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Gender Gap and Retirement Decisions: the Maternity Pension Supplement in Spain

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Abstract

The debate over the gender gap in all its forms is increasingly gaining attention, with academics studying its causes and governments designing policies to reduce it. In 2016, the Spanish Government introduced a retirement pension supplement for mothers of two or more children to compensate them for their demographic contribution. The policy was short-lived, as in 2019 the European Court ruled that men should be able to claim this benefit as well. However, the effects of the supplement on retirement decisions or the gender pension gap have not been yet evaluated. Using a difference in difference strategy and an Oaxaca-Blinder decomposition, we find that the policy was effective in reducing the gap for women. We argue that the trade-off between the penalty for early retirement and receiving the maternity supplement is the mechanism behind these results. Finally, we build a dynamic choice framework that would allow us to simulate women's behaviour under alternative versions of the policy.

Keywords: behavioral effects, financial incentives, gender gap, pensions, retirement.

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Contents

1 Introduction

In 2016, the Spanish Government introduced a supplement to the retirement pensions of women who had been mothers of at least two children to compensate them for their demographic contribution. It consisted of a percentage-based allowance dependent on the number of children (5% for 2, 10% for 3, and 15% for more than 3) and it only applied for contributed pensions that started on January 1, 2016.

Three years later, in 2019, the Court of Justice of the European Union ruled that the policy was discriminatory against men, giving the Spanish Social Security Institute two options: granting fathers access to the supplement or changing the eligibility criteria. In 2021, a new policy was implemented, that gave access to a monthly lump sum supplement to both men and women who had at least one child. Despite the new law, only women with certain characteristics were eligible between 2016 and 2019, creating a natural experiment for the evaluation of the effect of this policy on both the gender pension gap and retirement decisions.

Our contribution to the existing literature is threefold. Using rich longitudinal administrative data, we first study the effectiveness of the maternity supplement at reducing the gender retirement pension gap, extending to the Spanish case the analysis conducted in other countries (Saporta-Eksten (2020)) of policies designed with the same aim. Second, we contribute to the literature on the effect of retirement pensions incentives on labor force participation in Spain (Cairó-Blanco (2010); García-Pérez, Jiménez-Martín, and Sánchez-Martín (2013)), a country for which this analysis is of particular interest as its Old-Age Pension System has many incentives embedded in its regulations. Finally, we use full solution methods to develop a structural model that is useful for the design and evaluation of retirement policies.

We use the Continuous Sample of Working Biographies (hereafter CSWB), a micro-level longitudinal dataset built upon Spanish administrative records. For each year, it contains the complete earning histories of a 4 percent random sample of the Spanish labor force. To avoid the self-selection that could arise from the CSWB not including individuals without any contact with Social Security in a given year, we combine its waves from 2007 to 2019. For our resulting sample, we keep only men and women who could have potentially retired during the period 2011 and 2019. The first step of our methodology is the identification of women who were eligible for the policy. This posed a great challenge, as the CSWB does not include information on the number of kids of the sampled workers. Nevertheless, it does include the gender and year of birth of their cohabitants. Imposing some restrictions on age differences, we use this information to estimate the number of children and thus identify those women who were eligible for the supplement.

The second step is the study of the effectiveness of the supplement on its goal of reducing the gender pension gap. A key feature of the Spanish Old-Age Pension System is that early retirement is allowed, but entails a reduction of the pension received. As both women that retired before and at the normal retirement age were entitled to receive the supplement, the policy could potentially have increased the incentives to anticipate the moment of retirement. In this scenario, the pension increase generated by the supplement could have been offset by the penalty of earlier retirement, driving the gender pension gap in the opposite direction that the policy intended. In a first stage, we analyze the changes in pensions received by eligible and non-eligible women before and after the creation of the policy. To determine whether the potential changes observed are due to its implementation, we apply the Oaxaca-Blinder decomposition to test whether the effect of motherhood on retirement pensions changed before and after 2016.

The third step consists of the identification of the effect of these incentives on mothers' retirement decisions. Women who could potentially have retired between 2011 and 2015, controlling for socioeconomic characteristics and changes in the market, should have the same rate of retirement as those with similar characteristics and the same age between 2016 and 2019. To analyze if this was the case, we regress the probability of retiring at each of the cohorts between 61 and 65 years of age on the implementation of the supplement and a woman's eligibility for it.However, to ensure that we are comparing women of similar characteristics, we use a propensity score matching procedure to only keep individuals of common support.

The fourth and last step is to propose and solve a dynamic choice model that explains women retirement decisions. The goal of this model is to simulate the effects of introducing the newly-approved pension supplement and test whether the estimates of the structural approach match the results found in the reduced-form analysis.

Results show that the maternity benefit incentivized early retirement, as we observe an increase in the retirement hazard for all cohorts between 61 and 65 years of age. This result points out that women respond to the lower opportunity costs in terms of forgone monthly earnings that the policy creates, trading a higher retirement pension for more years of leisure. However, the Oaxaca-Blinder decomposition results show that having two or more children had a significant positive return to pensions of women only after 2016, from which we infer that despite the incentives created, the policy had a shrinking effect on the gender pension gap. This effect seemed to be driven by women who retired at 63 and 65, as we only observe an increase in pensions after the implementation of the policy for these two cohorts. In the case of 63-year-olds, we argue that the increase is due to the Spanish Old-Age Pension System granting access to voluntary retirement at this age, a retirement modality that also requires the payment of a penalty but does not entitle for receiving the supplement. As retiring at 65 does not entail any pension reduction, the implementation of the supplement results in an unopposed increase in the recipients' pensions.

The structure of the paper is as follows. Chapter 2 reviews the current literature and describes both the Spanish Old-Age Pension System and the maternity supplement. Chapter 3 presents the data, descriptive statistics, and initial estimates. Chapter 4 explains the methodological approach and analyzes the results. Chapter 5 introduces a structural model of women's retirement decisions. Finally, Chapter 6 concludes.

2 Background

2.1 Literature review

The gender gap in retirement income has received significant attention in the last decades (Meyer (1990); Frericks and Maier (2008); Morán (2010)). The existence of this gap is an inevitable consequence of the widely studied gender wage gap, Vicente Merino et al. (2010) determining that Spanish women have an average contribution base are 79 percent of that of men and that this gap is persistent for all contribution groups, sectors, and regions of Spain. Maternity has been identified as one of the key reasons for this gap, Kleven, Landais, and Søgaard (2019) identifying that the difference in earnings between men and women can be linked to the different ways having a child affects their careers. Evidence for the earnings penalty that motherhood entails has also been found for the Spanish case, Daniel, Lacuesta, and Rodríguez-Planas (2013) showing that Spanish women suffer a nine-year-long earnings dip after the birth of their first child, and according to estimates by Quinto, Hospido, and Sanz (2020) the earnings penalty grows up to 28 percent ten years after the birth date.

The impact of Social Security and public pensions' incentives on retirement behavior has been extensively studied (Samwick (1998); Gruber and Wise (1999); Casey et al. (2003)), with the identification of a strong negative correlation between labor force participation at older ages and pension generosity (Börsch-Supan (2000); Belloni and Alessie (2009)). This relationship has also been found for the Spanish case, finding responsiveness of workers' retirement decisions to changes in pension and unemployment benefit incentives (Boldrin, Jiménez-Martín, and Peracchi (1999); Jiménez-Martín and Sánchez Martín (2007)), with especially strong incentives for low-earning workers to bring their retirement as forward as possible (Sánchez Martín and Jiménez-Martín (2001)).

2.2 Spanish Old-Age Pension System

The Spanish Old-Age Pension System is the largest welfare program in Spain, accounting in 2021 for 35.8 percent of the total public expenditure, a share that has been steadily increasing in the last decades (Sanz-Sanz and Desiderio (2021)). It is a pay-as-you-go system financed through the annual payment of a fixed proportion of the gross labor income, and the amount received by workers is obtained by multiplying a benefit base and a replacement rate. The initial benefit base is a moving average of the individual's contribution to the Social Security during the 24 years prior to the retirement decision, and the replacement rate for workers who earned the country's average income during their working lives is 72.3 percent, significantly above the 45.5 percent average of the EU-28 (Cos (2021)). Eligibility to receive the full retirement pension requires to either be at least 67 years of age, or 65 years of age and have 38 years and 6 months of contributions to Social Security. The amount a worker can receive has an upper and a lower bound [1], although the Spanish Old-Age Pension system

[1] As stipulated by the Royal Legislative Decree 46/2021 of January 26, 2021, the maximum monthly retirement pension amounts to 2,707.49 euros. The minimum retirement pension amounts to:

- 851 euros per month if the worker has a partner under her care.
- 654 euros per month if the worker has a partner, but she is not under her care.
- 689.70 euros per month if the worker does not have a partner.

embeds many different sector- and occupation-specific exceptions to these rules.

Spanish law also considers two scenarios in which a worker can retire before being 65 years old: voluntary and non-voluntary early retirement. Voluntary retirement, a modality implemented in 2013, requires the worker to be 63 years old and have contributed for at least 35 years. On the other hand, non-voluntary retirement requires the worker to be 61 years old, have contributed for at least 33 years, and have been a registered jobseeker in the National Employment System for at least the previous six months. Both early retirement modalities entail a percentage reduction in the pension received for each quarter the worker had left until reaching 65 years of age. The magnitude of the reduction is dependent on the number of years contributed, and it is higher for voluntary than for non-voluntary retirement, ranging from 2 to 1.625 percent per quarter for the former, and from 1.875 to 1.5 for the latter.

