

# Children, Earnings and Careers in an Internal Labor Market.

## An Event Study Approach.

Claudio Lucifora<sup>\*1</sup>, Dominique Meurs<sup>†2</sup>, and Elena Villar<sup>‡3</sup>

<sup>1</sup>UCSC and IZA

<sup>2</sup>University of Paris Ouest Nanterre and INED

<sup>3</sup>University of Milan-Bicocca

August 2017

### Abstract

Using a 12-years panel of personnel records from a large, family-friendly French company, we find that women's labor market outcomes are largely affected by the birth of the first child. Instead, fatherhood does not significantly impact on men's wages or careers.

An event study approach with the use of control groups enables us to show that, prior to childbirth, mothers' remuneration is in line with that of non-mothers. However, one year after birth, it markedly falls, reaching  $-10\%$  in total pay and  $-40\%$  in individual bonuses.

This drop is persistent: 9 years after childbirth there is no evidence of a catching-up trend.

Mothers also have lower chances to be promoted to managerial positions.

---

\*claudio.lucifora@unicatt.it

†dominique.meurs@ined.fr

‡e.villar@campus.unimib.it

# 1 Introduction

The birth of a child leads to huge changes in all spheres of an individual's life. Parents of small children need to reorganize their entire working and leisure time, with relevant consequences for their labor market outcomes. It is nothing new that working women face most of the challenges that the arrival of a child imply: the evidence of a motherhood penalty in participation and earnings is strong, both in the US (Waldfogel (1997), Budig and England (2001), Anderson et al. (2003), Bertrand et al. (2010)) and Europe (Simonsen and Skipper (2012) for Denmark, Felfe (2012) for Germany, Wilner (2016) for France). Family policies have been considered the most effective mean to reconcile work and family responsibilities, mobilize female labor supply and promote gender equality. Scandinavian countries, for example, have been praised for offering working women good opportunities to pursue family and career. However, recent findings show that also within these institutional contexts the costs of motherhood are high and able to explain almost all the remaining gender gap in pay (Kleven et al., 2017) .

Established that children represent one of the main reasons for the persistence of females' disadvantages in the labor market, it is fundamental not only to quantify the cost of motherhood, but also to investigate how this cost is related to individuals' adjustments in working decisions and employers' reactions in terms of chances of career improvements, pay structure, and incentives schemes. We are able to provide new evidence on these mechanisms thanks to the availability of a 12-years panel (2005-2016) on the population of employees of a large French company that, for dimension and internal structure, can be considered as an internal labor market. To our knowledge, no previous studies have been done on the impact of childbirth on the careers and earnings of men and women within a firm. This allows us to contribute to different literatures. First, to the works on the consequences of parenthood in the labor market (Angrist and William (1998), Millimet (2000), Dustmann et al. (2016)), a specific stream belonging to the wide amount of research on gender inequality (Blau and Kahn (1992), Altonji and Blank (1999), Bertrand (2011)). Second, to the internal labor market (Doeringer and Piore (1971), Baker et al. (1994)) and personnel economics literatures (Lazear and Rosen (1981), Gibbons and Waldman (1999a), Lazear (2000)).

The aim of this paper is to capture the impact of first childbirth on the trajectories of earnings

and promotions of fathers and mothers with respect to childless employees and to shed light on the different adjustments in individuals and firm's behavior after birth. We focus on first childbirth only. Indeed, this is a peculiar event. It generates sharp changes in wages and careers that are likely orthogonal to unobserved determinants of these economic outcomes, which tend to evolve smoothly over time (Kleven et al., 2017). The analysis is based on event studies around the timing of childbirth. We develop a model which uses employees without children as a control group. Fixed effects allow us to account for time invariant characteristics between treated and controls. In a robustness check, we replicate the study on a balanced panel of parents without controls.

Despite a family-friendly institutional setting, we find a significant motherhood penalty. Before the birth of the child, the earnings of future mothers do not differ from those of childless female employees and are in line with that of males. However, one year after delivery, mothers' total earnings drop and do not increase back: 9 years after, their earnings are still 10% lower. The major reduction in pay, around 40%, is found in bonuses linked to individual productivity. Mothers also have lower chances of climbing up the hierarchical structure of the firm. No significant effects are found for fathers.

