1.67	2.58	2.83	2.43
	(3.498)	(4.881)	(5.028)	(5.017)
N	3,927	99,537	10,095	42,586

Mean coefficients; sd in parentheses

Figures for the birth cohorts 1948 - 1953. Policy impact is defined as the difference between the estimated pension benefits with and without the policy. Marital status is measured at age 62. The category "married" includes registered cohabiting partners.

B.3 Effect of the policy on the gender pension gap

Table 7: Impact of the policy on the gender pension gap

	Men	Women	Difference	Pension gap (%)
Policy in occupational pension	319,397	264,147	55,250***	17.30
	[182,691]	[111,260]	(537)	
No policy, first approximation	319,397	258,480	60,917***	19.07
	[182,691]	[113,478]	(539)	
No policy, second approximation	319,397	259,212	60,185***	18.84
	[182,691]	[113,286]	(539)	
PDV, policy in occupational pension	4,928,861	4,450,278	478,583***	9.71
	[3,194,388]	[2,111,937]	(9,605)	
PDV, no policy, first approximation	4,928,860	4,358,087	570,774***	11.58
	[3,194,388]	[2,145,328]	(9,651)	
PDV, no policy, second approximation	4,928,860	4,370,166	558,694***	11.44
	[3,194,388]	[2,142,422]	(9,647)	
N	159,495	158,751	318,246	318,246

Mean coefficients¡ sd in parentheses.
Figures for the birth cohorts 1948 - 1953. Pension amounts are the full-retirement equivalent for the year when the individual claims pension benefits for the first time, and include the second pillar (occupational and early retirement) pension. The calculations consider the increase in the gender pension gap had the policy never been retroactively extended for these cohorts.

Table 8: Impact of the policy on the gender pension gap, if included in the first pillar

	Men	Women	Difference	Pension gap (%)
No policy	319,397	264,147	55,250***	17.30
	[182,691]	[111,260]	(537)	
Policy in old-age pension	319,397	271,161	48,236***	15.10
	[182,691]	[109,440]	(534)	
PDV, no policy	4,928,861	4,450,278	478,583***	9.71
	[3,194,388]	[2,111,937]	(9,605)	
PDV, policy in old-age pension	4,928,861	4,564,088	364,774***	7.40
	[3,194,387]	[2,083,629]	(9,566)	
N	159,495	158,751	318,246	318,246

Mean coefficients; sd in parentheses.
Figures for the birth cohorts 1948 - 1953. Pension amounts are the full-retirement equivalent for the year when the individual claims pension benefits for the first time. The calculations consider the increase in pension benefits if childcare-related pension credits applied to the first pillar for the 1948 - 1953 cohorts instead of the second, with the same eligibility criteria and coverage. This is equivalent to how the policy affects beneficiaries born after 1963.

Table 9: Impact of the policy on the within-household gender pension gap

	Men	Women	Difference	Pension gap (%)
Policy in occupational pension	337,449	258,122	79,326***	23.51
	[186,326]	[107,070]	(636)	
No policy, first approximation	337,449	251,873	85,576***	25.36
	[186,326]	[109,600]	(640)	
No policy, second approximation	337,449	252,791	84,658***	25.19
	[186,326]	[109,376]	(640)	
PDV, policy in occupational pension	5,051,638	4,366,639	684,999***	13.56
	[3,195,369]	[2,049,941]	(11,395)	
PDV, no policy, first approximation	5,051,638	4,264,555	787,083***	15.58
	[3,195,369]	[2,088,372]	(11,464)	
PDV, no policy, second approximation	5,051,638	4,279,736	771,902***	15.28
	[3,195,369]	[2,084,872]	(11,458)	
N	110,483	115,378	225,861	225,861