The aim of the non-voluntary early retirement system is to protect workers whose work activity has ceased at a moment in their career in which finding another job is highly unlikely. However, it is an attractive legal pathway for workers and firms to agree on the worker's contract termination. From the worker's perspective, non-voluntary early retirement involves paying a smaller penalty than the voluntary modality. Crucially, non-voluntary retirement eligibility is conditioned to the worker being laid off due to "business restructuring" [1], a work cessation system through which the firm can reduce the compensation it needs to pay to the worker. Hence, it is beneficial for both parties to use the non-voluntary retirement scheme for previously agreed contract terminations.

2.3 The maternity supplement

In 2016, the Spanish government introduced a fixed supplement for the widowhood, disability, and retirement pensions of all women who had been mothers of at least two children to compensate them for their "demographic contribution". The supplement consisted of an amount calculated as a percentage of the pension, that was received from its initial granting until the recipient's death. Eligibility for the supplement was conditioned to either having retired at the normal retirement age or through the non-voluntary early retirement scheme.

The amount received was dependent on the number of children of the recipient: 5% for mothers of two, 10% for mothers of three, and 15% for mothers of more than three children. For mothers whose pension calculated from their contributions did not reach the minimum legal retirement allowance and thus it was increased up to that amount, the supplement was calculated with respect to their original annuity and then summed to the legal minimum pension. On the other hand, mothers whose pension calculated from their contributions exceeded the maximum legal retirement allowance and thus it was capped down to that amount, received half of their corresponding supplement calculated with respect to their original annuity, which was then summed to the legal maximum pension. If the mother's pension only surpassed the maximum legal retirement allowance when the supplement was added, they received their original supplement up to the point where this upper bound was reached and half of it for the exceeding quantity.

[1] Working cessation due to "business restructuring" includes any collective dismissal for economic, technical, organizational or production reasons; the termination of the contract by judicial resolution; or the loss of employment due to the death, retirement, or disability of the individual entrepreneur, among others.

As of December 2020, the supplement had been awarded to 797,115 pensions, 48.7% of which were widowhood pensions, 42.9% retirement pensions, and 8.4% permanent disability pensions. 55.2% of the cases were recognized to mothers of two children, 27.3% of the cases to mothers of three, and 17.5% to mothers of more than three, yielding an average of 2.6 children for the recipients. The average monthly granted supplement was 60.67€ and thus the average supplement per child being 23 € per month (*CCOO*, 2021).

In 2019, the Court of Justice of the European Union ruled the maternity supplement as unfair to fathers, mandating that either the eligibility criteria had to be modified or fathers should be granted access to the already implemented supplement [2]. As mentioned, the rationale for the policy was to compensate mothers for their demographic contribution. However, the CJEU argued that "since the demographic contribution of men is as necessary as that of women, the ground of demographic contribution to social security alone cannot justify men and women not being in a comparable situation with regard to the award of the supplement at issue".

In 2021, the Spanish government approved a new pension supplement following the CJEU mandate, which consists of a monthly lump sum [3] awarded to both men and women who have at least one child, irrespectively of whether they have retired voluntarily or non-voluntarily. However, while all mothers receive the supplement without needing to apply for it, fathers are required to prove that fatherhood impacted their earnings and working conditions. In addition, only one supplement can be received by the household, i.e., in the case of cohabitation of the eligible mother and father, the supplement can only be granted to one of them.

[2] Judgment of the CJEU in Case C-450/18, December 12, 2019.
[3] 378€ per child and annum, up to a maximum of four children.

3 Data

3.1 The Continuous Sample of Working Biographies

We use data from the Continuous Sample of Working Biographies (CSWB) which contains a 4 percent random sample of the Spanish workforce population who had some record in the Social Security database. It includes workers, pensioners, and unemployment benefit recipient's information on their sociodemographic characteristics (level of education, nationality, gender), job information (occupation, the dates the contract started and ended, and monthly earnings) and population characteristics. In addition, information on the number and date of birth of children living in the household at the time of the interview (including but not distinguishing own natural, adopted, step and foster children) is available in the analyzed year of the database and comes from the Spanish Municipal Registry of Inhabitants.To avoid self-selection issues and keep a representative sample across years, we combine information from twelve waves of the CSWB, from 2007 to 2019.

We create a sample of men and women who could potentially retire between 2011 and 2019. Then, for each section of the paper we use different subsets, depending on the corresponding analysis. We start from an initial sample of 1.435.237 observations from which we keep only natives (1,121,518) and without a disability higher than 33% (1,116,866). We then filter by looking only at people with more than 60 in the years 2011-2019 and with thirty years of contributive work by the time they reach that age (804.143).Since our main focus is studying the impact of the policy in the years in which this is feasible, we drop individuals who retired earlier than 61 and, thus, cannot apply for the supplement (501.047). We finally drop people who retired before 2011 and get a final sample of 385,910.

Once we do this, we define the two other samples of analysis: one for the estimation of the impact on the gender pension gap and other to analyze the impact of the policy on those who could potentially or did retired. For the former, we have 132,792 individuals of both gender, while for the latter we have 114.463 women that are described in Table 12 of the Appendix[4].

3.1.1 Estimating the number of children

One of the drawbacks of the CSWB is that there is no information about the number of children by worker nor the presence of a couple. The only source of information that is closely related to it is an additional file coming from the sample called "Convivientes". It contains the gender and age of birth of all the cohabitants of the worker in the year of extraction. Based on this, we can infer the presence of a children by making the following assumptions[5]:

- **Assumption 1:** The fecundity period of a woman in the sample ranges from 16 to 45 years old
- **Assumption 2:** Any cohabitant who was born when the women was between 16 and 45 is considered a child
- **Assumption 3:** Any cohabitant of the opposite gender that has less than 7 years of difference on age with respect to the women is considered as a couple

[4] For simplification, we described only this database. Additional tables can be seen in the online version of the paper

[5] The criteria is easily adaptable for more or less flexibility of the assumptions. For this paper, we decided to make the most relaxed assumption on the period in which a women could potentially have children

It is well known that these estimates generate a measurement error that increases for women whose first appears at later stages of their life. One way to confirm this intuition is by comparing our results with the 1999 Fecundity Survey from the Spanish National Statistics Institute (INE). This survey at a national level and includes 7.749 women between 15 and 49 years old, without conditioning on their civil status. Table 1 compares within their relative distribution of children by cohort and between different the two estimates. One can see how for later stages of life the contrast is bigger. However, and as we will show later, these differences do not affect the outcome of interest for the control sample and, what is more, it generates a downward bias that leave us with the lower bound of the true impact of the policy.

Table 1: Relative distribution of children by cohort and sample

1999 Fecundity Survey					
Nº Children nAge in 1999	0	1	2	3	4 or more
35 to 39	12.34	21.77	48.94	14.01	2.94
40 to 44	9.86	10.81	33.70	25.04	20.59
45 to 49	9.24	16.62	48.50	19.90	5.74
50 to 54	6.31	10.29	45.78	23.77	13.85
CSWB estimates					
35 to 39	25.46	30.62	35.44	6.79	1.69
40 to 44	27.42	32.97	30.41	7.4	1.79
45 to 49	30.09	26.05	29.52	10.38	3.95
50 to 54	43.82	32.6	16.84	5.05	1.69

Source: Authors' calculations based on CSWB and the 1999 Fecundity Survey (INE).

3.2 Descriptive statistics

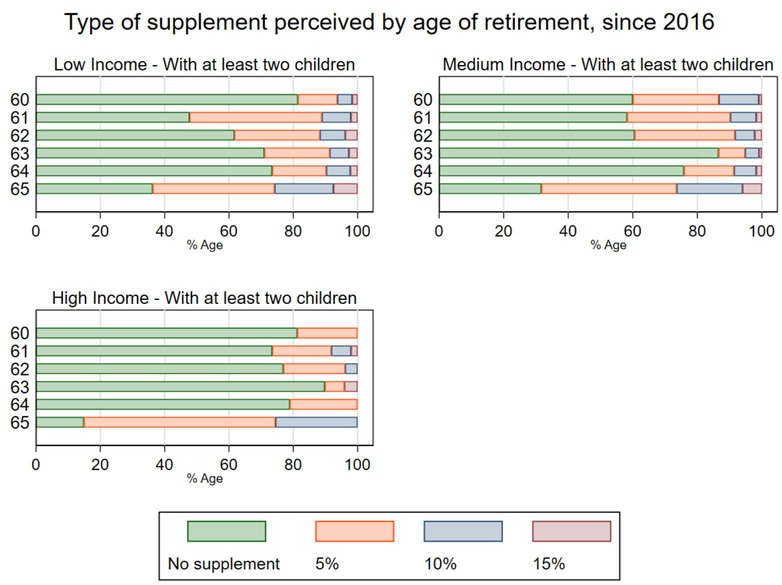

Figure 1: Distribution of the supplement by age of retirement

We now describe the main characteristics of our sample. Table 12 on the Appendix shows that only 33% of our sample decided to retire between the years 2011 and 2019. Moreover, only 20% of those who retired actually received the maternity supplement. If we look at the distribution of the supplement by age of retirement, it is clear that most of the women with two or more children who retired after 2016 applied for the policy, whereas only a fraction of those who retired between 61 and 64 asked for it. This will be consistent with our main findings where we see that those at the age of 65 have a higher incentive to retire and relative to younger cohorts.

4 Empirical results

We now present the main findings to show the impact of the policy on the gender pension gap and on women retirement decisions. Our baseline hypothesis is that the maternity supplement impacts the incentives for early retirement in a way that could offset the pension increase it initially produces. As a consequence, the gender pension gap could only end up being affected for those women that retire at an age for which these incentives do not play a role.