The motherhood penalty can arise from the combination of two factors: individual changes in working habits after the arrival of the child and firm's adjustments in promotion chances, pay structure, or incentive schemes. As all women, our female employees have to face two main decisions after childbirth: whether to continue to be employed within the firm or not and, if so, how many hours to work. We find that only a small share of women, around 4%, resign after becoming mothers. The majority of them stay active and move to another company. Among those who stay, we observe a reduction in weekly working hours, between 4 and 6 per cent, until children enter the schooling age. Then, there is clear evidence of a catching-up trend. A convergence pattern that, however, is not found in wages. The same regards promotions. After childbirth, mothers have a lower probability to get a managerial position. Recent influential work by Goldin (2014) has stressed how workplace culture and expectations (including working long hours) affect career improvements. We find that mothers tend to largely reduce their extra-time in the first three years after childbirth. In the same period, they also increase the number of hours of absence (not related to maternal or parental leave). However, from the fourth year

onwards, there are no significant differences between mothers and non-mothers. We also observe that mothers' wages become much more volatile after childbirth. Large part of this increase in dispersion is due to a rise in the permanent component of variance, suggesting a change in the way women's characteristics are valued by the firm after motherhood. Finally, we find that mothers seem to be less responsive to productivity incentives, as opposed to fathers.

The paper is organized as follows. Section 2 describes the institutional background and data. Section 3 presents the identification strategy and the estimation sample. Section 4 shows the main results. Section 5 explains the underlined mechanisms of the child penalty. Section 6 concludes.

## 2 Institutions and data

### 2.1 Institutional background

Family policies have a long history in France, a country where fertility has traditionally been at the core of social and political agenda. This made France the European country with the highest fertility rate, 2.0 children per woman in 2015<sup>1</sup>, and among the public systems that offer good opportunities to balance working and family life. Compared to other OECD countries, public investments in families with children is relatively high. In 2009, while France spent about 3.8% of GDP on family benefits, cash payments, services and tax breaks for individuals with children, the average OECD spending was 2.9%<sup>2</sup>.

A large network of local Family Allowances Funds (CAFs, *Caisse d'Allocations Familiales*) is responsible for the provision of job-protected child-related leaves and childcare services. Child-related leaves include maternity and paternity leave. These can be further extended to parental leave.

All working women are eligible to maternity leave for a total of 16 weeks for the first and second child. The minimal mandatory leave is 8 weeks: at least 2 before childbirth and 6 after. Generally, 6 weeks are taken before childbirth and 10 after. 26 weeks can be taken for a third, or more, birth. During maternity leave, the employment contract is suspended and the woman is entitled to daily allowances paid by social security. Allowances are calculated taking into account the

---

<sup>1</sup>World Bank

<sup>2</sup><http://www.perfar.eu/policy/family-children/france>

gross 3 wages earned before the date of interruption of work, divided by 91.25 (for monthly paid employees). A ceiling of 3,218 Euros per month has been set in 2016<sup>3</sup>.

Since 2002, paternity leave can be taken by all working fathers for up to 11 days for single birth and 18 days for multiple births. The leave must begin within 4 months after the birth of the child. Payment rules are equal to those of maternity leave.

Maternity and paternity leave can be expanded to parental leave. Parental leave is open to all employees with children who, at the timing of childbirth, have at least one year of tenure with the employer. The normal length of parental leave is one year, renewable two times. In case of multiple birth (at least three children), the leave can be renewed 5 times. Parental leave starts immediately after the end of maternity/paternity leave. During the leave, the employment contract is suspended. The employee perceives basic allowances for the provision of services for young children (PAJE, *Prestation d'Accueil du Jeune Enfant*) from the CAF. The amount of the allowance depends on family income and number of children.

Children have access to childcare services and preschool from a very young age, which is expected to help parents balancing work and family life. 48% of the country's children under age three are enrolled in some type of formal care<sup>4</sup>. These include publicly subsidized home-based care, accredited family daycare providers, and nursery (*crèches*). Allowances for *crèches* are guaranteed from CAFs according to family income and number of children, but a minimum of 15% of monthly payments is in charge of the family<sup>5</sup>.

A universal model of preschool education, the *École maternelle*, is available to all children aged 3-6. The program is fully funded and organized by the State. In many municipalities, enrollments can be made from the age of 2.

