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EFFECTS OF PARENTAL LEAVE REFORM ON THE GENDER PAY GAP: EVIDENCE FROM SPAIN

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Resumen

¿El permiso parental igualitario reduce las diferencias salariales entre hombres y mujeres? Desde 2020, España ha implantado un permiso obligatorio de 4 meses tanto para padres como para madres. Este cambio en la regulación permite diseñar un experimento cuasi-natural. La literatura sugiere que la discriminación de género tiene un fuerte vínculo con las políticas de permisos parentales. Dado que las mujeres han cargado históricamente con el proceso de crianza de los hijos, especialmente en los primeros meses del recién nacido, los empleadores podrían reflejar su mayor permiso parental en sus salarios, ya sea ofreciéndoles menos ascensos o pagándoles de hecho peor. Dado que la reforma iguala el periodo de permiso tanto para hombres como para mujeres, cualquier incentivo a la discriminación vinculado a los periodos de permiso dejaría entonces de existir, lo que permite esperar que la diferencia entre géneros se acorte en el periodo posterior a la reforma. La metodología de diferencias en diferencias aplicada aquí permite comparar a hombres y mujeres antes y después de la reforma, estimando la reducción de la brecha salarial entre hombres y mujeres. Habiendo muestreado a más de 400 mil trabajadores de España en dos periodos diferentes, 2018 y 2022, este estudio muestra que la brecha entre trabajadores y trabajadoras se ha acortado entre un 1,0% y un 1,4%. A continuación, este resultado se amplía para captar la posible discriminación vinculada a la maternidad, comprobando cómo ha afectado la reforma a la denominada penalización por maternidad. Una vez más, el modelo indica una reducción del 39,4% en la penalización de pago experimentada por las madres recientes tras la aplicación de la reforma. Estos resultados se ven confirmados por otras pruebas de robustez, lo que sugiere un resultado efectivo de la reforma en la reducción de la discriminación entre trabajadores y trabajadoras en el mercado laboral.

Abstract

Do equal parental leave reduces the gender pay gap? Since 2020, Spain has implemented an 4-month obligatory leave for both fathers and mothers. This change in regulation allows one to design a quasi-natural experiment. Literature suggests that gender discrimination have a strong link with parental leave policies. Since women have historically burdened the child-raising process, especially in the newborn's first months, employers might reflect their larger parental leave in their wages, either through providing them with fewer promotions or effectively paying them worse. Since the reform equals the leave period for both men and women, any incentives to discrimination linked to the leave periods would then cease to exist, allowing one to expect the gap between genders to be shortened in the period after the reform. The difference-in-differences methodology applied here allows for comparing men and women before and after the reform, estimating the reduction in the gender pay gap. Having sampled over 400 thousand workers from Spain in two different periods, 2018 and 2022, this study shows that the gap between male and female workers has been shortened between 1.0% and 1.4%. This result is then expanded to capture possible discrimination linked to motherhood, testing how has the reform impacted the so-called motherhood penalty. Once more the model indicates a reduction in the of 39.4% in the payment penalty experienced by recent mothers after the implementation of the reform. These results are then confirmed by further robustness tests, suggesting an effective result of the reform in reducing the discrimination between male and female workers in the labor market.

Contents

1 Introduction

Since 2007, paternity leave policies have been facing constant reforms in Spanish law. While maternity leave has been raised from 2 to 16 weeks in 1988, remaining at this level, paternity leave suffered its first reform in 2007, passing from four days to 2 weeks. This period was sequentially augmented in 2017 and 2018, passing to four and five weeks, respectively. Finally, through the "Real Decreto -ley 6/2019" (Gobierno de España, 2019), the leave for fathers was equalized to the mothers' in 16 weeks (Gorjón and Lizarraga, 2024).

The *Real Decreto* was developed with the specific goal of equalizing the labor conditions of men and women. Besides payment and the under representation of women, the legislation also focus on creating adequate environments for female workers, both in the hiring process as in discrimination and harassment in the work place. The Decree-Law came into force with the start of 2021. Although there are projects aiming for another expansion of the benefit to 20 weeks of leave, this reform has not yet taken place.

Even though the benefit allows for four months of absence from work, only the first six weeks must be taken right after the birth. The other 10 weeks can be used during the first year of the newborn. The leave must be taken in complete weeks and cannot be transferred between parents. Besides the 16 weeks, parents are both allowed to take feeding leaves, which are composed of two half-hour breaks. While the 16-week leave is fully financed by the Spanish Social Security system, the breastfeeding leave should be payed by the employer.

The adoption of equal parental leave policies aligned Spain with other European nations, such as Poland and Scadinavian countries, where paternity leave was equalized decades earlier. Historically, Spain has had low levels of female participation in the labor market. In 1991, for instance, Spain presented a 33.3% rate of female labor force participation, compared to a rate in other High Income countries of 50.8%.

Considering the Global Gender Gap Index, estimated by World Economic Forum, which measures the equality between men and women in four axis (Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment), Spain ranks 10th out of 146 economies, as of 2024. This ranking puts the country just below Scandinavian countries and other economies centered towards gender equalities, like Germany and Ireland.

In fact, historically Spain has promoted a series of policies aimed at creating equal conditions to men and women, resulting in considerable improvements in gender disparities found in the country (Sánchez, 2021). Bustelo (2016) deems the policies promoted in re-democratization period as state-feminism, pointing to both national and regional initiatives in creating gender-equal environments.

Within this context, the recent parental leave reform therefore allows for designing case-study methodologies regarding effects on gendered outcomes in labor markets. That is, this change in the legislation offers an opportunity to investigate the impacts of equal parental leave on gender employment and wage gaps deploying a quasi-natural experiment design to develop a proper difference-in-differences model.

Besides this introduction, this study is also divided into five more sections. Firstly, I present a literature review, indicating similar findings from previous studies. Then, the data used to develop results is presented, showing the particularities and limitations from it. In the fourth section, I discuss the methodology used for finding the results, presenting, in two different subsections, the main model and a further extension through an auxiliary dataset. Furthermore, in the fifth section, I discuss the results, explaining the main intuition behind the findings. This section is complemented by a robustness test. Finally, from each finding, I present the conclusions that may be derived from this research, also discussing what can further explored in future studies.

Overall, results indicate that the reform had a positive effect in reducing the gender wage gap. These findings are confirmed by an extension model. Even though the reform had positive outcomes, there are a series of caveats that must be dealt with the proper attention. Results show to be robust and available to derive further conclusions regarding the effectiveness of the reform and possible points of attention to future reforms.

2 Literature Review

The effect of maternal leave on the gendered biases of job opportunities and compensations has been central in the literature regarding the gap between men and women in the labor market. Plantenga et al. (2006) points out to the ambiguous impact it may have on female workers: while the existence of maternal leave creates incentives for women to be connected to a specific firm or even the labor market as a whole, its costs may also be transmitted from the employer to the employee, deepening gender gaps. The authors suggest equal and not extensive paid leaves for parents as a policy to lessen pay gaps. In the same direction, Nicodemo (2009) describe the unequal distribution of parental leave as a source of labor market discrimination, sometimes forcing women out of the labor force. Using data from the EU-SILC database, containing entries for 26 countries in the European Union, Cukrowska-Torzewska and Lovasz (2020) find opposite trends in Southern Europe and Nordic countries. While in the earlier, motherhood is associate with slight improvements in female workers' wages, in the latter it's associated with small but significant wage penalties.

From a theoretical point of view, Villa et al. (2020) point that gender pay gaps may be surge as the result of statistical discrimination mechanism. Through a Rational Expectation Equilibrium (REE) model, the authors point that the employer's belief that women are more prompt to engage in child-rearing activities and housework, thus reducing the labor supplied by female workers. For unskilled workers, this differences are further accentuated, since women present a different set of physical endowments, once more negatively affecting the labor supplied by them.

The motherhood penalty (MP) (i.e., the wage or employment reduction women face when having children) is fairly document. More broadly, the motherhood penalty is associated with productivity impairments and employer discrimination, by usually being expected to be less productive or dedicate less hours into work due to child-bearing responsibilities (**?**). Such is the case in Stevens et al. (2004), where in a labor survey, 20% of women returning from a maternity leave would be forced into accepting lower-status jobs and 40% would be forced to change employers. This means that the penalty may not be only expressed in lower payments, but also through hindering the career progression of mothers. When confronted with these numbers, managers and directors linked this behavior with business conditions. From these framework, Manning and Petrongolo (2008) found a large wage gap between full and part-time women. Although this difference is mostly linked to the type of job being done by these two modalities, even when controlling for occupation, authors find a raising trending in the part-time penalty among female workers. The authors link this behavior once more to the motherhood penalty, since marriage status and number of children also play a major role in this process. Cha et al. (2023), using data from 2018, indicates that the 29% of the gender wage gap is explained by the motherhood penalty. .

Even countries with consistent women-friendly policies, such as Denmark, faced a considerable set back in the political significance of gender equalizing proposals due to the Danish economy being affected earlier and harder by an economic crisis in the 1970s, a central period for similar policies in Sweden and Norway (Borchorst, 2008). Andersen and Shamshiri-Petersen (2016) also shows a stark contrast between gender equality perceptions in Denmark when compared to other Scandinavian countries, where the country's relative setback into women-friendly resulted in worse conditions for female workers in the labor market, as pointed by surveys.

From this sense, Åslund et al. (2025), discriminate between background composition in measures on motherhood penalty, comparing native and immigrant mothers in Sweden. Using a panel data, the authors create an event study following women's earnings before and after the birth of their first child in the country, controlling for the level of the gender wage gap from each worker origin country. However, the article indicates that overall labor markets trends in penalizing mothers affect all women in similar measures, presenting little to no effect over the dynamics of discrimination in the country. More recently, evidence from Barcelona shows that mothers tend to reduce their work supply after the birth of a child, with income, education and grandparents' playing a major role on this decision. Most interestingly, cultures where grandparents play a major role in the child's raising are linked to smaller penalties for mothers, as found by Meng et al. (2023). Using data from China, the paper identifies that in rural regions, where grandparents are closely linked to the nuclear family, the weight of having a child affects mothers in a relatively lesser extent when compared to more urbanized regions. This is linked to the amount of work women are forced to sacrifice when having kids being considerably small when grandparents can share the baring of the child.

More recently, Diallo et al. (2025) used administrative data to estimate the effect of the parental leave reform in Quebéc, Canada in 2006, which granted five weeks of paid leave to fathers. The authors examined the effects of the reform on workers who have been parents right after the reform, replicating the analysis twenty years later, with the same subset of parents. Results show that immediately after the reform, male participation in child-raising went up, while their wages were reduced. On the long run, however, the reform had no impact in earnings or employment for both of the parents.

On the other hand, equal parental leave has been often pointed as a source of gender equality. Castro-García and Pazos-Moran (2016) present evidence indicating that equal and mandatory parental leave has actually increased the participation of fathers in child raising. The authors pose equal parental leave as a necessary step for equal participation of men and women in the labor market. Heymann et al. (2010) also shows the compatibility of paid leave with maintaining levels of employability and wages.