Our empirical results go in line with this argument and can be explained by two main factors. First, as we will show later, women with a lower income are more likely to receive the maternity benefit and this could lead to a low impact on the average pension. Secondly, not many women receive the maternity benefit when they are either 61, 62 or 64, since they face a more detrimental trade-off.

In fact, the policy generates two different effects: on the one hand there is an income effect, i.e. ceteris paribus, the monthly pension is higher for every age of retirement, while on the other hand retiring earlier has a lower opportunity cost in terms of forgone monthly earnings. This trade-off, according to our results, is solved in favour of trading some money for additional years of retirement. Stated in other terms, women seem to take the maternity benefit to compensate for the penalty they have to pay in order to retire earlier and enjoy more years of retirement. Since the maternity supplement is provided only to women that retire earlier with certain conditions[6], we could have that the fraction of women paying the penalty increases, implying that the policy could have no effect even within a certain retirement age cohort. In fact, the impact of the penalty they have to pay can be even higher than the bonus they receive for the maternity benefit. Hence the earlier they decide to retire with respect to the normal age of retirement, the higher the penalty, leading to an overall negative effect.

Eventually, the overall effect is that more women retire earlier, since the policy increases the probability of retiring at every age, without affecting the gender except for women that retire at 65. Notice that it is the case that for some age cohorts, controlling for the type of retirement and other relevant covariates, the average pension for women with more than two children (treated group) increases more than the average pension for women with less than two children, implying that the policy has a positive effect by age of retirement. However, since less women wait for the "full pension", it might be the case that the policy implies an overall loss in the overall "social security wealth". Hence, we have that the pension gap (measured in average monthly pension after retirement) shrinks, mainly because of the positive income effect for women that reach the retirement age of 65 years old. Overall the income effect outweighs the substitution effect, i.e. women that retire at 65 receive an higher pension and this amount more than compensates for the increase in the number of women retiring earlier and paying an higher penalty.

[6] See the Background section

4.1 Impact of the policy on the gender pension gap

4.1.1 Methodology and Results

We begin our analysis using a difference in difference approach where the treated group are women with at least two children and the treatment is a dummy that takes into account the time dimension, equal to one for the years from 2016 on and equal to zero otherwise.

4.1.1.1 Propensity Score Matching

It is possible that the women who we are comparing have differences in their working biographies that affect their retirement decision. To avoid any source of significant differences between treated and controls, we model a first stage of the regression using propensity score matching (Rubin and Rosenbaum (1985)). In this way, the model can be defined as:

$$P(treated|X_i) = F(X_i'\beta) \tag{1}$$

Where $F(X_i'\beta) = \Lambda(X_i'\beta)$ follows a logistic distribution such that $\Lambda(X_i'\beta) = \frac{exp(X_i\beta)}{1+exp(X_i\beta)} = Pr(treated|X_i)$. As for X_i, we consider the following regressors which refers to the information from the previous quarter of the analyzed period:

- Region of birth
- Region of current residence
- Highest contribution group (proxy of qualification)
- Type of education
- Number of contracts signed
- The relation with the couple
- Number of children
- The time employed so far
- The accumulated wages so far

Once we run the regression, we match only observations with common support and with the closest propensity score (p_x). The matching is done by using a Kernel estimator such that:

$$K_i = K(\frac{p(x_i) - p(x_k)}{h_n}) \tag{2}$$

Where h is the bandwidth and K is an Epanechnikov kernel [7].Once we estimate the model, we evaluate the results of the matching using a two-sample t-test (see Table 2) to check if there are significant differences in covariates means for both groups (Rubin and Rosenbaum (1985)). On

[7] For a reference, see Pagan and Ullah 1999

average, there are not significant differences across both groups. Also notice that the Kernel estimates allow us to match treated units (using a function on the propensity score) with all those non-treated who have common support, so the resulting sample can relate more than one control for each treated women. In concrete, the weights are inversely proportional to the distance between the propensity scores of the two groups. Moreover, since all control units contribute to the weights, lower variance is achieved.

Finally, the estimated propensity score can be used as weights to obtain a balanced panel sample of treated and untreated women (Imbens (2004)) can also be used as weights to obtain a balanced sample of treated and untreated individuals.

Table 2: Difference in means test by treated and control (women who could potentially retired)

	Treated	Controls	Dif.	Pvalue
Level of skills				
Unknown skill	0.155	0.244	0.089	0.00000
Med skill	0.781	0.712	-0.069	0.00000
High skill	0.064	0.044	-0.020	0.00000
Type of education				
No or primary studies	0.663	0.761	0.098	0.00000
High school	0.223	0.167	-0.056	0.00000
College	0.113	0.072	-0.041	0.00000
Num of labor relations	7.944	7.423	-0.521	0.00000
Presence of a couple				
No couple	0.424	0.429	0.005	0.24846
Younger couple	0.443	0.441	-0.002	0.59843
Older couple	0.133	0.131	-0.003	0.36002
Number of children				
0 or 1 child	0.615	0.630	0.015	0.00079
2 or more children	0.385	0.370	-0.015	0.00079
Accumulated months employed				
40 months	0.000	0.003	0.003	0.00000
281-320 months	0.000	0.000	0.000	0.04080
Accumulated wages				
20000	0.234	0.319	0.085	0.00000
200000	0.000	0.000	0.000	0.46958
N	54,480			
Treated	18,708			
Control	35,772			

This table only includes the most relevant variables and categories for the analysis.
A complete description of the two-sample t-test can be seen in the online version of this paper

4.1.2 Social Security Wealth

The baseline regression is run using a sample of women who retired in the period of analysis since they are the ones from which we have information about their pensions,

$$\ln(SSW)_{i,t} = \beta_0 + \beta_1 child_{i,t} + \beta_2 treatment_t + \beta_3 child_{i,t} treatment_t + \boldsymbol{\gamma' x_{i,t}} \tag{3}$$

where i corresponds to an individual and t to the year of analysis. In terms of variables, $SSW_{i,t}$ is the social security welfare[8](see below for an explanation),$child_{i,t}$ is a dummy with value 1 if the women

[8] Notice that, under our framework, pension and social security wealth are equivalent concepts,although differently estimated

has two or more children and 0 if she has 0 or 1,$treatment_{i,t}$ is a dummy whose value is 1 if the women could potentially retired in the years 2016 to 2019 and 0 if she could do it between the years 2011 and 2015, and $x_{i,t}$ are the control regressors. These ones include socio-economic information[9], time fixed-effect, education, geographic variables,average income in the five years previous,type of qualification [10], a dummy for couples and other relevant controls.

The Social Security Wealth is defined as the present discounted value of lifetime social security benefits. Following the estimates from Garcıa-Gómez et al. (2020), for an individual i who starts receiving a pension at age R, her social security wealth is defined as:

$$SSW_{it}(R,i) = \sum_{a=R}^{T} Pension_t(R,i)\sigma_{t,a}\beta^{a \quad R} \tag{4}$$

Where $\sigma_{t,a}$ is the survival probability at age a in year t, T is the maximum length of life, and $\beta^{a \quad R}$ is the discount factor set at a rate of 3%. [11].

Once estimated,we report our results in Table 3.

Table 3: Results on the Social Security Wealth

	Women sample	Women sample the supplement
Two or more children Treated	0.0461	-0.0269
	(0.0119)	(0.0155)
Two or more children	0.00163	0.00477
	(0.00818)	(0.00884)
Treated	0.0569	0.0497
	(0.0133)	(0.0151)
Observations	20870	16620
Adjusted R^2	0.538	0.539

Robust standard errors in parentheses
$p < 0.05$, $p < 0.01$, $p < 0.001$

Source: Authors' calculations based on CSWB

The coefficient that measures the policy effect is β_3 on the "overall" regression. The positive and significant at the 1% level effect (0.046) implies that the treatment has an impact measurable in four percentage points on the social security wealth. It is important to emphasize that we do not use as a treatment the dummy variable for women that actually receive the maternity benefit, since it would generate a selection bias: they decided actively to take the maternity benefit and the treatment wouldn't be randomly assigned.

In principle, this regression has one main flaw: the treatment could explain a general different trend for women with two or more children and not the policy effect. We check for this possibility in two different ways: first we remove the observations that receive the maternity supplement to check whether the coefficient for β_3 changes (Overall w supplement regression) and then we run the same regression keeping only observation before 2016 and using as a treatment a dummy variable equal

[9] This data comes from the Spanish National Statistic Institute (INE) and contains information about the GDP per capita, unemployment rate, activity rate, employment rate and private sector rate by gender,region and year

[10] We define the level of skills based on the contribution group from the contracts signed during women working experience

[11] All the information related to mortality and life expectancy are author's calculations based on data from the Spanish National Statistic Institute (INE)

to 1 for years from 2015 on. For both regressions β_3 is not statistically different from zero, at any significance level.

Then we run regression (3), keeping observations for women that retire at a given age, for $age = 61, 62, \ldots, 65$, to see whether there is a different effect depending on the age of retirement. It is important to highlight that, in principle, we could have run a single regression including the interaction effects. However, age can interact with many control variables and running different regressions allows us to control for many simultaneous interactions of age with observables, in particular with the income level[12]. The results are reported in Table 4.