Our company can be defined as family friendly. Employees with dependent children receive specific pecuniary and non-pecuniary advantages. Maternity and paternity leave are paid at full salary. Additional 4 weeks of maternity leave are provided until the second child, while 2 starting from the third. Future mothers are allowed to take one hour off for each working day. Re-founding of pregnancy-related health costs are provided and both male and female employees

---

<sup>3</sup><https://www.service-public.fr/particuliers/vosdroits/F207>

<sup>4</sup>Population Europe Resource Finder and Archive

<sup>5</sup>[urlhttp://www.caf.fr/ma-caf/caf-du-bas-rhin/offre-de-service/petite-enfance/je-souhaite-placer-mon-enfant-en-creche](http://www.caf.fr/ma-caf/caf-du-bas-rhin/offre-de-service/petite-enfance/je-souhaite-placer-mon-enfant-en-creche)

get a childbirth premium. Contributions to childcare expenses are guaranteed to all employees with children aged less than 3. For children aged 3-6, additional monthly payments are provided. In 2012 the firm signed the “*Charte de la Parentalité*”, the Corporate Parenthood Charter. This is an agreement proposed at national level by the Observatory for the Balance of Time and Parenthood within the Company<sup>6</sup> and aims promoting working environments in which employees with children can easily reconcile professional and family lives. More than 500 firms in France have already signed it. The effort of our company especially regarded the possibility for parents to work from home through teleworking.

## 2.2 Data

Our analysis is based on personnel records for the full population of employees of a large manufacturing company in France. Data cover a 12-years period, from 2005 to 2016. The dataset combines different registers linked at the individual level via personal identification numbers and contains rich information on individual and working characteristics.

We made two major interventions to the original database. First, we keep only employees aged 20-50. The selection on age is aimed at avoiding not biological births, since changes in the number of dependent children at older ages are likely due to a new partnership status with a partner who already has children. Second, since in 2007 the company faced an extensive internal reorganization and split its distributional branch into a different and independent firm, we dropped all the employees who were employed in this division and transferred to the new firm.

The final dataset consists of an unbalanced panel of 82,084 employees, for a total of 505,930 individual-year observations. The share of women is around 29%.

Table A1 in the Appendix reports summary statistics by gender. Women are, on average, younger than men. They are more educated (30% of them has at least a first level degree, versus 27% of men), but less represented in managerial positions. They tend to work one hour per week less than men, around 33 hours per week, and to make more annual hours of absence (367, versus 291).

62% of males and 66% of females are parents, i.e. have one or more dependent children. On

---

<sup>6</sup>Observatoire de l'Équilibre des Temps et de la Parentalité en Entreprise; [www.observatoire-equilibre.com](http://www.observatoire-equilibre.com)

average, men have 1.90 children, while women 1.78. 70% of men and 64% of women are in a couple. Females are more likely to be single (20% against 18% of males) or divorced (8% against 4% of males).

Career paths in our firm can be easily described by one variable: *Remuneration Level* (RL). Indeed, the hierarchical structure of the company is summarized in 67 different remuneration levels, with 2 indicating the lowest blue collar and 68 the highest managerial position. The average RL for men is 28, while for women 27.

To each RL is associated a base salary. We added to this component all the complementary premiums attached to occupations (i.e. extra hours or night work) to create the variable *occupation based pay*. We also defined a variable that accounts for all bonuses linked to individual productivity. These are established each year by employees' direct supervisors. Total remuneration is made up by these two components plus occasional extra pay due, for example, to changes in the place of residence. The occupation based pay accounts for 2/3 of total pay, while individual bonuses for 1/3. On average, women earn less than men in all components.

### 3 The event study: impact of first childbirth

We want to study the impact of first childbirth on earnings and careers in an internal labor market. To do so, we develop an event study design. This methodology allows us to identify changes in economic outcomes around the event "*birth of the first child*".

#### 3.1 Identification

Consider a panel of  $i = 1, \dots, N$  individuals for whom a specific outcome  $Y_{it}$  is observed for  $t = 1, \dots, T$  calendar times (e.g. years). In an ideal setting, every individual receives a treatment in some time periods  $P_{it}$  (e.g. some specific years within the panel), and stays treated forever. Let define  $S_{it} = t - P_{it}$  the *relative event time*: it indicates, for each individual, the relative distance to the time in which the event occurs.