The MP has shown to be responsive to gender egalitarian policies in the labor market. Kluve and Tamm (2013) use the *Elterngeld* policy change in Germany, which expanded benefits and equalized part of the leave period, as a natural experiment. Authors find that the costs of motherhood were considerably reduced and the father's participation on the child raising jumped from 4% to 16% after the policy implementation. For instance, the penalty in mothers' wages is considerably reduced following the expansion of child-care services. Using Canadian data, Patnaik (2016) suggests a 25% expansion of women's labor supply and earnings from the baseline after a reform in the leave benefits. This raise in female worker's wages serves as reduction source for gaps between men and women.

Andersen (2018) uses five distinct Danish parental leave reforms in a sample of first-time parents, providing an analysis of household dynamics before and after these reforms. The paper indicates that the within-household wage gap is reduced through extending the father's leave and overall a stronger involvement of the father in the child's care-taking is a route to more gender equality. One import caveat of this study is to identify that other policies played a major role in changing the parental leave dynamics. From the same institutional point of view, Petersen et al. (2014) uses employer-employee datasets from Norway in order measure changes in gaps from within families in response to reforms in parental leave policies. While the father's premia stayed relatively the same throughout the sample, the mother's penalty faced considerable reductions throughout the period. The fixed-effects model developed links this behavior to the considerable reductions in working hours and small inequalities among salaries. The combination of these two dynamics affect considerably mothers: if high payment comes only after long hours, women with small children will tend to opt out of these positions. In this sense, child-care services, while mostly irrelevant for high earning families who can afford private services, may have major impacts for poorer families.

Other labor reforms have been able to reduce gender discrimination. Caliendo and Wittbrodt (2022) builds a difference-in-differences model to identify the effect of minimum-wage reforms in the gender wage gap among low-earning workers in Germany, between 2014 and 2018. Authors find a substantial reduction in the gap between men and women in the 10th percentile of the wage distribution. This results do not hold, however, for wages above the median value. **?** indicate that wage transparency is a possible source of reduction of the gender wage gap. The authors point especially to the effects of the *Real Decreto* 902/2020, which creates the obligation for companies with more than 50 employees that operate from within Spain, to provide data on wages and gender.

3 Data

In order to better design the analysis as a quasi-natural experiment, this study deploys two sets of microdata. The "Wage Structure Survey" ("*Encuesta de Estrutura Salarial*" or the EES) is an inquiry promoted by the *Instituto Nacional de Estadística* each four years. Given this periodicity and the timing of the Parental Leave Reform, which took place in 2020, the two latest surveys (from 2018 and 2022) allows for an adequate analysis. Since both surveys took place, respectively, two years before and after the reform, the EES shows are proper source for this study.

The EES uses the registers of the Spanish Social Security, which are collected through about 28,500 thousand establishments in each year. These establishments answer a questionnaire consisting of questions on wages, gender, type of contract, immigration status, age, years of seniority, occupation, among other information related to the establishment's characteristics, such as size, sector, whether the establishment is public or not. In other words, the EES allows for developing interesting policy analysis given the level of granularity present in each entry. In this section, I explain each of these variables, pointing out the possible limitations present in data.

The variable "Seniority" does not represent the total experience a professional possess, rather the time that a specific individual is employed in that specific establishment. This represents a limitation to the analysis, since the total experirncr of an employee has a direct impact on his or her earnings. For this reason, the variable named as "Seniority" represents a proxy of the real experience of worker. In the same sense, the variables "Age" and "Education" are represented as groups rather than the real numeric entries for each worker. The "Age" variable are presented as groups containing intervals of age of each worker. "Education", rather than representing the total years of study of an employee, indicates the level of education achieved in seven groups (1 - Less than primary, 2 - Primary education, 3 - Lower secondary education, 4 - Upper secondary education, 5 - Post-secondary non-tertiary education, 6 - Tertiary education (up to 4 years), 7 - Tertiary education (more than 4 years)), however, for econometric purposes, this variable is assumed as quantitative. Finally, worker entries also present variables for sex (male or female, present in the dummy variable "Female") and whether the individual is Spanish-born or not. From the latter entry, it is build the variable "Immigrant" which is dummy indicating if an individual was born outside of Spain. The EES does not present information relative to the type of immigrant (e.g., refugees), country of origin or the years in Spain since migration. Both datasets also show relevant aspects of level, which are relevant for specifying the model described bellow. All these variables are from now on referred as individual-level controls.

Data also encompasses specificities of the work contract of each worker: whether the worker is hired through a fixed or undetermined period contract and whether the journey contracted is part-time (10h/week or 30h/week) or full-time (40h/week). Firms are classified in public, private and NGOs. This classification was expressed as the dummy variable "Public". Company size, as other variables, is rather expressed in eight groups, each representing the range of the number of employees in a company (*1* - 1 to 4 employees, *2* - 2 to 9 employees, *3* - 10 to 19 employees, *4* - 20 to 49 employees, *5* - 50 to 99 employees, *6* - 100 to 199 employees, *7* - 200 to 499 employees, *8* - more than 500 employees). Other establishment-related variables include "Legislation", meaning the type labor regulations and union coverage present in a workers contract; and "Market Size", indicating the geographical dimension of a business presence (*1* - Local/Regional, *2* - National, *3* - European Union, *4* - Global). All these variables are called in future sections "Firm-Level Controls".

The "Occupation" variable follows the National Classification of Occupations, indicating with fairly factual level the position occupied by each worker. The granularity of information linked to occupation is however limited. A more detailed occupational description could offer more interesting insights. Nonetheless, the granularity of this entry offers an overall perspective of the abilities an employee possesses as well as the specific wage dynamics of that position, allowing for interesting results in our model. Each occupation is presented in Table 1. Regarding sectors, the EES uses the classification present on the CNAE-09 (*Clasificación Nacional de Actividades Económicas*), encompassing the groups from B to S [1]. Both sector and occupation variables are used as fixed effects in the models developed in the next section. Considering the low granularity of the data, this variables are helpful to capture the dynamics from within each industry.

Salary entries represented the wage earned by a worker in the month of October, in the two waves the survey was conducted (i.e., October/2018 and October/2022). However, the EES also included other entries regarding special payments, such as paid leave taken by the employee during the year prior to the survey. All monetary values are brought to present value, as of March/2025, using Spain's Consumer Price Index, as published by INE.

Given that women are more prone to take part-time jobs than men, considering female workers often assume housekeeping and child-raising responsibilities more often than their partners [2]. This

[1] B - Extractive Industries, C - Manufacturing Industries, D - Administration of Energy, Gas, Vapor and Air Conditioning, E - Administration of Water and Residuals, F - Construction, G - Retail, H - Transports and Storage, I - Hotels and Tourism, J - Information and Communication, K - Financial Activities, L - Real Estate, M - Scientific and Technical Activities, N - Administrative and Auxiliary Activities, O - Government and Defense, P - Education, Q - Sanitation and Social Services, R - Entertainment Activities, S - Other Activities.

[2] In 2018, 66.1% of part-time positions were occupied by women. In 2022, this number went up to 67.1%

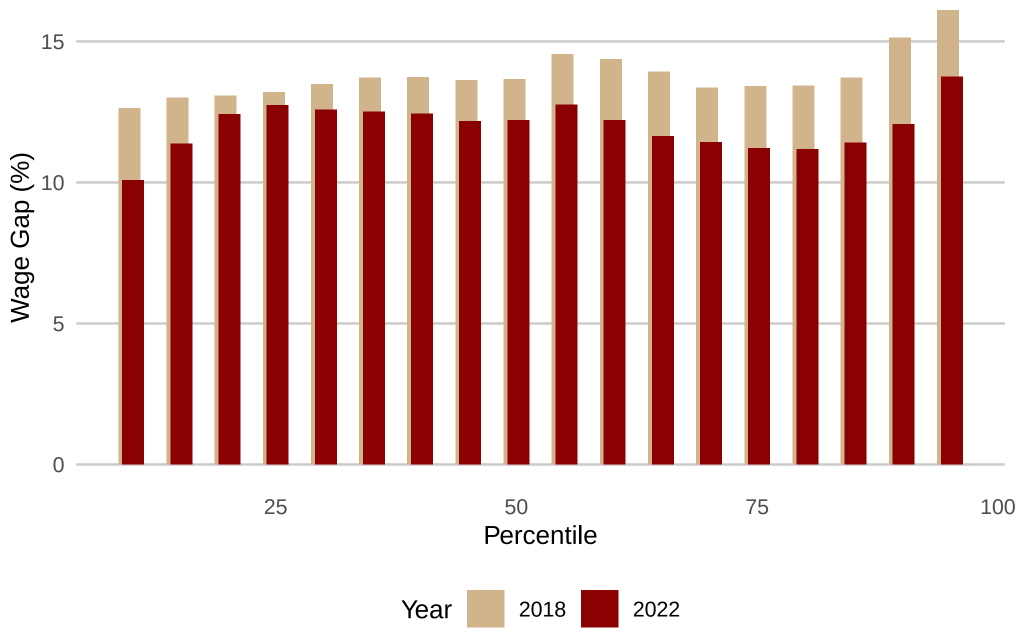

Figure 1: Hourly Wage Gap between male and female workers

dynamic is especially perceptible in Spain (Álvarez and Miles-Touya, 2016). For this reason, the salary entries are converted to hourly earnings, accounting for every worker's monthly wage, as well as special remunerations, paid overtime, and bonuses. This approach limits the influence part-time jobs may have on gender pay gaps.

The Table 1 below presents a summary of statistics for variables in 2018 and 2022. All monetary values were deflated to values of march of 2025. For all entries, the mean and standard deviation are referenced to the hourly earnings of each worker in that subgroup, with exception of seniority, which refers to the average seniority a worker has in the position, as measured in years. In a simple average analysis, the average female hourly earnings grew 22 cents, while average male hourly earnings grew by 16 cents. This evidence indicates a reduction of the gender pay gap, which passed from 2.40 /hour in 2018 to 2.34 /hour in 2022, as estimated by the average wage from each gender.

At the appendices, a table of descriptive statistics for each sector may also be found. The Table 6 follows the same structure as the one presented above.

Figure 1 shows the gaps between male and female worker's wage for each percentile. As pointed before, even though the gender wage gap (as measured by the average wage) was reduced in 6 cents/hour, the differences are small. Nonetheless, it is important to notice that presence of glass ceiling, present in the figure bellow. Gender wage gaps increase along with the distribution, accelerating in the upper tail Albrecht et al. (2003). Most interestingly, one may see a considerable reduction in the wage gap in both of the extremes of the distribution. On the 95th percentile, for instance, the wage gap dropped 2.35 percentage points in the periods before and after the reform. In the same sense, it also possible to point a major eduction in the gender wage gap in the lowest percentiles, which suggest that sticky-floors have also become less prominent. Conversely, wages were less affected between the second and third quartiles of the hourly payments curve.