Table 4: Results by age for the Social Security Wealth

		61	62	63	64	65
Two or more children	Treated	0.0116	0.0289	0.0783	0.0158	0.0588
		(0.0213)	(0.0327)	(0.0357)	(0.0403)	(0.0184)
Two or more children		0.0102	0.00553	-0.0648	-0.0106	0.00768
		(0.0164)	(0.0248)	(0.0257)	(0.0289)	(0.0115)
Treated		0.0315	0.0445	0.0294	0.0967	0.0623
		(0.0221)	(0.0381)	(0.0412)	(0.0432)	(0.0207)
N		3755	2244	2559	2205	10107
adj. R^2		0.602	0.521	0.502	0.474	0.498

Robust standard errors in parentheses
$p < 0.05$, $p < 0.01$, $p < 0.001$

Source: Authors' calculations based on CSWB

The interaction effect is significant only for women who retire at 63 and 65. The effect for those who retire at 65 is comparable to the overall effect in sign, magnitude and significance (5% level). Indeed those women do not face any trade-off and the effect is unambiguous[13]. Furthermore, remember the the largest fraction of women receiving the maternity supplement belong to this class.

For women that retire at 63 we have a positive effect that can be explained in two different ways, acting together. First, the trade-off at 63 is not that high and the differential effect considering the maternity supplement can be positive[14]. Hence the many women that are retiring to get the benefit can lead to a positive overall effect. This does not happen at 64 since it is probably more suitable to wait one year to get the full pension.

Second, as we pointed out in the explanation of the retirement system, 63 is the first year in which women can retire through the ***voluntary early retirement system***. Indeed, many women with two children can take this opportunity to retire, since their career could have been in principle more complex than the one women with zero or one children had. If this is the case, the positive and significant interaction term is due to a significantly lower baseline level for women with two or more children. Indeed if before 2016 women with two or more children retired voluntarily more than women

[12] Including many interaction effects also generates a potential problem in terms of variance, implying that the standard errors can be too high just because we are adding a lot of noise. This is another reason why we prefer to run different regressions

[13] Only the income effect is acting in this case: giving more money ceteris paribus on age implies an higher SSW

[14] If many women retire earlier and the overall effect considering the penalty is negative the effect would be ambiguous, while even increasing the number of women retiring at 63 the differential effect considering the penalty is positive

with 0 or 1 child it can be that after 2016, given the policy, they try to find an agreement with the employer to get the supplement[15]. This pattern seems to be confirmed by the negative and significant (at the 10% level level) coefficient for β_1. Notice that if this is the reason the overall impact on the gender pension gap can be irrelevant, since those women are mostly women with a low income and two children, which account for a small share of the gap. However, it is important to underline the importance of eliminating the difference between women with less that two children and women with at least two children that retire at 63.

4.1.3 Gender gap decomposition

We showed that the policy implied an increase in the average pension for women with two children, driven by those who retired at 63 and 65. Does this increase imply a reduction in the gender pension gap? In principle, if we assume the policy only affects women, we should find a positive answer. However, there can be a different trend for men with two or more children or for couples, implying different potential results. For the purpose of this analysis, we look at the differential in the average monthly retirement pension between men and women. This will be done by using the so-called Oaxaca Blinder decomposition of the gender difference in average pensions (Oaxaca (1973) and Blinder (1973)).[16]

The aim is to decompose the gender pension gap in the monthly pension[17] between men and women.

$$\Delta \bar{Y} = \bar{Y}_{\text{men}} \quad \bar{Y}_{\text{women}}$$

If we model the monthly pension scheme as a linear projection on covariates and an unobservable term, then the average monthly pension for men and women is equal to

$$\begin{aligned} \bar{Y}_{\text{men}} =& \bar{\boldsymbol{X}}^{0}_{\text{men}} \boldsymbol{\beta}_{\text{men}} \\ \bar{Y}_{\text{women}} =& \bar{\boldsymbol{X}}^{0}_{\text{women}} \boldsymbol{\beta}_{\text{women}} \end{aligned}$$

since by construction the average of the residuals is zero in an OLS regression. Inserting this linear projection into the previous decomposition it is easy to get the Oaxaca-Blinder decomposition:

$$\begin{aligned} \bar{Y}_{\text{men}} \quad \bar{Y}_{\text{women}} =& \bar{\boldsymbol{X}}^{0}_{\text{men}} \boldsymbol{\beta}_{\text{men}} \quad \bar{\boldsymbol{X}}^{0}_{\text{women}} \boldsymbol{\beta}_{\text{women}} \\ =& \bar{\boldsymbol{X}}^{0}_{\text{men}} \boldsymbol{\beta}_{\text{men}} \quad \bar{\boldsymbol{X}}^{0}_{\text{women}} \boldsymbol{\beta}_{\text{women}} + \bar{\boldsymbol{X}}^{0}_{\text{women}} \boldsymbol{\beta}_{\text{men}} \quad \bar{\boldsymbol{X}}^{0}_{\text{women}} \boldsymbol{\beta}_{\text{men}} \\ =& (\bar{\boldsymbol{X}}_{\text{men}} \quad \bar{\boldsymbol{X}}_{\text{women}}) \boldsymbol{\beta}_{\text{men}} + \bar{\boldsymbol{X}}^{0}_{\text{women}} (\boldsymbol{\beta}_{\text{men}} \quad \boldsymbol{\beta}_{\text{women}}) \end{aligned}$$

The previous equation disentangle the gender difference in average monthly pension (in log terms), allowing to asses the impact of the difference in ***endowments***, i.e. the differences in the average of covariates of men and women, if men were to earn the same as women.[18] The second term is the

[15] Even if this mechanism seems plausible and confirmed by the empirical findings a deeper analysis would be necessary to disentangle this effect

[16] There are econometric techniques that estimate the differential of other distributional statistics, but these methods are out of scope of this analysis. Nevertheless, it would also be interesting to examine the effect of the maternity benefit at other locations in the distribution of the monthly retirement income

[17] Measured in log-pension

[18] Here, the difference is evaluated at the coefficient ("returns") of men. Identically, we could have added and

difference in returns on pension income weighted at the average covariates for women. The first term is usually referred to as the "explained differences", while the second one as the "unexplained component", since it is based in differences in the $\boldsymbol{\beta}'s$ that can be due to a different effect of the covariates or to omitted variables. Once again it is important to highlight that the order of the decomposition matters. Yet, the previous formulation is not convenient to interpret the gender pension gap, since we measure the explained and unexplained effects in different units. One additional step of add and subtract yields,

$$
\begin{aligned}
&(\bar{\boldsymbol{X}}'_{\text{men}} - \bar{\boldsymbol{X}}'_{\text{women}})\boldsymbol{\beta}_{\text{men}} + \bar{\boldsymbol{X}}'_{\text{women}}(\boldsymbol{\beta}_{\text{men}} - \beta_{\text{women}}) \\
=&(\bar{\boldsymbol{X}}'_{\text{men}} - \bar{\boldsymbol{X}}'_{\text{women}})\boldsymbol{\beta}_{\text{men}} + \bar{\boldsymbol{X}}'_{\text{women}}(\boldsymbol{\beta}_{\text{men}} - \boldsymbol{\beta}_{\text{women}}) \\
&+(\bar{\boldsymbol{X}}'_{\text{men}} - \bar{\boldsymbol{X}}'_{\text{women}})\boldsymbol{\beta}_{\text{women}} - (\bar{\boldsymbol{X}}'_{\text{men}} - \bar{\boldsymbol{X}}'_{\text{women}})\boldsymbol{\beta}_{\text{women}} \\
=&\Delta\bar{\boldsymbol{X}}'\boldsymbol{\beta}_{\text{women}} + \bar{\boldsymbol{X}}'_{\text{women}}\Delta\boldsymbol{\beta} + \Delta\bar{\boldsymbol{X}}'\Delta\boldsymbol{\beta}
\end{aligned}
$$

From these estimations we obtain three effects for a given reference group (in our case, women):

1. The impact of the difference in averages for observable covariates (i.e. *endowment effect*) between men and women, if they had the same $\boldsymbol{\beta}_{\text{women}}$. For example, if men have an higher education level (on average), the interpretation would be the impact on the pension gap of education, considering the marginal return of education $\beta^{\text{educ}}_{\text{w}}$

2. The difference in returns if women had the same marginal effects on covariates as men (i.e., *discriminatory effect*). This term implies that if $\beta^{\text{educ}}_{\text{w}} \neq \beta^{\text{educ}}_{\text{m}}$ the difference on the average pension can be due to unexplained differences on $\boldsymbol{\beta}$

3. An interaction of the first two effects which is not easy to interpret.

Yet, in our case, men do not receive the maternity benefit, hence, both their average and coefficient are equal to 0. But this implies, after simple algebra and considering only the maternity benefit,

$$\bar{Y}_{\text{men}} - \bar{Y}_{\text{women}} = \bar{X}_{\text{women,matern.}}\beta_{\text{women,matern.}}$$

So, it is only useful to interpret the effect on the gender pension gap as the difference in endowments, assuming that men would receive the same returns on pension if they *hypothetically* would receive the maternity benefit. Since we cannot assume a counterfactual where men earn a maternity benefit, because they did not in the period of analysis, we compare the returns to pensions of having two or more children of men and women, provided that they were equally likely to have them. In absence of the policy, we would assume that the difference in returns (i.e. β^{child} is positive, since women have historically been the main force in raising their children, and therefore they might have needed to reduce their labour supply. Consequently, women accumulate less contribution years, and hence receive a lower pension compared to men. However, since β_{women} can be biased by those "discriminatory effects", i.e. having a child is more costly for a women, we can expect a change in the second component of the decomposition after the policy is introduced. If the policy has an effect, we

subtracted $\boldsymbol{X}'_{men}\boldsymbol{\beta}_{women}$, and we would have evaluated the difference in covariates at the returns for women. This is a weakness of the Oaxaca-Blinder method, i.e. the order of decomposition matters.