Within this framework, the dynamic effect of the event on the observed outcome can be estimated from (Borusyak and Jaravel, 2016):

$$Y_{its} = \sum_{s=-\infty}^{\infty} \gamma_s 1\{s = S_{it}\} + \eta_i + \nu_t + \varepsilon_{its} \quad (1)$$

$S_{it}$  are event time dummies. They equal 1 when the individual is at a specific time distance before or after the occurrence of the event. Thus,  $\gamma_s$  capture two types of effects. For  $s < 0$ , pre-event trends. For  $s > 0$ , the effective treatment effects: the dynamic impacts of the event on the outcome of interest.  $\eta_i$  and  $\nu_t$  are individual and time fixed effects,  $\varepsilon_{its}$  a random noise.  $s \pm \infty$  indicates the longest time window around the event.

Usually  $S_{it}^{-1}$ , the event time dummy which equals 1 when the individual is in the time period just before the realization of the event, is the reference dummy. For the model to hold, a standard assumption is that  $Y_{it,s=-1} = \eta_i + \nu_t + \varepsilon_{its}$ . Since the treatment effects are homogenous across  $i$  and  $t$  and depend only on  $s$ ,  $Y_{it,s \neq -1} - Y_{it,s=-1} = \gamma_s$  identifies the dynamic causal impacts of the event on the outcome of interest.

This formulation cannot be directly applied to our settings. The nature of the event we want to analyze, first childbirth, deserves close examination, due to endogeneity of fertility decisions. Our analysis would be meaningless if our event would be determined by the outcomes under study.

Our identification strategy is based on the idea that we are able to distinguish three determinants of earnings and careers, two related to children, and one unrelated. The first is made up by “child anticipated effects”. These are time-invariant life cycle preferences that influence individuals’ choices on education, sector of employment, or occupations. The second consists of time-variant “child shocks” that can have a direct effect on economic outcomes. The third captures all determinants of earnings and careers that are independent from childbirth, like age. To control for these issues, we use the classical design of Equation (1), adding employees who do not have any dependent children as a control group. The use of fixed effects allows us to control for all time invariant child anticipated effects, while using childless employees as a control group enables us to control for child shocks. Within this framework, we assume that, conditional on the set of independent determinants of earnings and careers, childbirth is exogenous to economic outcomes.



## 3.2 Empirical strategy

We begin our exercise by identifying our treatment group: a subsample of employees who experienced the birth of the first child within a specific time window. We focus on first childbirths in three years, 2007, 2008, and 2009. This decision was driven by the need to have enough childbirths to develop the analysis and a relatively large time span before and after the event. We observe 2,686 births for a total of 27,020 employee-year observations.

Our control group is made up by all the employees who, during the whole period, never receive the treatment, such as do not have any dependent children. We have 26,050 childless employees, for a total of 120,581 employee-year observations.

We proceed by creating a function of the event time,  $s$ . We set  $s = 0$  for the years of the event (2007, 2008, or 2009) and index all the other years relative to the event years. Since we are working on an unbalanced panel, we include, for each individual, the longest possible time window around the event. This implies that  $s$  ranges from  $-4$ , for those who had the first child in 2009, to  $+9$ , for those who had the first child in 2007. From this function, we create 14 event time dummies.

We want to analyze the dynamic impact of first childbirth on total annual earnings, its main components (bonuses and occupation based pay), and remuneration levels. To capture the impact of childbirth on these outcomes, we run the following regression separately for men and women:

$$Y_{its} = \sum_{s=-4}^9 \gamma_s 1\{s = S_{it}\} + \sum_j \delta_j 1\{j = age_{it}\} + \eta_i + \nu_t + \varepsilon_{its} \quad (2)$$

$Y_{its}$  is the log of the outcome of interest for individual  $i$  in year  $t$  and at event time  $s$ . We simply add to Equation (1) a set of age dummies to control non-parametrically for underlying life-cycle trends. The fundamental difference with the previous specification is that our estimation sample includes both treated and non treated. We include our control group in the reference category,  $S_{it}^{-1}$ , the event time dummy relative to the year just before childbirth. Individual fixed effects allow to control for unobservable time invariant characteristics among the two groups, while year fixed effects for time trends. Errors are clustered at the individual level.

### 3.3 The estimation sample

Table A2 in the Appendix shows the main characteristics of our estimation sample. Mothers are slightly younger than non-mothers, while there are no differences in the average age between fathers and non-fathers. At first childbirth, men are around 32 years old, women 30. Fathers are more educated than non-fathers. Instead, the share of mothers with a university degree is the same of that of non-mothers. However, mothers are less represented in managerial positions with respect to childless women.