Although the EES presents a complete and understanding set of entries of the Spanish labor market, there are a number of limitations that should be taken into account. The first of them would be the absence of any variable linked to marriage or parenthood of an employee. Since the main goal of this paper is to measure wage gap reductions promoted by the equaling of paternity leave, having information about whether an individual has taken a parental leave or not. Unfortunately, as mentioned before, the only information regarding this topic is the number of days take as absence in October of a given year, not allowing for properly identifying the cause of the absence. This means that from the dataset it

Table 1: Summary Statistics

Variable	2018 N	2018 Mean	2018 SD	2022 N	2022 Mean	2022 SD
Hourly Earnings	216,708	19.31	43.35	240,473	19.46	39.78
Monthly Earnings	216,708	3225.36	7162.20	240,473	3280.47	6758.49
Seniority	216,708	10.65	10.18	240,473	10.92	10.31
Age Groups						
Less than 19 years old	532	10.45	13.36	717	11.22	17.23
20-29 years old	21,075	14.18	31.47	24,425	14.96	31.46
30-39 years old	52,928	17.95	39.36	49,305	18.51	40.30
40-49 years old	72,438	19.53	40.36	77,933	20.19	40.54
50-59 years old	54,074	21.35	47.60	65,934	20.46	39.75
More than 60 years old	15,661	22.95	63.29	22,159	21.23	44.05
Education Levels						
Less than primary	1,943	13.76	22.98	1,227	15.46	35.15
Primary education	34,312	14.64	28.27	33,538	14.93	32.33
Lower secondary	50,038	15.64	39.99	56,293	15.57	32.55
Upper secondary	45,423	17.85	42.10	48,893	17.90	41.74
Post-secondary non-tertiary	21,475	20.19	46.51	24,673	20.52	43.25
Tertiary (up to 4 years)	24,545	22.53	47.77	35,831	22.18	41.63
Tertiary (more than 4 years)	38,972	27.56	53.48	40,018	27.65	46.40
Demographics						
Male	94,164	20.35	46.10	107,815	20.51	41.45
Female	94,164	17.95	39.45	107,815	18.17	37.57
Immigrant	12,043	17.13	36.10	16,462	17.15	33.62
Employment Characteristics						
Public Sector	35,543	23.64	50.55	44,338	23.98	47.20
Part-Time	38,950	15.69	45.28	42,903	15.15	35.51
Fixed Contract	44,425	16.13	42.21	25,973	19.15	42.68
Occupation						
Directors and managers	6,958	39.34	70.87	7,904	35.88	47.57
Health and education professionals	14,223	26.16	48.84	16,792	28.91	58.73
Other professionals	23,085	25.50	54.78	28,666	23.97	40.61
Associate professionals	34,746	21.94	52.41	39,187	20.38	39.09
Office clerks (internal services)	15,603	17.98	35.56	15,130	17.39	33.43
Office clerks (customer-facing)	14,581	15.59	31.18	17,240	15.21	30.41
Hospitality and retail workers	14,385	13.82	28.94	14,917	14.04	29.91
Health and care workers	12,780	14.42	31.91	14,597	15.14	33.43
Security services workers	4,851	16.34	32.49	5,661	16.88	36.88
Skilled agric. and fishery workers	811	17.04	33.16	821	16.07	23.48
Skilled construction workers	7,052	13.74	22.44	5,936	15.01	29.24
Skilled manufacturing workers	21,391	17.60	37.46	22,405	18.15	39.66
Machine operators and assemblers	10,929	19.39	56.41	10,544	23.24	56.93
Drivers and transport operators	8,183	16.73	32.62	9,963	16.34	33.39
Unskilled service workers	13,729	12.99	26.17	15,336	12.81	24.28
Agric., construction, and transp.	13,350	15.12	34.20	15,346	16.95	40.90
Military occupations	51	11.43	4.21	28	16.36	16.33

is also not possible to identify whether the worker had benefited from the parental leave in any of the waves of the survey. Additionally, information about wages is limited to the gross salary, not presenting differences in contributions for social security or taxes each individual may experience. Finally, since the dataset is a cross-section rather than a panel, it is not possible to derive any conclusions regarding family dynamics, such as the within-household gender gap and how are tasks divided between parents. On the presence of any of this variables, more precise results could be found from the dataset.

4 Methodology

The approach selected to measure the change in the gender pay gap, as an effect of the parental leave reform, is the difference-in-differences methodology. Since Card (1992), DiD regressions have been instrumental in providing insights into labor market responses to public policy changes. The DiD design needs two groups and two periods. The pivotal assumption here is that groups behave similar before the treatment ($t = 0$), and only one of the groups is affected by the treatment, composing the post-tratment period ($t = 1$). Although the parallel trends assumption cannot be directly tested, the inclusion of rich individual and firm-level controls mitigates potential bias. By constructing a robust counterfactual, this methodology enables a comparison of treatment and control groups before and after the reform, establishing a causal link between the policy and its effects.

Figure 2 shows the wage densities for both male and female workers in both time periods. As we can see below, wages behave mostly equal, with female workers being mostly concentrated around slightly smaller earning levels. This figure is specially helpful in producing a visual reference for the parallel trends assumption behind the model. As it is possible to notice in below, the figure also suggests an approximation of the distributions of male and female workers. It is important to notice that deflating to present value the hourly minimum wage (for a 40h work week) would be 5.57/h for 2018 and 7.94 /h. Once more, aiming to expand the discussion on the penalties linked to part-time work, so relevant to female workers, in the appendices I show the same figure segregate between part-time and full-time journeys.

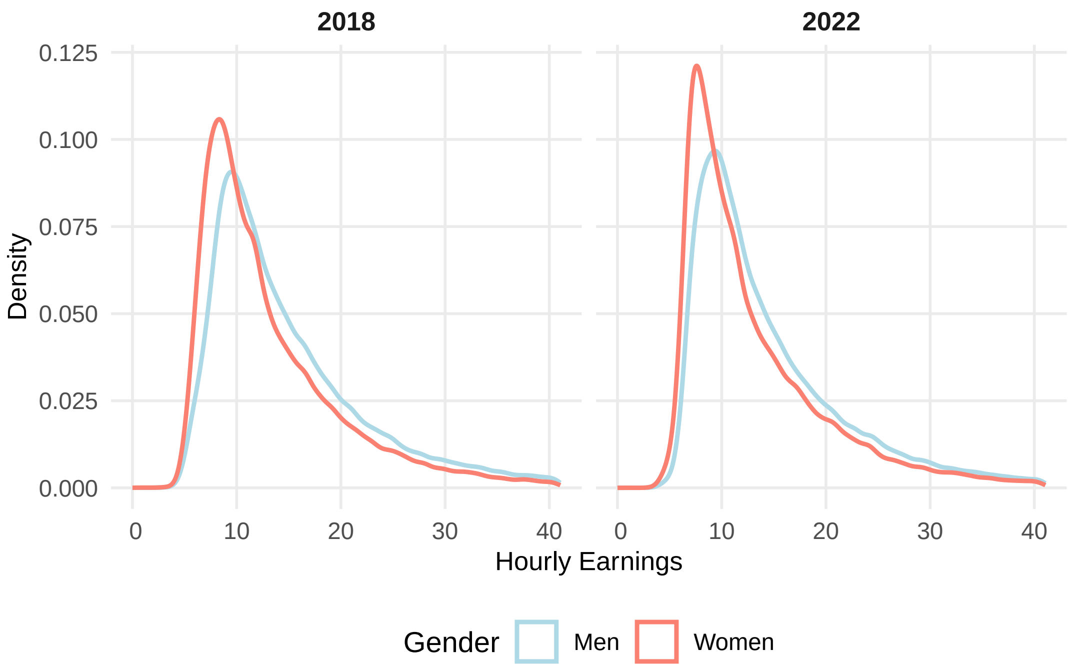

Figure 2: Wage Densities for Male and Female Workers in 2018 and 2022

In this context, the parental leave reform serves as the central event distinguishing pre- and post-treatment periods. While women posses the same leave period before and after the reform - composing our control group -, men have had their leave period expanded after 2020, which allows for designing a treatment group. This proposed methodology offers an unique approach to the gender pay gap problem, providing novelty results. The model here developed uses female workers as a control group for their male counterparts, the treatment group. In this sense, the central assumption here is that men and women differed essentially in the period of obligatory parental leave period. Hence, the estimator measured by the model shows an the average effect of the reform over male workers. This design allows to contour the limitations imposed by the dataset, where no information regarding the family and children of the workers is available. Additionally, considering that the data on the source of absence of a workers is also not available, it is not possible to identify, by any means, whether the worker has taken a parental leave in the selected time-frame.

This approach is heavily based on the one developed in Didier (2021), where the author also deploys similar control and treatment groups. From this framework, this method considers wages as a reflection of an individual's position in the labor market into the labor market, responding to the his or her skills and seniority, as well as the sector the worker is part-taking. A similar design was conducted in Moreno-Galbis and Wolff (2008), where the authors measure changes in gender discrimination in salary in France, using two samples of the labor-related microdata survey.

Additionally, the difference-in-differences model developed above is also tested using fixed effects for occupation and sector. This approach follows the line present in Millimet and Bellemare (2023), where fixed effects are described as a major source of causality. In other words, through including these fixed effects, the model aims to correctly isolate the policy reform effect on the gap between genders.

4.1 Empirical Model

Initially, in order to check how different groups reacted in the period, I estimate separate mincerian equations for male and female workers. The rationale behind this strategy is to identify how the different components define wages of men and women. By adding a dummy that identifies the post-reform entries, meaning the entries coming from the 2022 sample, it is possible to contrast how male and female workers seniority changes in their earnings between the two periods. Hence, we may formalize the model as follows:

$$Earnings_{it}^{male,female} = \beta_0 + \beta Post_t + \Gamma_1 X_{it} + \Gamma_2 Zit + \epsilon \tag{1}$$

The same model is applied both to the subset containing only male or only female workers, as deemed by each column of the table. The dependent variable is the log of hourly earnings for each worker. The variable $Post_t$ is a dummy indicating whether the observation comes from before or after the reform.

To better capture the determinants of wages, we follow the seminal work developed by Mincer (1976). Thus, our specification includes the variable for $Expe-rience_{it}$, which indicates the seniority of worker i in the year t, the variable $Edu-cation_{it}$, which indicates the level of education of a worker, Age_{it}, which indicates the age group of the worker at the time of the survey, and $Immigrant_{it}$, a dummy indicating if the worker was born outside of Spain. In this sense, the model adds to vectors of controls: X_{it}, which contains variables linked to each employee, meaning educational level, age [3], seniority on the position, immigration status - a dummy indicating whether the worker is an immigrant or not - for each worker i at each year t; and a vector Z_{it}, which are named from now on "Firm-Level Controls", which shows a number of variables linked to each business, meaning whether the contract is for a part-time or full-time journey, the geographic scope of the firm's business, the labor regulation, and union coverage of the employees. All these variables are explained in depth in the "Data" section. To each vector of controls there is a vector of estimators (Γ_1 and Γ_2), each one of theme associated to one of the control variables. The results, containing selected controls are presented in the table 2 below.