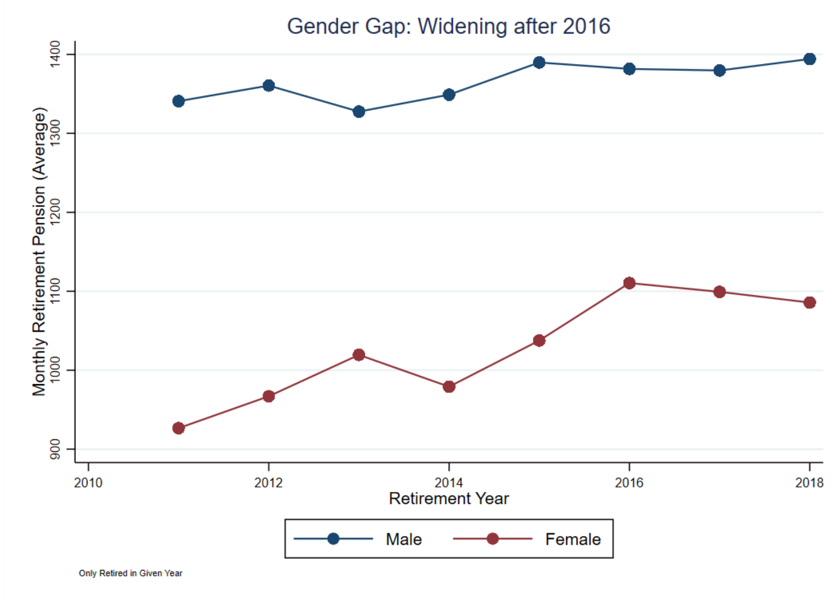

Figure 2: Time Series: Average Pension Gap Between Men and Women

should find a change in the β for women since this coefficient embeds the policy effect, while the β for men should remain the same[19].

The average monthly pension in 2018 was 25% lower for women than for men, as it can be notice in Figure 2. Furthermore the gender pension gap seems to increase after 2016. It can clearly be the case that the positive effect helped flatten this negative trend, having a positive impact on the average pension for women, implying that other factors lead to the widening of the gap. The Oaxaca-Blinder decomposition aims to disentangle the effect of the policy. First notice in Figure 3 that the downward trend is driven by women that retire earlier, while for women that are 65 years old the line stays flat. Since for those women we showed that there is a positive impact of the policy it might be that the policy balanced the negative trend due to other (observable or un-observable) factors.[20]

Once again it is important to remark that this is an unambiguous effect. What matters is that there seems not to be the same flattening of the curve for women, which implies that the policy could have a low real impact in the gender gap, due to the presence of the "substitution effect". Indeed if many women retire earlier it can be that: the overall loss for the penalty outweighs the income effect and less women retire at 65, implying a change in the distribution of SSW.

In Table 5 we can see that the differential estimated effect in the monthly pension between women and men is 26,5%, consistent with our previous findings. We are interested in the "unexplained" component due to the dummy "child". This is a measure of the change in the effect of having children over time. Intuitively, if the β in the regression for $\log(SSW)$ changes for women and not for men it

[19] The underlying assumption, that we test we a robustness check, is that there is no trend in terms of "returns" from having a child, neither for men nor for women. However we should find a positive impact even assuming that the trend for women and men is the same and the policy shrinks the discrimination effects, i.e. reduces the trend for women

[20] The analysis is conducted in average terms. Since the policy is aimed for women with two children it might be that there are positive redistributive effects

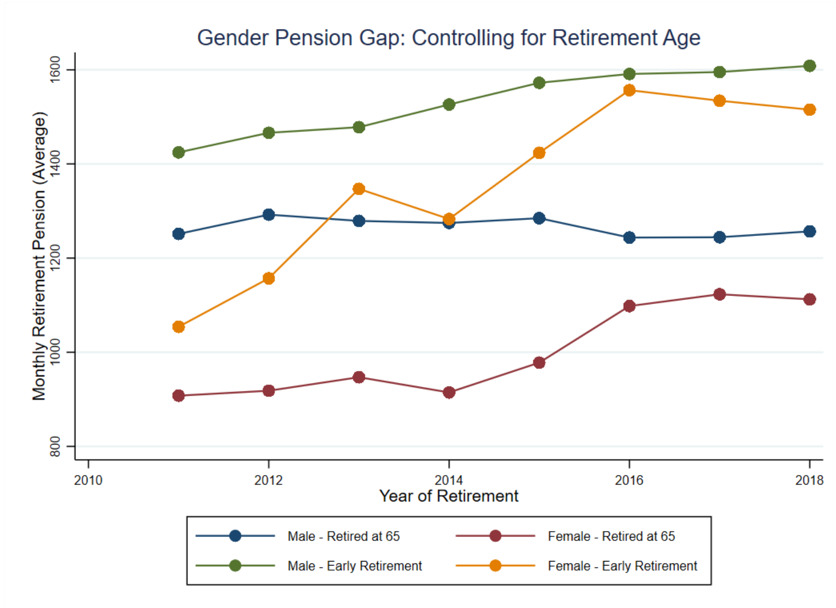

Figure 3: Time-Series of Average Gender Pension Gap: Controlling for Age

is probably due to the policy. We cannot include directly the maternity benefit for the same reason as before, in addition to the fact that men do not receive the benefit $\beta_{\text{m}}^{\text{child}} = 0$.

Notice that in the first three columns the differences in the "unexplained component" is positive and significant at any level, implying that it contributes positively to the pension gap. After 2016 the difference is negative and significant, driven by women that retire at 65 (columns (5) and (6)). This result goes in the exact direction of our previous findings: the policy has an impact on the average monthly pension only for women that retire at 65 and it does not affect the gender gap in case of early retirement. In the appendix we provide robustness check to show that there is no change in $\beta_{\text{men}}^{\text{child}} = 0$ over time. Again, this kind of analysis doesn't say much in terms of redistributive effects of the policy.

In order to provide more evidence we also apply the Oaxaca-Blinder method for women with two children before and after 2016. This allows us to check whether the change in β_{w}^{child} is the driver of the gender pension gap. Table 6 summarize our findings.

First notice that before 2016 there is no significant effect in the change of β_{w}^{child}. The third regression emphasizes a positive change in the coefficient, implying that having two children implies and higher pension after in 2016 with respect to 2015. We interpret this change in the coefficient as the effect of the policy. The fourth regression is useful to highlight that the impact of having children acts through the maternity benefit, since once we control for it the "unexplained component" becomes non-relevant. Even though we don't have a counterfactual for years before 2016, this results implies that after the year the policy was introduced, the only positive and significant impact that children have on average pension is through the maternity benefit. Finally we perform the same analysis for women that retire only before they are 65 and we find a lower effect significant only at the 10% level, while for women that retire at 65 the results are comparable to the overall sample.

Table 5: Oaxaca-Blinder Decomposition of Average Monthly Pension. Comparison of Returns to Pension of Having Two or More Children.

	(1) Before 2016	(2) Before 2016 + 65	(3) Before 2016 Early	(4) After 2016	(5) After 2016 + 65	(6) After 2016 Early
Differential						
Difference	0.353	0.285	0.202	0.265	0.153	0.0630
	(0.00543)	(0.00789)	(0.00858)	(0.00660)	(0.0102)	(0.0113)
Coefficients						
1=Two or more children	0.00772	0.00664	0.00659	-0.00629	-0.0133	-0.00206
	(0.00226)	(0.00314)	(0.00378)	(0.00328)	(0.00500)	(0.00596)
Observations	49192	18736	20447	32338	11008	9631

Robust Standard Errors (in Paranetheses). Evaluated at Returns and Endowments of Women. Dependent Variable: Gender Difference in Average Log Pension.
$p < 0.10$, $p < 0.05$, $p < 0.01$

Source: Authors' calculations based on CSWB

Table 6: Oaxaca-Decomposition of the average monthly retirement pension for women over time.

	(1) 2011-2013	(2) 2013-2015	(3) 2015-2016	(4) 2016-2018
Differential				
Difference	0.0776	0.0220	0.0734	-0.0230
	(0.0149)	(0.0143)	(0.0134)	(0.0126)
Endowments				
1=More than Two Children	0.00000877	0.000256	0.000888	-0.00116
	(0.0000602)	(0.000595)	(0.000535)	(0.00102)
1=Matern. Suppl + Two or more Children				0.00555
				(0.00168)
Coefficients				
1=Two or more children	0.000820	0.00660	0.0115	0.000468
	(0.00609)	(0.00562)	(0.00586)	(0.00921)
1=Matern. Suppl + Two or more Children				-0.00380
				(0.00694)
Interaction				
1=More than Two Children	0.00000727	0.000925	0.00107	0.0000673
	(0.0000660)	(0.000838)	(0.000696)	(0.00132)
1=Matern. Suppl + Two or more Children				-0.000680
				(0.00125)
Observations	6378	7244	7973	8959

Dependent Variable: Monthly Retirement Pension (logs). Standard Errors in parantheses.
$p < 0.10$, $p < 0.05$, $p < 0.01$

The analysis provides a strong evidence for an impact of the maternity benefit on gender pension gap, mostly driven by women that retire at 65 (income effect), i.e. for which the income effect prevails. Indeed we show in the next chapter that there is a relevant change in behavior, i.e. women retire earlier due to the policy. Hence, the substitution effect implies that even if for women that retire earlier than 65 we have a slightly positive effect, the effect would be much stronger if those women retired at 65 (no penalty involved). However the analysis shows that the income effect prevails, and there is an overall positive impact on the gender pension gap. Two remarks are important at this point of the analysis. The first one is that given that women with more than 2 children are only a relatively small fraction of the sample the impact on the average pension for women is restricted and difficult to be properly detected. Second, we have a downward bias due to our estimation of the number of children and it can clearly be that this is lowering our estimates.