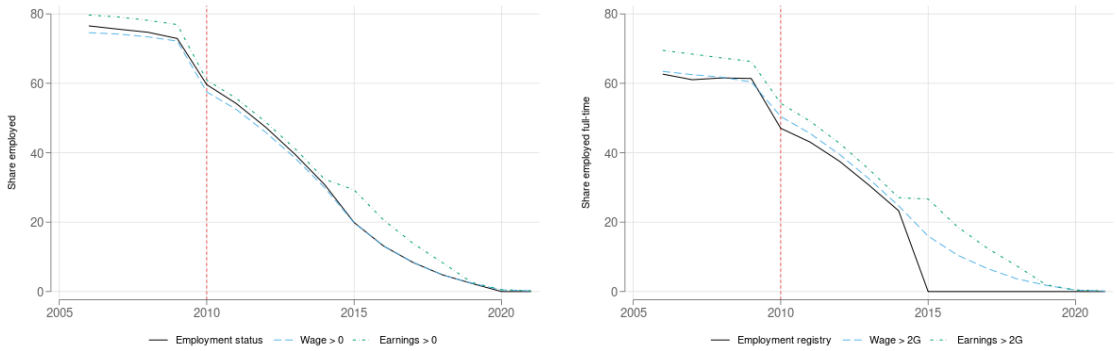
Mean coefficients; sd in parentheses.
Figures for the women born in 1948 - 1953 and their partners in 2009. Not married women in 2009 are thus excluded. Pension amounts are the full-retirement equivalent for the year when the individual claims pension benefits for the first time, and include the second pillar (occupational and early retirement) pension. The calculations consider the increase in the gender pension gap had the policy never been retroactively extended for these cohorts

Table 10: Impact of the policy on the within-household gender pension gap, if included in the first pillar

	Men	Women	Difference	Pension gap (%)
No policy	337,449	258,122	79,326***	23.51
	[186,326]	[107,070]	(636)	
Policy in old-age pension	337,449	265,780	71,669***	21.24
	[186,326]	[104,980]	(633)	
PDV, no policy	5,051,638	4,366,639	684,999***	13.56
	[3,195,369]	[2,049,941]	(113,95)	
PDV, policy in old-age pension	5,051,638	4,491,446	560,192***	11.09
	[3,195,369]	[2,017,043]	(11,337)	
N	110,483	115,378	225,861	225,861

Mean coefficients; sd in parentheses.
Figures for the women born in 1948 - 1953 and their partners in 2009. Not married women in 2009 are thus excluded. Pension amounts are the full-retirement equivalent for the year when the individual claims pension benefits for the first time. The calculations consider the increase in pension benefits if childcare-related pension credits applied to the first pillar for the 1948 - 1953 cohorts instead of the second, with the same eligibility criteria and coverage. This is equivalent to how the policy affects beneficiaries born after 1963.

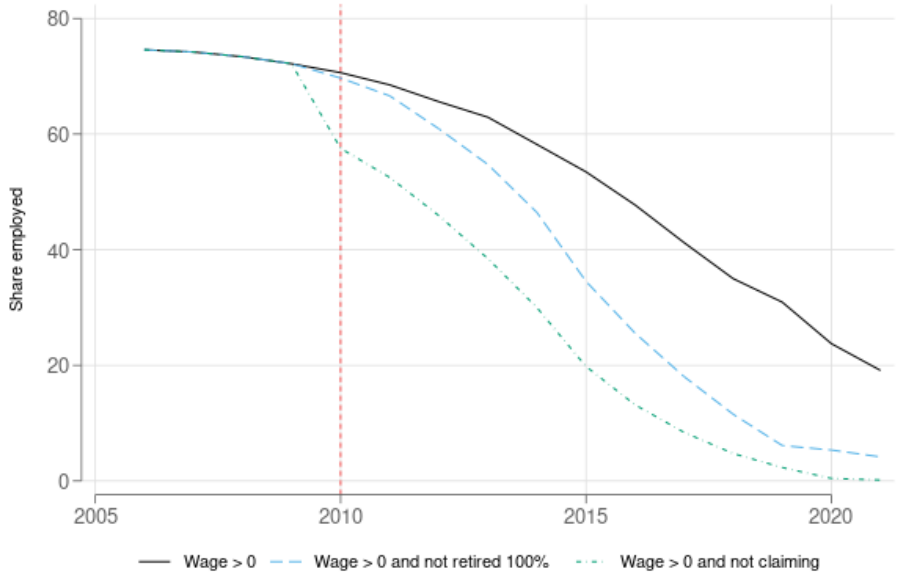
B.4 Comparison of different employment measures



(a) Employment

(b) Full-time employment

Figure 4: Employment (wage-based)



B.5 Effect of pension wealth on female labor supply and retirement decisions

Figure 5: Employment (wage $>$ 0 and not claiming), restricted sample