The coefficient for the post-reform dummy is negative for both genders, but the decline is smaller among women, suggesting a narrowing of the gender wage gap. This trend serves to reinforce the idea

[3]The model also includes the squared values for the age and seniority. This is important since earnings tend to present diminishing returns as workers get older. The estimator associated to this variable is negative, indicating this concave relation between age and earnings.

Table 2: Gender Segreggated Regressions

	Dependent variable:	
	log(Hourly Earnings)	
	Male	Female
Post	-0.034^{***}	-0.021^{***}
	(0.002)	(0.002)
Seniority	0.014^{***}	0.011^{***}
	(0.0003)	(0.0004)
Education	0.120^{***}	0.123^{***}
	(0.001)	(0.001)
Age	0.170^{***}	0.101^{***}
	(0.006)	(0.007)
Immigrant	0.054^{***}	0.071^{***}
	(0.004)	(0.005)
Part-Time	-0.095^{***}	-0.069^{***}
	(0.004)	(0.003)
Observations	255,202	201,979
R^2	0.248	0.243
Adjusted R^2	0.248	0.243
Residual Std. Error	0.545 (df = 255180)	0.546 (df = 201957)
F Statistic	$4{,}003.808^{***}$ (df = 21; 255180)	$3{,}086.802^{***}$ (df = 21; 201957)
Note:		*p<0.1; **p<0.05; ***p<0.01

of a shortening in the gap between genders, already suggested in Figure 1. The difference between the estimator suggests that for male workers, post-reform salaries saw a reduction of 3.4%, while for female workers the reduction was of 2.0%. This pattern also appears in the variable $Part-Time_{it}$, where the penalty related to this type of contract is smaller for women than it is for men. This serves as evidence for better allocation of demands linked to motherhood, as women usually migrate to part-time positions after the birth of child (Manning and Petrongolo, 2008). Other than that, the variable shows slightly larger returns from education for male workers, as well for bigger returns linked to age. Female employees on the other hand receive a bigger premia linked to immigration. However, these results may reflect aggregate shocks affecting both groups, thus motivating the DiD specification.

The second model aims to capture a more causal approach. As the difference-in-differences design suggests, the effect of interest can be measured interacting through the interaction of variables taking part in the model. Here, the model aims to capture the reduction in the gender pay gap as a result of the policy change, introduced in 2020. In other words, the model here deploys a quasi-natural experiment design. A positive coefficient would indicate a narrowing of the wage gap. Hence, we can represent the model as follows:

$$Earnings_{it} = \beta_0 + \beta_1 Female_i + \beta_2 Post_t + \beta_3 Female_i \times Post_t + \Gamma_1 X_{it} + \Gamma_2 Zit + \epsilon \tag{2}$$

The dependent variable is once more the hourly earnings of a given worker, presented in log for ease of interpretation. To capture the gender wage gap, the model includes the dummy variable $Female_i$, indicating whether the worker i is male or female. The variable $Post_t$, as before, is a dummy, that indicates if the wage entry comes from the 2018 or the 2022 survey, meaning before and after the reform, respectively. The difference-in-differences design comes from the interaction of both variables. Through interacting both entries, the estimator captures the effect level of the wage gap between men and women, after the parental leave reform. Since our hypothesis is that the gap could be closed - or at least shortened - by the reform, we would expect to see the estimator of the interaction variable to be positive. In the results below, this interaction is called $Treatment_{it}$.

In the same sense as before, the model possesses two set of controls, deemed X_{it}, for worker-level controls, and Z_{it} for firm-level controls. In order to investigate the dynamics of the model, we test the regression with only the employee related controls and with both set of controls. Additionally, I also test the inclusion of fixed effects linked to occupation and sector. This different iterations with the model aims to produce a robust conclusion, expanding the level of causality of the results. The Table 3 shows the results of the model.

The estimator is positive irrespective to the presence of firm-level controls or fixed-effects, varying on the scale of the effect on each iteration. On simple OLS regressions (models 1 and 2) the estimator associated to the variable $Treatment_{it}$ is shows that the reform has had the intended effect, shortening the gap between male and female workers on by 1.3-1.4 percentage points. For the fixed effects, however, the estimator indicates that the parental leave reform reduced the gender wage gap by approximately 1.0-1.3 percentage points.

In order to better isolate the effects of the parental leave reform on the gender wage gap, I include the fixed effects for occupation and sector. Rather to include these categorical variables as dummies, through using them as fixed effects, the model allows for each sector and occupation to have their own intercept, capturing wage-setting dynamics from each sector and occupational segregation between genders. In this sense, moving from the simpler model (1 and 2) to a fixed-effect approach (models 3 and 4) guarantees a more robust approach to the analysis being conducted. Nonetheless, it is interesting to point out that the findings here produced are strongly linked to the specification being adopted.

The change in the scale of the treatment coefficient shows the relevance of a proper identification strategy. This variation is consistent with the set of fixed effects present in models 3 and 4, showcasing that without a robust model, the policy effect might identify a slightly bigger effect. Hence, it is possible to say that, as per the identification strategy, the model indicates positive returns related to the policy, although considerably sensitive to identification strategy.

In both models β_0 is the intercept and ϵ is the error term.

Table 3: Difference-in-Differences Models

	Dependent variable:			
	log(Hourly Earnings)			
	(1)	(2)	(3)	(4)
Treatment	0.014***	0.013***	0.011***	0.010***
	(0.003)	(0.003)	(0.003)	(0.003)
Female	−0.189***	−0.172***	−0.139***	−0.130***
	(0.002)	(0.002)	(0.002)	(0.002)
Post	−0.032***	−0.034***	−0.030***	−0.031***
	(0.002)	(0.002)	(0.002)	(0.002)
Seniority	0.019***	0.013***	0.017***	0.011***
	(0.0002)	(0.0003)	(0.0002)	(0.0003)
Education	0.133***	0.122***	0.075***	0.066***
	(0.0005)	(0.001)	(0.001)	(0.001)
Age	0.166***	0.143***	0.138***	0.120***
	(0.005)	(0.005)	(0.005)	(0.005)
Immigrant	0.064***	0.061***	0.065***	0.058***
	(0.003)	(0.003)	(0.003)	(0.003)
Part-Time		−0.087***		−0.053***
		(0.002)		(0.002)
Fixed Effects			✓	✓
Firm-Level Controls		✓		✓
Observations	457,181	457,181	457,181	457,181
R^2	0.225	0.251	0.276	0.299
Adjusted R^2	0.225	0.251	0.276	0.299
Residual Std. Error	0.556 (df = 457171)	0.547 (df = 457157)	0.537 (df = 457138)	0.529 (df = 457124)
F Statistic	14,743.370*** (df = 9; 457171)	6,674.682*** (df = 23; 457157)		

Note: *p<0.1; **p<0.05; ***p<0.01

4.2 Extension for the Motherhood Penalty

In order to enhance the results presented from the Difference-in-Differences model, another model can be developed to test the motherhood penalty. This model aims to identify the main mechanism through which the reform helped reduce the gender wage gap. In other words, to develop a channel analysis. Since the main hypothesis behind the previous model is that the reform would help equalize costs between men and women in the labor market, testing the effects the reform had on the wages of mothers vis-a-vis other workers may offer a major causality to the findings of the previous section. Although the data used, *Encuesta de Estrutura Salarial*, does not provide information regarding the parental status of the worker, using the *Encuesta de Fecundidad* dataset allows for developing interesting insights about the motherhood penalty, aiming to make the previous results more robust.

The *Encuesta de Fecundidad*, from now on called EF, contains information regarding fertility decisions from men and women in Spain. It presents microdata indicating whether each individual had children, how many children, besides characteristics from each individual, such as job related variables (occupation, public/private sector, age, among others). The main limitation from this survey is that it is scarcely conducted, so far this dataset has been published in three waves: 1985, 1999, and 2018. As the most recent survey has been coincident with the EES dataset of 2018, used in the previous model, it is possible to deploy the EF into the analysis. Some descriptive statistics for the relevant variables from the EF dataset can be found in Table 7 in the Appendices.

To better make use of this dataset, I limit the observations to workers (removing any self-employed, business owners, and retired individuals), making it more aligned with the EES survey, that also contains only workers. One important assumption here is that the choice for having children did not change before and after the reform. Since the most recent dataset is of 2018, we assume that workers from both EES surveys (of 2018 and 2022) have the same propensity to have children, given the same set of variables. This assumption aims to overcome the absence of any other dataset further than 2018. This validity of this assumption may be put into question, given that the reform might change the behavior of having children. Besides that, the Covid-19 pandemics might have been a major source of uncertainty, resulting in many couples postponing the expansion of their families (Zhao et al., 2024). To overcome this limitations, the prediction model below uses a series of controls to make results more compatible.

Since the parental leave reform equalized the leave period for both fathers and mothers, one might expect a reduction of the wage penalty mothers face after having children. In other words, after the policy reform, one might expect that the wage reduction faced by mothers is likely to be reduce, considering that now there is no mechanism for any payment discrimination between the parents. Hence, the model developed below aims to support the previous exercise, building a clear channel explanation to identify the source of the gender wage gap shortening, making the evidence shown before more robust.

From the EF, it is possible to develop a prediction model, to estimate the likelihood of a woman in our EES sample to be a mother. In other words, using coincident variables between the datasets, it is possible to use a the EF dataset to create predictions for our workers dataset, EES. Through these matching variables, the goal is to create a new variable, that identifies how likely a worker in the EES is to be father or mother. As a dependent variable for the prediction model, I use the recent parenthood variable, which identifies whether the worker has had any children in the last 3 years. This variable serves as a proxy for having children after the reform.

To estimate the likelihood of recent parenthood, I train gender-specific Random Forest classifiers (Breiman, 2001) using individual-level data from the 2018 Wage Structure Survey (EF 2018). The model included demographic and labor characteristics as predictors: age, education level, immigration status, type of contract, working time (part/full), and public sector employment. Predicted probabilities from this model were then used as continuous covariates in the main regression specification to capture the latent effect of parenthood on earnings. Opting for a Random Forest model here, over a logistic regression, for instance, allows the prediction to capture non-nonlinearities and interaction between variables, which would be hardly identified through logit models. Besides, since the model aims to work as a prediction, the dimension of the estimators is mostly irrelevant, making Random Forests once again more suitable here.

Using 500 decision trees, this estimator is then reapplied to the EES dataset to create a new variable, representing the likelihood of a worker to have been a mother or father. In other words, using the model trained through the EF dataset, I predict the propensity of a worker from the EES dataset to be a parent.

The recent parent likelihood estimator, presented as $\hat{Parenthood}$ below is derived from the matching variables of the EF and the EES datasets, being used respectively as train and prediction data. A similar approach to this model can be found in O'Leary et al. (2012), where authors use a support dataset to create a propensity variable. This is done through matching similar variables in the two different datasets, as what has been done here.