4.1.4 Retirement behavior

Throughout this section we want to explain the mechanism behind our previous findings. The main reason why the policy doesn't affect much the overall gender pension gap can be that women decide to retire earlier paying the penalty on the "full" pension they would receive at 65. In other words, there is an early retirement trend that lowers the income effect of the policy. In fact, if women retire earlier in order to have a longer retirement period, they might be paying an high penalty and the overall impact after receiving the supplement is reduced. Hence we can have more women retiring earlier, with a slightly higher pension than they would have received before the policy. However many of those women might have retired later in "normal" conditions, implying that the overall gap increases.

Recall that when a woman retires, the observation is deleted from the sample. Hence, using the linear probability model for the retirement decision reported in equation (5), what we are really evaluating is the probability of retiring conditional on the fact that they decided to continue working

Table 7: Oaxaca-Blinder Decomposition of Average Monthly Retirement Income of Women Retired at 65

	(1) 2011-2013	(2) 2013-2015	(3) 2015-2016	(4) 2016-2018	(5) Before/After 2016
Differential					
Difference	-0.00858	-0.0319	0.0837	0.00669	0.0680
	(0.0366)	(0.0300)	(0.0238)	(0.0213)	(0.00801)
Endowments					
1=Two or More Children	0.000862	-0.00204	0.000190	-0.00547	0.00123
	(0.00164)	(0.00208)	(0.000681)	(0.00306)	(0.000664)
1=Matern. Suppl + Two or more Children				0.0233	
				(0.00642)	
Coefficients					
1=Two or More Children	-0.00247	0.0162	0.0145	0.00494	0.0129
	(0.0174)	(0.0131)	(0.0119)	(0.0175)	(0.00331)
1=Matern. Suppl + Two or more Children				-0.00868	
				(0.0123)	
Interaction					
1=Two or More Children	0.000170	0.00236	0.00108	0.000946	0.00374
	(0.00123)	(0.00250)	(0.00143)	(0.00338)	(0.00103)
1=Matern. Suppl + Two or more Children				-0.00430	
				(0.00614)	
Observations	1193	1685	2204	2796	20113

Dependent Variable: Monthly Retirement Pension (logs). Standard Errors in parantheses.
$p < 0.10$, $p < 0.05$, $p < 0.01$

Table 8: Oaxaca-Blinder Decomposition of Average Monthly Retirement Income of Women Retired Before 65

	(1) 2011-2013	(2) 2013-2015	(3) 2015-2016	(4) 2016-2018	(5) Before/After 2016
Differential					
Difference	0.220	0.0760	0.0592	-0.0103	0.179
	(0.0284)	(0.0227)	(0.0202)	(0.0190)	(0.0110)
Endowments					
1=Two or More Children	-0.000372	0.00101	0.000451	0.00197	0.000996
	(0.000840)	(0.00157)	(0.000676)	(0.00143)	(0.000949)
1=Matern. Suppl + Two or more Children				-0.000624	
				(0.000872)	
Coefficients					
1=Two or More Children	0.0133	0.00329	0.0100	-0.00519	0.00994
	(0.0119)	(0.00977)	(0.0105)	(0.0121)	(0.00480)
1=Matern. Suppl + Two or more Children				0.00101	
				(0.00753)	
Interaction					
1=Two or More Children	0.000572	0.000686	0.000458	-0.000627	0.00275
	(0.00124)	(0.00205)	(0.000756)	(0.00149)	(0.00138)
1=Matern. Suppl + Two or more Children				-0.000142	
				(0.00106)	
Observations	1830	2385	2679	2879	9613

Dependent Variable: Monthly Retirement Pension (logs). Standard Errors in parantheses.
$p < 0.10$, $p < 0.05$, $p < 0.01$

(or being unemployed) in the previous period. Hence we have an ***hazard rate***.

$$\mathsf{P}(retired_{i,t} \boldsymbol{j} \boldsymbol{x}) = \beta_0 + \beta_1 child_{i,t} + \beta_2 treatment_t + \beta_3 child_{i,t} treatment_t + \boldsymbol{\gamma}' \boldsymbol{x_{it}} \tag{5}$$

We include the same controls as in regression (3).We define $retired_i$ as a dummy variable if individual i retired in a certain year of the sample. We do these estimates in the sample of women who could have potentially retired since it is the one referring to the analysis of retiring behavior. Comparing the average of these estimates (Table 9), one can see how there are differences across the level of children and years of analysis.

Table 9: Share of retired people, by age, number of children and treatment

Age of retirement	Probability of retiring				Number of observations			
	2011-2015		2016-2019		2011-2015		2016-2019	
	0 or 1	2 or more	0 or 1	2 or more	0 or 1	2 or more	0 or 1	2 or more
61	0.13	0.11	0.054	0.068	14,214	11,103	17,061	10,931
62	0.099	0.058	0.046	0.054	13,860	10,237	15,774	9,714
63	0.12	0.056	0.094	0.085	14,085	8,782	13,974	9,151
64	0.12	0.063	0.087	0.052	13,777	6,554	12,681	9,549
65	0.54	0.38	0.27	0.47	13,201	4,610	11,227	9,690

Source: Authors' calculations based on CSWB

Once we have all our variables of interest, we proceed to estimate our model (see results in Table 10). The interaction effect is positive and significant at any level, implying that the probability of retirement given that they are still working has a different trend for women with 2 children with respect to women with zero or one children. In particular the policy implies a differential increase in the conditional probability of retirement of 6 percentage points after the introduction of the policy for women with two or more children. Hence the conditional probability of retiring increases after 2016 of 1.2 percentage points for women with two or more children, while it decreases for women with less than 2 children.

Table 10: Results of the overall for the Pr(retired)

			Overall	By level of income
Two or more children	Treated		0.0628	0.0898
			(0.00578)	(0.00599)
Two or more children			-0.0412	-0.0610
			(0.00426)	(0.00421)
Treated			-0.0500	-0.0609
			(0.00656)	(0.00665)
Two or more children	Treated	Low Income		0
				(.)
Two or more children	Treated	Med Income		-0.0938
				(0.0158)
Two or more children	Treated	High Income		-0.0742
				(0.0267)
Observations			118405	118405
Adjusted R^2			0.196	0.198

Individuals weighted by the propensity score
Robust standard errors in parentheses
$p < 0.05$, $p < 0.01$, $p < 0.001$

Source: Authors' calculations based on CSWB

Notice that it can clearly be that less women retire at 65 years old, implying an overall change in the distribution for age of retirement, but this would not be captured by this regression, which takes into account a conditional probability (conditional on the fact that women did not retire before). Once again we include the robustness analysis (Table 13 and we find β_3 statistically equal to zero if we don't consider women that receive the maternity benefit or if we just keep the sample for women that retire or potentially can retire before 2016, where treatment equal to one for years from 2013 to 2015.

Then we run five different regressions, as in the case for $\ln(SSW)$, keeping observation for women that retire at a specific age, for $age = 61, 62, \ldots, 65$, to see whether there is a different effect depending on the age of retirement. Notice that the coefficients (β_3) are all positive and significant at any level for 61,62 and 65 year old women, while it is significant at the 10% level for women that retire at 63. We have no effect for women that retire at 64, which is in line with the higher trade-off they face at that age, since they only have to wait one year for the full pension. This implies that, given that a woman is not retired yet, for every age, the probability of retiring after the treatment significantly increases for women with two or more children , controlling for the baseline trend for women with 0 or 1 child. Results are report in Table 11.

Notice that the impact is quantitatively the same for women younger than 65 years old at the time of retirement, while it is much higher for women at 65. This finding reflects two mechanisms: the first is related to the fact that the baseline trend is negative for women at 65, related to the increase on the age of retirement, typical for west European countries and, in particular, for Spain. Hence the policy goes in the direction of offsetting this effect and generating an overall increase in probability comparable to the one for early retirement ages (10% vs 5%). The second, and more important, is that those women do not face any trade-off and are more willing to retire in order to take the maternity benefit.

Table 11: Results of the Pr(retired) by age

		61	62	63	64	65
Two or more children	Treated	0.0363	0.0458	0.0313	0.00675	0.296
		(0.0106)	(0.00942)	(0.0137)	(0.0148)	(0.0328)
Treated		-0.0297	0.00786	-0.0137	-0.0122	-0.175
		(0.0106)	(0.0110)	(0.0159)	(0.0180)	(0.0390)
Two or more children		-0.0270	-0.0382	-0.0541	-0.0552	-0.122
		(0.00759)	(0.00673)	(0.00747)	(0.00917)	(0.0227)
N		37190	31864	28862	25614	22981
adj. R^2		0.144	0.107	0.117	0.122	0.170

Robust standard errors in parentheses
$p < 0.05$, $p < 0.01$, $p < 0.001$

Source: Authors' calculations based on CSWB

Finally we run the same regression including an interaction effect with the income level, since we suspect the trade-off of retiring earlier is less relevant for low income women (the penalty they have to pay is lower). The results are reported in table 10. Since women with a lower income are more likely to receive the maternity benefit the impact on the average pension can be reduced, but important considerations in terms of redistributive effects can arise.

5 Structural Model

In this section, we propose a dynamic choice model to model women's retirement decisions building on Eckstein and Wolpin (1989). This model will serve not only help to further validate our empirical findings, allowing for a counterfactual analysis, but also to evaluate different retirement policies. The procedure is to use full solution methods to estimate deep structural parameters that are relevant for employed women's retirement decisions and then to simulate how adding the maternity supplement would change their behavior.