Parents are observed for the first time in a low-middle hierarchical level (around RL 21 over 68). They are able to improve their RL over the period, since fathers are lastly observed at RL 33, while mothers at 31.

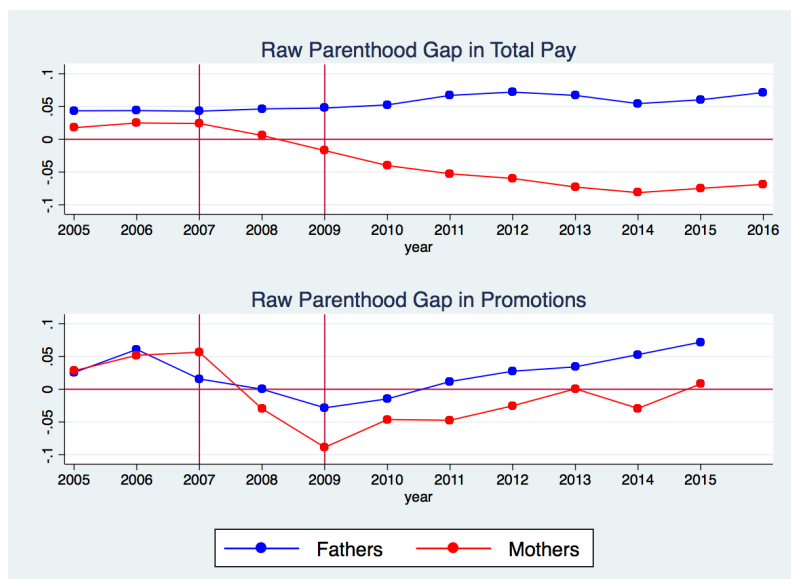
Women who have their first child work, on average, one hour less per week with respect to childless women. They are also more absent from work. Not accounting for maternity leave, they make, on average, 335.52 annual hours of absence, while non mothers 299.34. The average number of hours of paternity leave is 65.

4% of mothers leave the company during the period. This fact can represent a possible source of attrition in our data, even if the number is very small (181 women). As Figure A1 in the Appendix shows, around 60% of them move to another company, 29% go on parental leave, while 7% enter in some retirement scheme. Almost 50% of these women leave the company within the first 3 years after delivery.

Figure 1 shows predicted parenthood gaps in earnings and promotions over the period under analysis. Predictions are based on linear regression models, controlling for age, tenure, and educational level. We consider an individual as promoted if, for each subsequent year, she makes a step upward within the hierarchy of the firm. This is why we have this information only until 2015. The vertical lines delimit our birth window: 2007 – 2009.

This simple descriptives show that until 2008 the gap in pay between mothers and non mothers is basically null, but from 2009 onwards it starts to widen. In 2016 it is still around 5%. The pattern of promotions is similar, even if a catching-up process is visible by the end of the period. Instead, a positive, and increasing, gap in pay and promotions is found for fathers.

Figure 1: Gaps in Earnings and Promotions



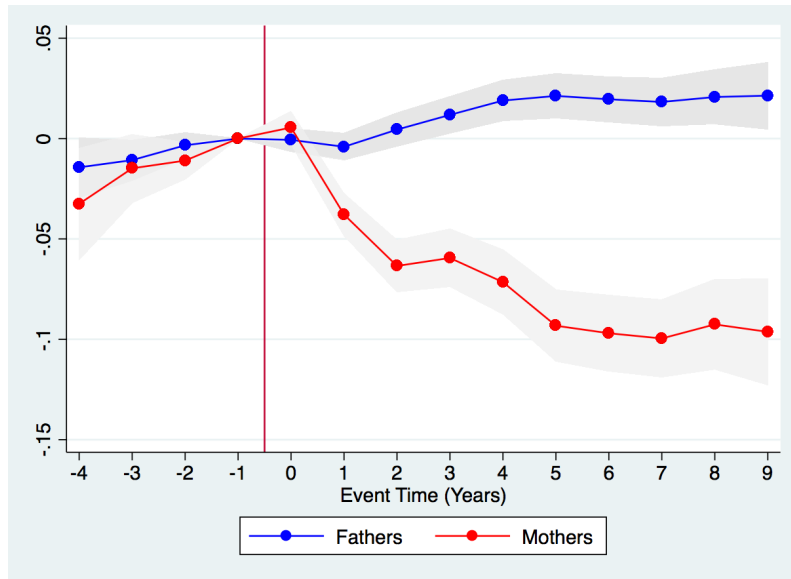
## 4 Main results

In this section we present the event time coefficients estimated from Equation (2). 95% confidence intervals are included. The vertical red line indicates the timing of birth.