Below I present the regression model using this new variable, on the lines of Model (4) from the DiD , found in Table 3.

$$
\begin{aligned}
Earnings_{it} = \beta_0 + \beta_1 \hat{Parenthood}_{it} + \beta_2 Post_t + \beta_3 Female + \\
\beta_4 \hat{Parenthood}_{it} \times Post_t + \beta_5 Female_{it} \times Post_t + \\
\beta_5 \hat{Parenthood}_{it} \times Female_t + \beta_6 \hat{Parenthood}_{it} \times Female_t \times Post_t + \\
+ \Gamma_1 X_{it} + \Gamma_2 Z_{it} + \epsilon
\end{aligned}
\tag{3}
$$

Here, once more the dependent variable is the log of hourly earnings, for each worker i, in year t. The variable $\hat{Parenthood}$ shows the likelihood of a given worker i, to have been a mother or father in year t. Now the model features three interaction between variables. The estimator associate with $\hat{Parenthood}_{it} \times Post_t$ indicates the penalty associated with possibly having children after the reform. The estimator associate with $Female_{it} \times Post_t$ indicates the penalty associated with being a female worker after the reform (i.e., the same estimator found in the gender wage gap model from the previous section). The estimator associate with $\hat{Parenthood}_{it} \times Female_t$ indicates the wage penalty associated with a female worker likely being a mother, a proxy for the motherhood penalty. The estimator associate with $hatParenthood_{it} \times Female_t \times Post_t$ indicates the payment penalty associated with a female worker likely being a mother after the reform, the variable of interest here. The other variables shows the same structure as presented before in model (4). The variable $Post_t$ is a dummy indicating whether the observation comes from before or after the reform, Γ_1 is the set of individual-level controls, and Γ_2 is the set of firm-level controls. This model also features fixed-effects for occupation and sector.

Table 4 shows the results from the model above.

Table 4: Effect of Parenthood and Gender on Earnings

	Dependent variable:
	log(Hourly Earnings)$_{it}$
Female × Parenthood × Post	0.345***
	(0.061)
Female × Parenthood	-0.017
	(0.043)
Female × Post	0.006**
	(0.004)
Parenthood × Post	-0.012
	(0.030)
Female	−0.119***
	(0.003)
Post	−0.030***
	(0.002)
Parenthood	0.319***
	(0.023)
Observations	457,181
R^2	0.300
Adjusted R^2	0.300
Residual Std. Error	0.528 (df = 457120)
Note:	*p<0.1; **p<0.05; ***p<0.01

Firstly, all the dummies ($Female_{it}$, $Post_{it}$, and $\hat{Parenthood}_{it}$) show to be significant, indicating a continuing presence of gender wage discrimination ($Female_{it}$ is negative), salary reduction in the post-reform period ($Post_{it}$ is negative), but a bonus for parenthood, indiscriminate between men and women ($\hat{Parenthood}_{it}$ is positive). Although the model shows a penalty for parenthood after the reform, the estimator associated with $\hat{Parenthood}_{it} \times Post_{it}$ is not significant. Most interestingly, the interaction between $Female_{it} \times Post_{it}$, the main variable of interest in the previous section, confirms once more a reduction in the gender wage gap after the reform. This estimator is, however, smaller and slightly less significant than the one found in model (4) before. This suggests that other variables here offer more explanatory power, suggesting that the gender wage gap was reduced by 0.6%, rather than 1.0% found before. Simultaneously, the model captures the presence of the motherhood penalty in the dataset, negative estimator associated with $Female_{it} \times \hat{Parenthood}_{it}$, although this estimator does not appear as significant. Finally, the variable of interest shows a considerable reduction of the motherhood penalty after the reform. The $Female \times \hat{Parenthood}_{it} \times Post_{it}$ indicates that after the reform, the wage penalty associated with being a mother was reduced by 34.5%, suggesting a major shift in how the labor market deals with motherhood after the equalizing of the parental leave period between genders.

5 Discussion

Although in the difference-in-differences model, each interaction presents different approaches, they indicate a similar result: under the proper set of controls, it is possible to identify a reduction of the gender wage gap in the period after the parental leave reform. In this section, I discuss the results obtained in each model, also motivating the sensibilities that explain each finding.

The estimators associated to the variables "Seniority" and "Education" loose part of their explanatory power when under the "Firm-Level" controls (models 2 and 4). This might be explained by the inclusion of variables such as occupation and sector as controls in these models, which might offer a great level of explanation. For instance, given the occupation "Managers and Directors", individuals might posses roughly the same educational levels and comparable levels of tenure, reducing the weigh these variables have on wages. From the most robust model (4), it is possible to see that each year of seniority implies in a 1.1% change in the earnings of a worker. In the same sense, each step into education produces a 0.66% increase into wages. As shown in 2, while returns on tenure tend to be the same for male and female workers, returns on education still are bigger for male workers than for their female counterparts.

The estimator linked to the variable "Age" also shows decreases under the inclusion of firm-level controls. Most interestingly, 2 shows that the premia related to age is bigger for male workers than it is for female workers. While for men, each age group (see the "Data" section) is linked to a raise in 18.5% in the hourly earnings, for women the same number is 9.9%, almost half.

The "Immigrant" estimator shows an opposite direction of what was expected in literature. Canal-Domínguez and Rodríguez-Gutiérrez (2008) indicates a gap between native and an immigrants in Spain, mostly linked to the differences in productivity. However, the authors point that this disparity decreases across the wage distribution. Contrastingly, the estimator associated with immigrant workers shows a positive effect, indicating that these employees earn from 6.5% to 5.8% more than their native counterparts, as shown on the models present 3. This discrepancies between the findings and the other results present in literature may be accounted for the developments in the assimilation of immigrants into the Spanish economy. As pointed in Izquierdo et al. (2009), the gap between immigrant and native workers shows to be considerably shortened after the arrival of the immigrant in Spain. Since most of the results present in the literature are dated at the end of 2000s, it is possible to assume that not only most of immigrants saw a positive assimilation, but also that the Spanish economy improved in terms of absorbing this workers. Additionally, the difference in fertility between native and immigrant (García-Gómez et al., 2023), also offers an interesting opportunity for measuring the impact of parental leave reform among this population.

The most complete model, present as model 4 in table 3, which presents the widest set of controls in both individual and firm-levels, as well as fixed effects, indicate a modest shortening of 1.0% in the gender wage gap after the reform. Less controls, however, seem to indicate that the reform did not revert wage discrimination leading to women earning less in the period before. This fluctuation can be linked to the heterogeneity from work characteristics in the models.

In order to investigate this heterogeneity, as robustness check, I re-estimate the difference-in-differences model, using the definition from model 4 from table 3 for each subgroup. Figure 3 below shows the estimator for treatment (β_3, in the terminology of specification 2) from inside each group. In the figure, for each subgroup, it is presented the level of the estimator associated with the variable deemed $Treatment_{it}$ ($Female_i \times Post_t$). The figure also shows the confidence interval for each estimator. In all cases, the estimator showed to be significant at the level of 5%.

From this figure, it is possible to derive a number of observations. Initially, one may observe that irrespective of the contracted journey, full or part-time, the estimator remained positive. Nonetheless, the positive return was stronger to the part-time workers. This reduction is notable since one of the may sources of discrimination towards mothers is linked to the part-time penalty (Manning and Petrongolo, 2008). Since mothers are usually pushed towards positions with smaller journeys and part-time positions are usually penalized - due to the type of jobs that allow for part-time journeys - mothers tend to be penalize when having children, seeing major reductions in their earnings. On the contrary, our model shows that within the group of part-time workers, the reform provided positive returns to earnings, on the scale of 2.5%. Even with the limitations of the used dataset, it is possible to assume from this result that mothers did in fact benefit from the reform, since the reform allowed for better returns in different journey formats.

Two caveats appear from this analysis. The glass-ceiling effect as pointed before, tends to be stronger in larger working hours (Albrecht et al., 2003, Petersen et al., 2014). This pattern tends to penalize full-time workers more than their part-time counterparts, which would itself reduce the effect of the parental reform in positions with larger working hours. Second, it is also important to consider the "Trabajador Fijo Discontinuo" form of work. This legislation is aimed for seasonal workers, where contracts last for specific periods smaller than a year. This legislation was largely used by firms in order to reduce the payroll size, and hence the taxes payed. However, in March of 2022, Spain approved a new regulation for seasonal workers (*Real Decreto-Ley 32/2021*, Gobierno de España (2021)), creating more strict rules for hiring on this type of workers, but also expanding the requirements for deploying this contract. In the used dataset, these workers would be classified as 'Part-Time', meaning that the estimator indicating wage discrimination also considers the discrimination towards seasonal workers (see Tables 2 and 3). Although this could be a confound result, since part of the entries comes from October 2022, where the seasonal worker reform has already been taken place, it is possible to affirm that this reform has been too recent to present considerable effects over the wage discrimination faced by these workers. The parental leave reform, on the other hand had taken place almost two years before the latest data entries, meaning that its effect would probably be more present than the seasonal worker reform. As pointed before, this result is confirmed by the onus associated to part-time workers, as it is smaller for women than it is for men (see Table 2).

As pointed above, in Figure 1, the gap presents larger values at the top of the wage distribution, which suggests the existence of glass ceilings. The evidence presented above, however, suggests that high-earning women were the ones actually benefited the most by the reform. This is exemplified mainly through analyzing the other subgroups present in 3. Contrasting the estimators found in the public and private sectors allows for deriving this conclusion. As Moreno-Mencía et al. (2022) cites, in Spain the public sector is usually associated with high salaries and highly educated workers. This characteristics leads to the gender wage gap being larger in public offices than in the private sector, once more confirming the presence of a glass ceiling. From this framework, the result shown above, which indicates a larger benefit for women in the public sector than in the private, allows for assuming that the reform guaranteed better returns for high earning women. Otherwise, specific legislation for each sector may also be a source of explanation for this distinguished effect.