Following the seminal paper by Rust (1987) we make the classical assumptions:

1. Additive separability of the utility function and the error term ε_t
2. $\varepsilon_t | \boldsymbol{x}_t \overset{i.i.d.}{\sim} F_\varepsilon(\varepsilon_t)$
3. Conditional independence of future x, $F_x(x_{t+1} | d_t, x_t, \varepsilon_t) = F_x(x_{t+1} | d_t, x_t)$
4. $\{\varepsilon_{jt} : j \in D\}$ independent across alternatives and type 1 extreme value (Clogit)

Where D:=$\{$R,E$\}$ (R: retire, E: stay employed), represents the agent's choices, with $d_{Rt} = 1$ if the individual retires at time t and is otherwise zero. In this model, the agent is forced to retire at 66 if she hasn't already. Time is discrete and indexed by $t = 0, 1, ..., \bar{T}$, where $\bar{T}$ represents the agents' death.

The agent's state utilities are given by:

$$
\begin{aligned}
u_{Et} &= \log(w_t) + \gamma l_t + \delta_1 \log A + \alpha_1 \mathsf{I}_F + \varepsilon_{Et} \\
u_{Rt} &= \log(b_t) + \gamma + \delta_2 \log A + \alpha_2 \mathsf{I}_F + \varepsilon_{Rt}
\end{aligned}
$$

where w_t is wage at period t, l_t leisure, A the accumulated wealth, $\mathsf{I}_F = 1$ if partner is retired and zero otherwise, ε_{Et} the unobserved state variables for the employed, b_t the retirement benefit, and ε_{Rt} the unobserved state variables for the retired. Note that l_t=1 when agent is retired.
The main variable of interest in this model is the pension (or retirement benefit) b_t, which we define as:

$$b_t = \big(1 - p(65 - O_t)\big) b_{65} + M(n) b_{65}$$

where p is the fixed penalty agent pays for retiring early. The expression in red is the maternity supplement based on number of children n, which will be introduced after parameters are estimated. To simplify the analysis we assume $p = 0.07$, which is a good approximation of the annual penalty for non-voluntary early retirement in Spain. In addition old age, O_t, evolves deterministically: $O_t = O_{t-1} + (1 - d_{Rt})$

The individual's payoff in period t depends on the vector of state variables, $s_t = \{O_t, w_t, l_t, b_t, \mathsf{I}_F, A, \varepsilon_{jt}\}$. For convenience of notation, we split the state space into O_t and t, the latter representing all state variables other than O_t. The objective of the individual is to maximize their expected utility:

$$EU(t, O_{t-1}) = \mathsf{E}_t \Big[\sum_{j=t}^{\bar{T}} \beta^{j-t} \big(d_{Rj} u_{Rj} + (1 - d_{Rj}) u_{Ej} \big) \Big]$$

at any time t=0,1,...,$\bar{T}$ with respect to d_{Rt}.

Let $\theta = (\alpha_j, \delta_j, \gamma, \beta)$ be the vector of parameters we are interested in estimating, where $j \in D$. Although for some parameters we will only be able identify their difference, that will not be a problem since our main interest is not the calibrated parameters themselves, but the outcome of the simulation. Once the model is solved we want to predict how the outcome varies with the introduction of the maternity benefit and compare how the predictions relate to the empirical observations. Additionally, we are interested in evaluating the overall distribution of retirement ages and checking whether there was a significant shift after the policy was introduced. In order to do so we would calibrate the model on the pre-2016 sample.

After characterizing the conditional value functions:

$$U_E(t, O_{t-1}) = \log(w_t) + \gamma l_t + \delta_1 \log A + \alpha_1 \mathbf{I}_F + \varepsilon_{Et} + \beta \mathbb{E}_t\big(V(t+1, O_{t-1}+1) | d_{Rt} = 0\big)$$
$$U_R(t, O_{t-1}) = \log(b_t) + \gamma + \delta_2 \log A + \alpha_2 \mathbf{I}_F + \varepsilon_{Rt} + \beta \mathbb{E}_t\big(V(t+1, O_{t-1}) | d_{Rt} = 1\big)$$

the maximization problem then becomes:

$$V(t, O_{t-1}) = \max \Big\{ U_E(t, O_{t-1}), U_R(t, O_{t-1}) \Big\}$$

In order to solve the model, we define the the decision rule the agent faces:

$$d_{Rt} = 1 \text{ iff } U_R(t, O_{t-1}) \geq U_E(t, O_{t-1})$$

Since the continuation value is the same after the agent retires at 65 (last period she can make a decision), we are able to solve the model backwards (solution in appendix 7.2). At period t=65, the decision rule boils down to

$$d_{Rt} = 1 \text{ iff } \varepsilon_{R65} - \varepsilon_{E65} \geq \Psi(65, O_{64})$$

We find such a decision rule for every period, and due to the Clogit assumption on ε_t we are able to construct the log-likelihood and proceed to estimation.
The log-likelihood function writes as:

$$\mathsf{L}(\theta) = \sum_{i=1}^{n} d_R \log P(\varepsilon_{Rt} - \varepsilon_{Et} \geq \Psi(t, O_{t-1}) | s_t) + (1 - d_R) \log P(\varepsilon_{Rt} - \varepsilon_{Et} < \Psi(t, O_{t-1}) | s_t)$$

For estimation, we would proceed with a nested algorithm. First solving the model backwards by finding the threshold levels of epsilons, then evaluating the likelihood and using an algorithm such as Newton-Raphson to optimize. Repeating until convergence.

Once the parameters are estimated, the calibrated model can be a valuable tool for policy evaluation. Particularly, it could be used to analyze whether the benefits of the new supplement approved in 2021 are above or below their optimal level using Chetty (2006) approach. On one hand, the elasticity of the retirement hazard with respect to changes in the level of benefits could be obtained through the same administrative data used for this study. On the other hand, the model would provide us with the agent's marginal utilities when she is employed and retired, allowing for a normative welfare analysis of the generosity of the policy. By comparing the level of the supplement, we could find a policy that optimally balances aggregate welfare trade offs. The incentive should be one such that women receive enough benefit to compensate the wealth loss from raising children, but not too high to avoid reduction of labor force participation.

We conjecture that the simulation of the 2021 policy using the theoretical model will lead to very different outcomes when compared to the 2016 policy. Since we found that most mothers benefiting from the policy are of low income, and that they will now receive a monthly lump sum instead of percentage base supplement, we expect there to be a stronger income effect. This could lead to a more significant shrinking of the gender pension gap, thus making the policy more effective for their initial goal. The effect on the hazard rate of retirement is ambiguous. Women might now think that it is worth waiting a few more years to retire in order to avoid the penalty on the higher supplement (higher loss); however, the boost in pension might also lead to earlier retirement for the same argument as what drove that behavior after the 2016 policy.

6 Conclusions

This paper analyzes a policy that increased retirement pension benefits for mothers of two or more children in Spain. The policy consisted of a percentage-based increase of the recipient's retirement pension, ranging from 5% to 15% depending on the number of children. Using rich micro-level longitudinal data from Spanish Social Security records, we study its effectiveness in reducing the gender pension gap and how it changed mothers' incentives to retire.

We find that the policy had a significant effect in reducing the gender pension gap, as having two or more children only had significant returns to pension benefits after its implementation. However, the results are found to be smaller than they could be expected, as we only observe an increase in the Social Security Wealth of those women who retired at 63 and 65 years of age. The reason for this small effect can be explained by the intertemporal substitution effect produced by the interaction between the supplement and the penalty for early retirement present in the Spanish Old-Age Pension System, incentivizing retirement before 65, the normal retirement age. This effect results in many women anticipating their retirement, as we observe an increase in the retirement hazard for all cohorts between 61 and 65 years of age.

According to our results, the maternity benefit, although not having a major effect in reducing the gender pension gap, could be argued that was successful in compensating mothers for the personal and financial costs entailed by maternity and gave them the freedom to decide in which way they wanted to be compensated. On the one hand, they could wait until the normal retirement age and receive a higher pension. On the other hand, in case motherhood impacted negatively their health and working conditions, it reduced the cost of early retirement.

The main drawback of our analysis is the lack of data on the number of children in the Spanish Social Security administrative records used. We thus use the fact that these records contain the gender and age of the workers' cohabitants to, after imposing some restrictions in age differences, identify which of them are likely to be the workers' children. As we can only identify children who live with their mothers, we underestimate their number for the older women in our sample. This error could imply that we are identifying mothers that are recipients of the supplement as ones that are not, thus finding a lower bound for the effect of the policy. However, we only find a significant effect for, precisely, the older women in our sample. Hence, we defend that our estimates accurately capture that the policy had no effect on the pension of 61- and 62-year-old women.

Future research on the maternity benefit ought to shed light on the different effects it produced between women who were and were not in a couple. For example, it would be interesting to study whether it also affected their husbands' pensions and retirement hazard at early retirement ages. We believe it is also of great interest to analyze the impact of the policy on the lower end of the income distribution.

In short, this paper studies the importance of financial incentives for determining the outcomes produced by a benefits-based policy, particularly for mothers in the later stages of their working life. Given the increasing number of policies aimed at reducing the gender income gap in its various forms, we believe the analysis conducted and the results found will be a useful guideline for policy-making and a significant contribution to the research on mothers' working and retirement preferences.

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7 Appendix

7.1 Tables

Table 12: Descriptive statistics of the final sample for women who could retire

Variable	Mean	Std. Err.	[95% Conf.	Interval]
No couple	40.01%	0.29%	39.45%	40.57%
Younger couple	36.02%	0.28%	35.48%	36.57%
Older couple	23.97%	0.25%	23.48%	24.45%
No children	33.21%	0.26%	32.70%	33.71%
1 child	27.49%	0.24%	27.02%	27.97%
2 children	27.31%	0.24%	26.83%	27.78%
3 children	8.85%	0.15%	8.55%	9.15%
4 or more children	3.14%	0.09%	2.95%	3.33%
No or primary studies	70.78%	0.25%	70.29%	71.26%
High school	20.60%	0.22%	20.17%	21.03%
College	8.62%	0.15%	8.32%	8.92%
Andalucia	15.13%	0.19%	14.75%	15.51%
Aragon	3.13%	0.09%	2.94%	3.31%
Asturias	2.39%	0.08%	2.23%	2.55%
Baleares	2.34%	0.08%	2.18%	2.51%
Canarias	3.22%	0.10%	3.04%	3.41%
Cantabria	1.44%	0.06%	1.31%	1.56%
Castilla y Leon	2.71%	0.09%	2.54%	2.88%
Castilla-La Mancha	5.23%	0.12%	4.99%	5.47%
Cataluña	20.01%	0.22%	19.59%	20.44%
C Valenciana	9.66%	0.16%	9.34%	9.97%
Extremadura	1.90%	0.07%	1.76%	2.05%
Galicia	7.66%	0.14%	7.38%	7.94%
Madrid	14.67%	0.19%	14.30%	15.05%
Murcia	2.13%	0.08%	1.98%	2.29%
Navarra	1.56%	0.07%	1.43%	1.70%
Pais Vasco	6.01%	0.13%	5.76%	6.27%
La Rioja	0.73%	0.05%	0.64%	0.82%
Ceuta y Melilla	0.06%	0.01%	0.03%	0.09%
Time employed (in months)	158.28	0.09	158.12	158.45
Average wage (in logs)	4.92	0.02	4.88	4.96
Average last wage (in logs)	4.59	0.02	4.56	4.63
Time as worker	51.34%	0.27%	50.81%	51.87%
Time as self-employed	28.60%	0.25%	28.11%	29.08%
Time unemployed	19.76%	0.15%	8.31%	8.91%
Time under special regime	0.30%	0.03%	0.25%	0.36%
Retired	33.46%	0.00%	33.46%	33.46%
Has the maternity supplement	20.85%	0.22%	20.42%	21.28%
Age retired	64.24	0.01	64.21	64.26
Retired in 2011	9.13%	0.16%	8.83%	9.44%
Retired in 2012	10.64%	0.17%	10.31%	10.97%
Retired in 2013	10.86%	0.17%	10.52%	11.19%
Retired in 2014	10.91%	0.17%	10.58%	11.24%
Retired in 2015	11.81%	0.18%	11.46%	12.15%
Retired in 2016	13.02%	0.18%	12.66%	13.38%
Retired in 2017	13.64%	0.19%	13.27%	14.01%
Retired in 2018	15.44%	0.20%	15.05%	15.82%
Retired in 2019	4.56%	0.11%	4.25%	4.69%

Table 13: Robustness regressions

	(1) Pr(retired)	(2) Pr(retired)	(3) Pr(retired)
Two or more children	-0.000919	0.0162	-0.0270
	(0.00346)	(0.00388)	(0.00262)
Two or more children Treated		0.00380	-0.0255
		(0.00929)	(0.00407)
Treated		0.231	-0.000518
		(0.0197)	(0.00354)
N	66705	66763	91419
adj. R^2	0.088	0.259	0.223

(1) regress the probability of retiring in 2011-2015 and show no impact of children;
(2) is the overall impact on retirement but without those who received the maternity supplement;
(3) is the baseline regression but comparing 2013 vs 2014-2015
$p < 0.05$, $p < 0.01$, $p < 0.001$. Robust standard errors in parentheses

Source: Authors' calculations based on CSWB

.

Table 14: Oaxaca-Blinder Decomposition for Average Pension of Men over Time

	(1) 2011-2013	(2) 2013-2015	(3) 2015-2016	(4) 2016-2018	(5) Before/After 2016
Differential					
Difference	-0.0211	0.0379	-0.00230	0.00528	0.0129
	(0.00951)	(0.00997)	(0.0101)	(0.0101)	(0.00508)
Endowments					
(first) Two or More Children	0.000923	0.00217	0.00108	0.00140	0.00362
	(0.000444)	(0.000674)	(0.000571)	(0.000541)	(0.000442)
Coefficients					
1=Two or More Children	0.00459	0.000340	-0.00668	0.00346	-0.00118
	(0.00521)	(0.00569)	(0.00620)	(0.00634)	(0.00284)
Interaction					
1=Two or More Children	0.000319	0.0000386	-0.000334	0.000309	-0.000254
	(0.000383)	(0.000644)	(0.000349)	(0.000572)	(0.000612)
Observations	12641	12678	12486	12388	50890

Dependent Variable: Monthly Retirement Pension (logs). Standard Errors in parentheses.
$p < 0.10$, $p < 0.05$, $p < 0.01$

7.2 Model Derivation

Maximization problem:

$$V(t, O_{t\;\;1}) = \max \left\{ U_E(t, O_{t\;\;1}), U_R(t, O_{t\;\;1}) \right\}$$

The last decision is made at period T=65 (no continuation value). We obtain the decision in terms of ϵ_{RT}

Decision rule: $d_{Rt} = 1$ iff $U_R(t, O_{t \quad 1}) \quad U_E(t, O_{t \quad 1})$

$$
\begin{aligned}
U_R(T, O_{T \quad 1}) &\quad U_E(T, O_{T \quad 1}) \\
\log(b_t) + \gamma + \delta_2 \log A + \alpha_2 \mathsf{I}_F + \varepsilon_{RT} &\quad \log(w_T) + \gamma l_T + \delta_1 \log A + \alpha_1 \mathsf{I}_F + \varepsilon_{ET} \\
\epsilon_{RT} \quad \epsilon_{ET} \quad \log(w_T) + \gamma l_T + \delta_1 \log A + \alpha_1 \mathsf{I}_F &\quad \log(b_t) \quad \gamma \quad \delta_2 \log A \quad \alpha_2 \mathsf{I}_F \quad \Psi(T, O_{T \quad 1})
\end{aligned}
$$

Now we obtain the decision rule at every period $t \quad T \quad 1$ in terms of ϵ_t:
Since ϵ_{t+1} is independent of ϵ_t and O_t is deterministic, we have that $\mathsf{E}_t = \mathsf{E}$. So we have:

$$
\begin{aligned}
U_E(t, O_{t \quad 1}) &= \log(w_t) + \gamma l_t + \delta_1 \log A + \alpha_1 \mathsf{I}_F + \varepsilon_{Et} + \beta \mathsf{E}\big[V(t+1, O_{t \quad 1} + 1)\big] \\
U_R(t, O_{t \quad 1}) &= \log(b_t) + \gamma + \delta_2 \log A + \alpha_2 \mathsf{I}_F + \varepsilon_{Rt} + \beta \mathsf{E}\big[V(t+1, O_{t \quad 1})\big]
\end{aligned}
$$

Comparing utilities we get the decision rule:

$$
\begin{aligned}
U_R(t, O_{t \quad 1}) &\quad U_E(t, O_{t \quad 1}) \\
\log(b_t) + \gamma + \delta_2 \log A + \alpha_2 \mathsf{I}_F + \varepsilon_{Rt} + \beta \mathsf{E}\big[V(t+1, O_{t \quad 1})\big] & \\
\log(w_t) + \gamma l_t + \delta_1 \log A + \alpha_1 \mathsf{I}_F + \varepsilon_{Et} &+ \beta \mathsf{E}\big[V(t+1, O_{t \quad 1} + 1)\big] \\
\epsilon_{Rt} &\quad \epsilon_{Et} \\
\log(w_t) + \gamma l_T + \delta_1 \log A + \alpha_1 \mathsf{I}_F &\quad \log(b_t) \quad \gamma \quad \delta_2 \log A \\
\alpha_2 \mathsf{I}_F + \beta \mathsf{E}\big[V(t+1, O_{t \quad 1} + 1)\big] &\quad \beta \mathsf{E}\big[V(t+1, O_{t \quad 1})\big] \\
&\quad \Psi(t, O_{t \quad 1})
\end{aligned}
$$

To reduce notation: define S if the condition $\epsilon_{R65} \quad \epsilon_{E65} \quad \Psi(65, O_{64})$ is satisfied and N otherwise. Having the decision rule for the final period and all other periods, we can solve the problem backwards: As an example, at 64 we need: $\mathsf{E}\big[V(65, O_{64})\big]$:

$$
\mathsf{E}\big[V(65, O_{64})\big] = P(S)\mathsf{E}\big[U_R(65, O_{64}) j S\big] + P(N)\mathsf{E}\big[U_E(65, O_{64}) j N\big]
$$

Where

$$
\mathsf{E}\big[U_R(65, O_{64}) j S\big] = \log(b_{65}) + \gamma + \delta_2 \log A + \alpha_2 \mathsf{I}_F + \mathsf{E}\big[\varepsilon_{R65} j S\big]
$$

Where

$$
\mathsf{E}\big[\varepsilon_{R65} j S\big] = \int_{\Psi(65, O_{64})}^{1} \epsilon_R \frac{f_{\epsilon_R}(\epsilon_R)}{P(S)} d\epsilon_R
$$

$$
\alpha_2 \mathsf{E}\big[\mathsf{I}_F j S\big] = \alpha_2 P(\text{ husband retired } j S)
$$