A similar dynamic can be found when analyzing educational levels. In both cases, the effect appears in a larger scale at the tails of the distributions rather than the center. While workers with upper secondary and post-secondary non-tertiary levels of education appear the estimator possesses negative values, for individuals with lower secondary or less and tertiary levels of education the reform seemed to present positive return for female workers' wages. This comes in line with evidence presented in Binder et al. (2024), where authors cite that the gap between male and female workers at the top of the wage distribution is wider for highly educated individuals, while at the bottom of the distribution it is wider for the least educated women. This dynamic also contributes to the glass-ceiling discussion, since more ed-

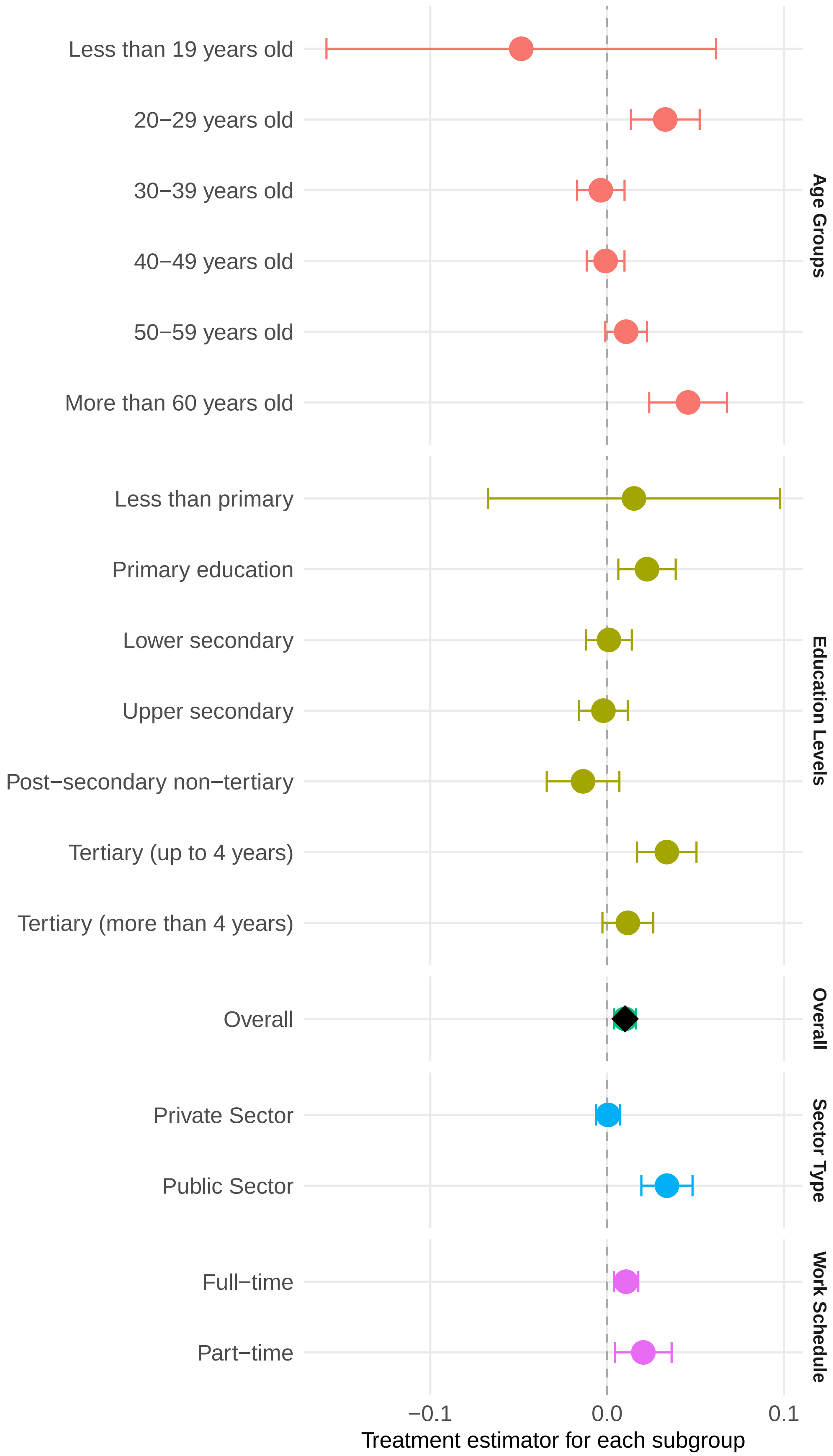

Figure 3: Gender Wage Gap Estimator for each demographic group

ucated women may be inserted in environments with higher payments, but may not be to access these wages. Most interestingly, the category "Post-secondary non-tertiary" education presents a negative estimators. Although for employees with "Less than Primary" the effect appears to be positive, indicating a gap shortening, the confidence interval shows that among this group, effects tend to be heterogeneous.

For age groups this dynamic is maintained, the exception being workers with less than 19 years old. For workers in the group of 20 and 29 years old as for workers older than 50 years old, the estimator shows a positive effect. While for middle-aged employees, i.e. the groups between 30 and 49 years old, the estimator are reduced, showing that the reform presented little to no effect within these subgroups. As present in Table 3, the estimator linked to the variable Age_{it} shows a positive sign (and a negative sign for the squared version). This trend once more supports the hypothesis that the reform was specially effective for workers in both ends of the wage distribution. While workers between 30 and 49 years old may be in occupying more mid-level positions, both young and older workers might be positioned in entry or senior positions. This result is also interesting given that the average age of mothers in Spain was 32.2 and 32.5 in 2018 and 2022, respectively (Dattani et al., 2025). For workers with less than 19 years old, effects appear to be negative, indicating a broadening of the gender wage gap. However, this group also presents a large confidence interval, which indicates a stronger heterogeneity among this group.

As discussed before, the extended model developed to estimate the impacts of the reform on the motherhood penalty aim to identify the channel through which the reform reduced the gender pay gap. The results above indicated that the earnings reduction associated with motherhood was reduced by 34.5%. This reduction however may not be transmitted to all women in their childbearing years. This behavior might explain why the estimator appears near zero for women between 30 and 49 years old. In other words, the reform helped to shorten the penalty experienced by mothers, but not the payment gap experienced by all women in their reproductive years. As the main hypothesis here is that the reform acts on the gender gap through equalizing costs between men and women to employers, it is plausible that the institutional dynamics affected mostly women at the margins of the labor market, at both ends of the age and wage distributions. Hence, the proposed effect here, that the reform was most effective in reducing the binding of glass-ceilings and sticky-floors for female workers. Figure X in the appendices shows the same subgroup analysis to the parenthood model.

It is also important to consider the fixed effects used. Using occupations and sectors as fixed effects assumes their effect on wages to be time-invariant, meaning they capture structural differences across these groups. In other words, the model controls for variation from within-occupation and within-sector, capturing the inner dynamics from each of these subgroups. As pointed in literature, controlling for this set of characteristics does not eliminate the gap, but rather reduces its size (Blau and Kahn, 2017, Brynin and Perales, 2016). Nonetheless, there are important factors regarding occupational and sector discrimination, meaning that even controlling for this inner dynamics, the model previously developed does not account for changes in the composition of each occupation. This means that the reform might have changed, through institutional developments, the set of positions occupied by women. Sloane et al. (2021) points to a migration of women to historically male-oriented occupations. As the authors point, these movements might also be responsible for reducing the earnings gap between genders, given that female-centered positions are usually associated with lower earnings, although this pattern has been shown to be in decline.

From the data, it is possible to see that although this trend is present to some extent, occupations show a major level of heterogeneity. For instance, the "Directors and Managers" category, the best paid position, presented only 34.1% of its positions occupied by women in 2022, however "Health and education professionals", the second best paid occupation, indicates women sharing 68.7% of the entries under this category. This underscore the need for more refined entries under occupational variables. Since in the EES, this variable does not define the exact position occupied by an employee, it is not possible to differentiate from workers within the category. In the previous example, health professionals might include both doctors and nurses, who might experience different levels of female participation as well as payment disparities.

Even considering this limitation, however, it is not possible to see major changes in the occupational preferences of women in the four years between 2018 and 2022. Figure 4 plots the share of women in a given position against the average earnings of that position, for both years present in data. As it is possible to notice, the figure does not indicate major fluctuations of women towards better paying occupations. Overall, occupations present small variations in the share of female workers within these

Figure 4: Share of Female Workers in each occupation

four years.

In the Appendices section, Figure 6 plots similar results to each sector. Similarly, the results suggest that within the four-year gap between the data points, occupational and sector discrimination has seen little variation. This finding motivates once more the use of sectors occupations as fixed-effects, given that they capture mostly time-invariant trends.

Another important aspect not necessarily accounted for in the model is the Covid-19 pandemics that took place between 2020 and 2021. As the pandemic achieved global scale, in April 2020. The gendered impact of the pandemic was fairly documented, as in Wenham et al. (2020) finding that a larger exposure of women to high risk positions. In Spain, this result also holds true. Salas-Nicás et al. (2021) points to the worsening of work conditions in Spain during the pandemics being strongly linked to gender, besides age and class. As mentioned before, women occupy unproportionally positions in health and education, sectors under stress during the pandemic. Even though lockdown policies put restrictions to work and mobility, limiting growth in 2020, Spain has presented a strong growing potential after 2022 (Pedauga et al., 2022). From this overlook, it is possible to argue that the results of the parental leave reform might have presented large results over the gender wage gap under a different economic conjunction. Datasets containing specific information about the pandemic years might present different results.

A proper analysis of intra-household dynamics is also not viable through the used dataset. This is an important result found in other parental leave reforms worldwide (Castro-García and Pazos-Moran, 2016). From the evidence present in the literature, equalizing reforms tend to also promote reductions in the gap from within-household, besides improving the distribution of time-spent with the new-born. As data used is not structured as a panel, it is not possible to check for any equalizing effect the reform might have had in each family.

5.1 Robustness Test

In order to do study eventual problems with the model, I develop here a falsification test, aiming to enhance the robustness of the model's findings. Kahmann (2021) points as falsification test, either us-

Permutations	10	50	100	500	1000
Empirical P-Value	0.1%	0.1%	0.1%	0.3%	0.3%

Table 5: Empirical P-Value for different Permutation Numbers

ing placebo samples or through changing dynamics from within the used dataset, as a major source of testing robustness from Difference-in-Differences. As the author points, DiD design demand parallel - and not equal - trends between control and treatment groups, meaning that both groups may present pre-treatment differences. However, what needs to be demonstrated is that these said differences are no confound factor with the event being studied (Kahn-Lang and Lang, 2020).

In our model, to demonstrate the absence of these significant pre-treatment differences is considerably relevant given that the causality of the model is indirectly captured by the model. In order words, proving that female workers serve as an effective counterfactual for male workers, the empirical strategy here, is necessary to confirm that the reduction that the gap reduction found in the econometric models can be related to the policy reform.

From this perspective, a possible robustness test is using a placebo dataset, where the placebo aims to test the individuals included in the treatment group (i.e., female workers present in the 2022 dataset). The rationale behind this placebo treatment is to test whether through falsifying the control and treatment groups, the same effects would be found, thus indicating a violation of the Parallel Trends Assumption (PTA) and invalidate the causality of the model estimated in previous sections. In the models developed above, the number of controls also allows for some level of overfitting. Hence, using a placebo dataset eliminates this possibility.

To do so, I deploy the permutation-based re-sampling technique. Gagnier et al. (2012) cites this technique as a mechanism for eliminating false positives or negatives. Re-sampling here means randomizing the individuals considered part of the control or treatment groups. Through running the model once more, now with the randomized treatment group, this technique tests whether the effect found in the original estimator occurs by mere randomness or it may be in fact considered causal (Good, 2013). The statistic derived is often called empirical p-value, and compares the real estimator, as derived by the real dataset, with the ones obtained through randomized re-sampling. The empirical p-value, therefore, estimates the probability of a estimator of the same magnitude or bigger to be found in through the randomized re-sample. In other words, what is the chance of the estimated effect to be randomly produced. The larger the value, the larger the probability that the results of the model are driven by randomness rather than causality. The definition of this statistics is found in Equation 4 below.

$$p_{\text{empirical}} = \frac{1 + \sum_{i=1}^{N} \mathbb{I}(\hat{\beta}_{\text{placebo}} \geq \hat{\beta}_{\text{real}})}{1 + N} \tag{4}$$

This definition above uses a one-sided test, where it is estimated the number of placebo estimator ($\hat{\beta}_{\text{placebo}}$ that are equal or greater than the real estimator ($\hat{\beta}_{\text{real}}$). In this estimation, I use the estimator present in model (4), given its the most complete model, and also the smallest estimator, making these findings as conservative as possible. The function $\mathbb{I}$ is equal to one when the inequality (($\hat{\beta}_{\text{placebo}} \geq \hat{\beta}_{\text{real}}$)) is true and zero when it is false. While in the denominator, N represent the number of permutations - or iterations - being used. By adding one both in the numerator as in the denominator, the empirical p-value avoids reaching null p-values, a technique described in Phipson and Smyth (2010).

From this framework, I estimate 1,000 permutations of the year and gender variables, randomly assigning pre- and post-treatment status to each worker in each iteration. Each re-sampled dataset is then used to estimate the regression present as model (4), from Table 3. This allows for obtaining a thousand placebo estimators that are than compared with the real estimator, as described above. The empirical p-value found indicates that only 0.3% of the randomly created estimators are equal or greater than the one found by the Difference-in-Differences model. This finding can be interpreted as the probability that the real results were generate by chance rather by the intended causality.

Table 5 below the estimation for the empirical p-values for different number of permutations. In all scenarios, the p-value allows to reject the null hypothesis that the effect is randomly found, thus confirming that the estimated effect is indeed causal.

In the appendices, Figure 8 presents part of the distribution of each estimator found in the randomization through the thousand permutations. It is possible to see that the real estimator, presented in red, cannot be found by chance.

6 Conclusions

This research aimed to investigate the effects of the parental leave policy reform in Spain, as defined by the "Real Decreto -ley 6/2019". The reform equalized the leave periods between fathers and mothers, thus offering an opportunity to compare the effects of such policy change over the gender wage gap. As present in the gender disparities literature, the different legislation men and women face in the labor market, may be a source of discrimination. Hence, this research used a quasi-natural modeling to test the effect of the parental leave equalization on the gender wage gap.

Through a Difference-in-Differences approach, it is possible to estimate that the reform provided a 1.0% to 1.4% wage improvement for women respective to their male counterparts. This result is dependent of a proper use of controls, both for individual characteristics as for firm-level characteristics, besides being controlled through sector and occupation fixed effects. Although the effect of the reform may be modest, two important points arise from the results. Firstly, the reform may present larger results over time. Since the model developed aims to capture the indirect effects the reform has had on the gender wage gap, the reduction might be more pronounced given more time, when business and institution can better adapt their institutional environment to the new legislation.

A further extension model is developed, where through a different dataset, containing information on fertility from 2018, I estimate the likelihood of a worker to have become a parent in the period after the reform. This extended model indicates a reduction in the motherhood penalty, which is a likely channel for the gender pay gap reduction found in the previous model. Although this result is not the main focus of this research, it allows for making the results from the previous model more robust.

In this sense, I also developed a robustness test, where a randomize the treatment variable in order to test how likely random the results are. As shown in the robustness section, through a different number of permutations, it is possible to test that the results are not able to be found by pure randomness, rather by causality.

As presented before, the reform presented larger results over both ends of the wage distribution. Hence, creating a more equalized environment for hiring and promoting men and women - through the parental leave reform - was able to reduce the gap especially among women in low- and high-earning positions, leaving mid-earning position more or less intact. These results suggested that the reform was able to mitigate the presence of sticky floors and glass ceilings in the Spanish economy. Another important aspect, that indicate the relevance of the results, follows the career choices of male and female workers, in terms of occupation and sector. As discussed, women did not migrate to a different set of occupations and sectors, comparing before and after the reform. This effect might be further studied in future research, examining whether over time, women may choose different careers as a consequence of the reform.

Future gender-equalizing policies can focus on reducing discrimination for mid-level positions, since for this group effects appear to be reduced. Women in this positions are usually in their childbearing years, therefore offering different incentives for promotions and raises in wages. Nonetheless, let the hypothesis of a more equal gender environment created by the reform hold true, one could expect that over time, the effect could be enhanced.

The limitations of the dataset were overcome through using a series of controls as explained before. However, future research may look into the motherhood penalty itself. Through a dataset that allows for identifying the proper motherhood status of each worker, further research might identify the wage penalty mothers face after the birth of a child, studying how has this penalty changed after the reform. Another possible study may investigate the effects the reform presented in fertility decisions. Under more equalized gender policies, such as the one promoted by the reform, parents may change their fertility decisions. A proper dataset may allow for a proper investigation on the decision of having children. Another important aspect missing of the used dataset is the intra-household dynamics. The reform might have presented effects in reducing the intra-household gender gap, also equalizing how have parents divided the chores of raising a child.

Further studies could also develop an event-study approach, how have the same results changed over time, investigating the how has the gender pay gap responds each year after the reform. Additionally, the occurrence of the Covid-19 pandemic in 2020 and 2021 may have presented serious limitations in both sides of the labor market, restricting the possible effects of the policy in reducing the gender wage gap. For this reason, it is possible to argue that over time, the reform may present larger effects, in opposition to the modest effects found above.

Overall, this research shows that positive returns in the gender equality arose in the Spanish labor market after the parental leave reform.

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A Appendices

In the Table 6 below, I present the data for each sector in each of the datasets for 2018 and 2022. The table shows the number of workers in each sector (N), the mean earnings (Mean), and the respective standard deviation (SD) for each sector in each year.

Table 6: Summary Statistics by Sector

	2018			2022		
Variable	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Sector						
B - Extractive Industries	1,707	24.176	54.633	1,828	22.093	47.302
C - Manufacturing Industries	49,450	20.217	46.878	54,391	21.405	48.618
D - Administration of Energy	1,916	29.793	25.991	2,189	28.793	39.468
E - Water supply and sewerage	6,115	19.009	37.461	7,300	17.859	31.444
F - Construction	12,458	15.120	22.093	8,792	15.663	24.132
G - Retail and Wholesale	17,668	15.923	34.656	19,128	16.290	31.466
H - Transportation and storage	11,226	23.651	69.235	12,913	20.169	43.552
I - Hotels and Tourism	8,192	13.608	23.731	9,645	13.458	23.584
J - Info. and communication	11,988	23.659	59.031	15,094	21.148	39.577
K - Financial Activities	8,902	27.546	41.971	9,142	25.703	39.819
L - Real Estate	1,661	17.204	27.113	1,786	17.555	23.825
M - Scientific and tech. activities	16,027	18.193	27.710	17,211	18.623	29.876
N - Admin. and aux. services	20,427	13.973	37.257	23,302	13.843	26.632
O - Government and Defense	9,746	21.779	42.841	10,997	22.622	42.415
P - Education	7,704	21.137	35.982	10,365	22.977	43.670
Q - Sanitation and Social Services	19,240	20.880	45.540	23,341	22.207	48.883
R - Entertainment Activities	6,756	18.684	57.774	7,204	16.782	37.685
S - Other Activities	5,525	15.426	31.496	5,845	14.937	25.717

Figure 5 shows the distribution of wages by the type of contracted journey for both 2018 and 2022. This figure evidences the disparities between the two types of journey. Even considering the hourly wages, it is possible to see that there is a considerable payment penalty linked to part-time position. As discussed before this may be linked to general low earnings and productivity, which limits bigger payments to longer working hours (Petersen et al., 2014), which especially affects the earnings of women who migrate to positions with shorter journeys after the birth of a child.

Table 7 below shows the descriptive statistics from the *Encuesta de Fecundidad* dataset, used in section 4.2. The variables shown below are the ones selected to build the prediction model, described in the aformentioned section. The column shows the number of observations in each strata, by gender.

Figure 6 below shows the relation between the share of female workers and the average earning for each sector present in the dataset, for both 2018 and 2022. As discussed previously, occupational segregation has seen little to no change within the four-year period present in the dataset. The figure belows confirms this pattern for each of the sector, which show only small fluctuation regarding the participation of female workers in high earning sectors.

Figure 7 shows the estimator for the interaction $Female \times \widehat{Parenthood}_{it} \times Post_{it}$ for each demographic subgroup. The estimator shows a positive return of the reform for most groups, with the exception of women above 40 years old. This group, since removed from the main child-bearing years, may have not benefited as much as other groups. On the contrary, female workers may have higher opportunity costs associated with having children in these ages, sacrificing higher wages, as discussed in the before, due to the presence of a glass-ceiling. Other than that the estimator showed a positive sign for all educational levels, being especially larger for women on the "Secondary Non-Tertiary" group (usually linked to professional education). Although relatively similar, the estimator appears to be larger for the private sector, rather than for the public sector, as well for part-time workers rather than full-time

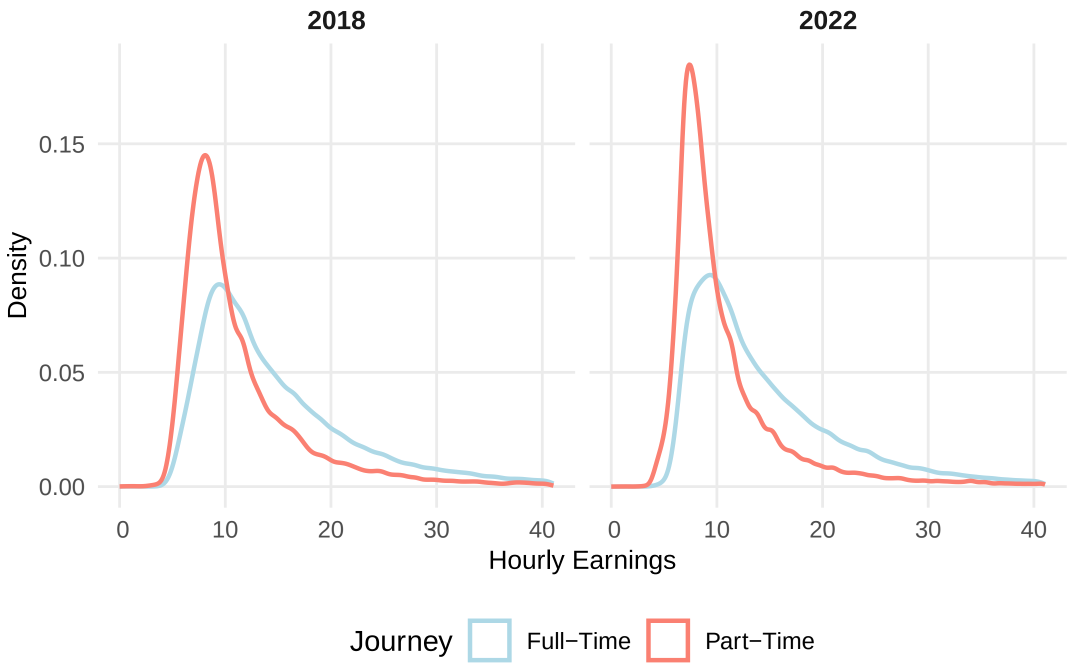

Figure 5: Wage Densities for Full-Time and Part-Time Workers

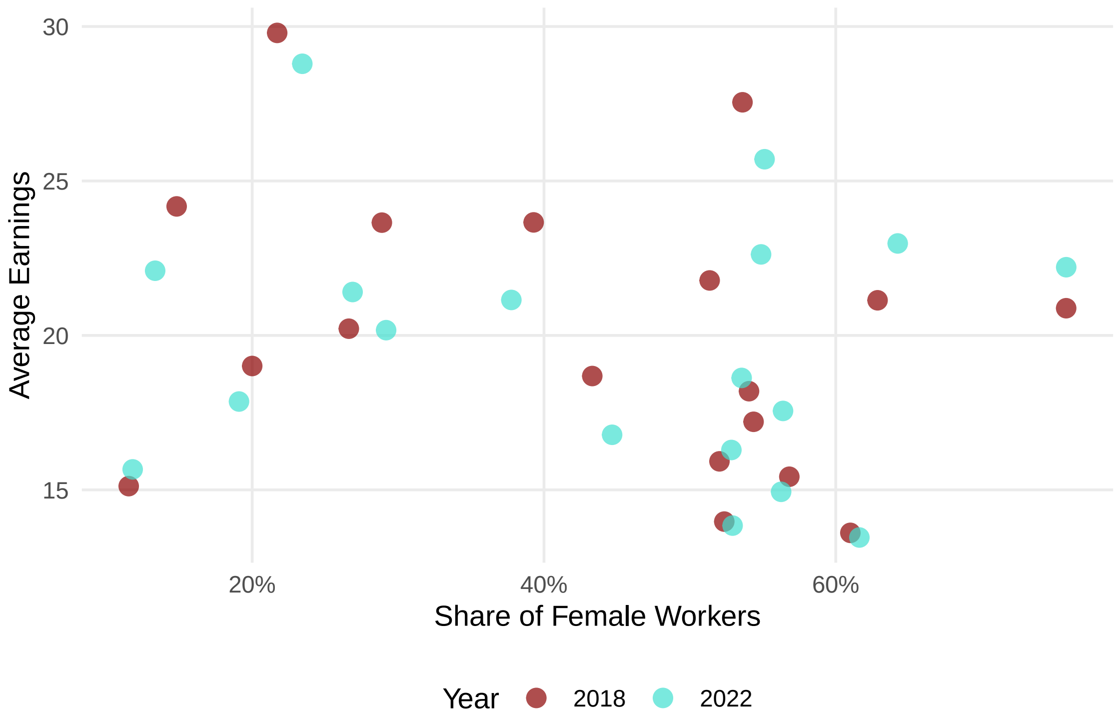

Figure 6: Share of female workers in each sector

Table 7: Descriptive Statistics from the *Encuesta de Fertilidad* Dataset

	Male	**Female**
Total	1,380	7,051
Recent parenthood (children < 3 years)	234	898
Age Group		
Less than 19 years old	7	31
20–29 years old	182	913
30–39 years old	430	2,009
40–49 years old	495	2,643
50–59 years old	266	1,455
More than 60 years old	0	0
Education Level		
Less than primary	23	45
Primary education	142	513
Lower secondary	157	540
Upper secondary	215	861
Post-secondary non-tertiary	412	1,941
Tertiary (up to 4 years)	409	3,026
Tertiary (more than 4 years)	22	125
Demographics		
Immigrants	138	733
Employment Characteristics		
Public sector employment	284	2,135
Part-time employment	92	1,724
Fixed-term contract	1,076	5,170
Occupation		
Directors and managers	61	176
Health and education professionals	111	1,254
Other professionals	139	439
Associate professionals	186	844
Office clerks (internal)	100	991
Office clerks (customer-facing)	43	727
Hospitality and retail workers	117	1,057
Health and care workers	8	229
Security service workers	49	162
Skilled agricultural/fishery workers	36	70
Skilled construction workers	68	7
Skilled manufacturing workers	121	183
Machine operators and assemblers	115	62
Drivers and transport operators	51	7
Unskilled service workers	33	635
Agriculture/construction/transport	114	178
Military occupations	28	30

workers.

Figure 8 below shows the distribution of the random estimators, found through 1,000 permutations of the treatment variable, as explained in the Robustness Test section. Each bar represents the frequency a placebo estimator was found through the randomization process. The red line shows the real estimator, as present in model (4) of Table 3. The figure makes evident that only 0.3% of the placebo estimators were equal or larger than the real estimator, serving as a stronger evidence of the causal inference.

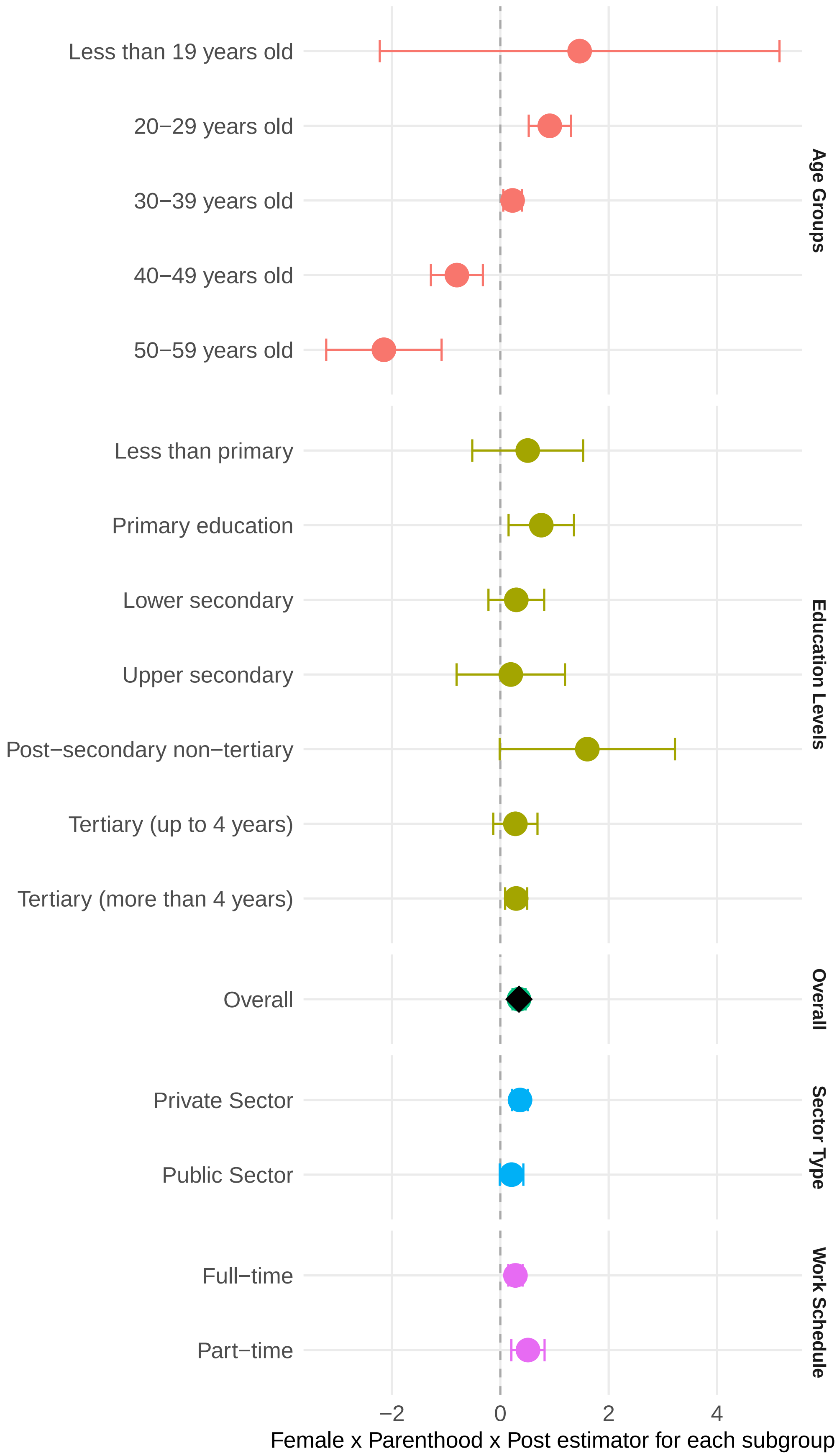

Figure 7: Motherhood Penalty Post-treatment for each demographic group

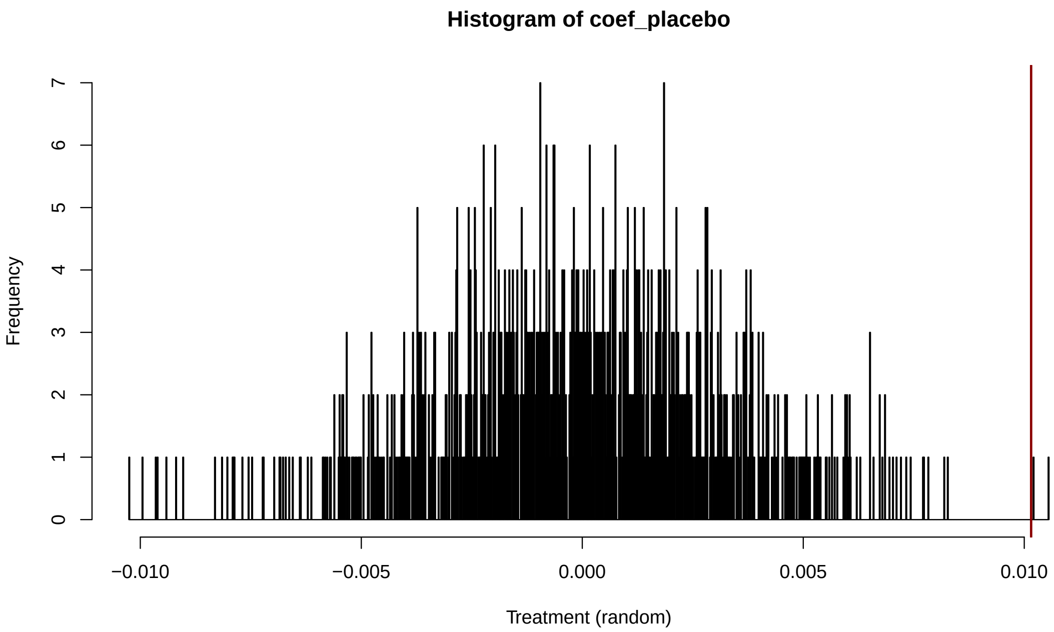

Figure 8: Histogram of placebo estimators from 1,000 permutations