Figure 1 reports findings on the impact of first childbirth on total annual pay. Pre-event trends show no significant differences between individuals who are becoming parents and their childless counterpart. Moreover, the patterns of males and females' earnings evolve in a similar parallel way. One year after birth, however, mothers' total pay significantly drops. It continues to fall for other 3 years to finally settle only 5 years after childbirth. 9 years after the event mothers are still earnings 10% less than childless women and there is no sign of a catching-up process. Results for fathers, instead, show a slightly increasing trend with respect to non-fathers.

Figure A2 in the Appendix shows that women in non-managerial positions are more penalized than managers. An explanation of this fact can be that white-collar employees, the great bulk of female workforce in the firm, have less flexibility in the workplace. Thus, it is more likely for them to switch to a reduced time contract after childbirth.

Figure 2: Total Annual Remuneration



Results on occupation based pay (Figure 3) follow the same patterns. There are no significant differences between future parents and childless employees before childbirth. One year after, mothers' pay drops and does not increase back. An increasing and significant trend is found for fathers.

Figure 3: Occupation Based Pay

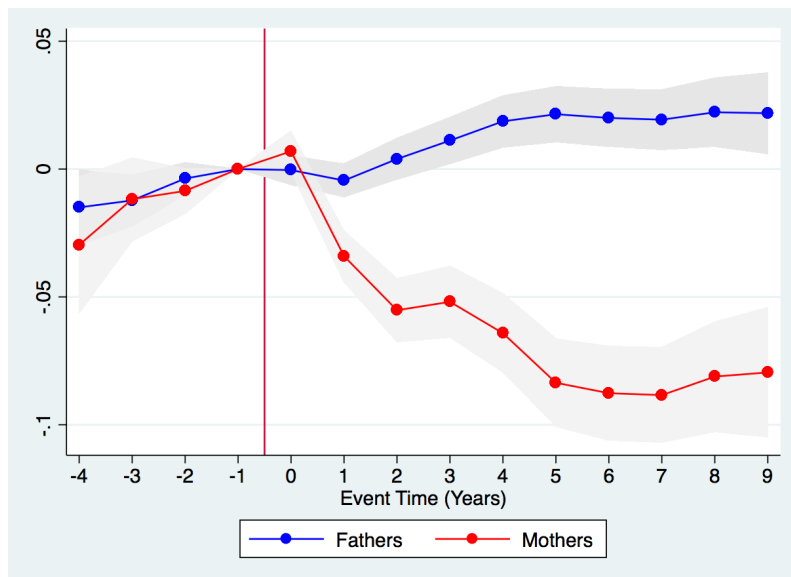
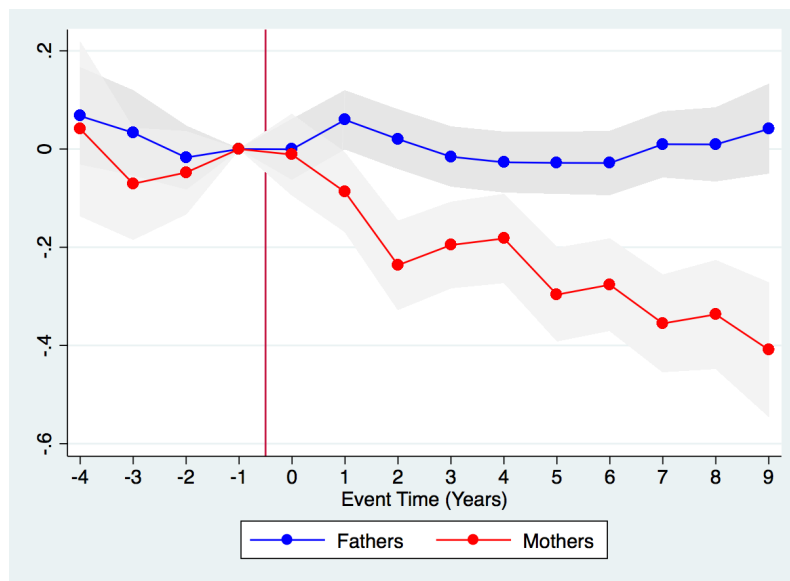


Figure 4 shows findings on bonuses linked to individual productivity. This variable component of total annual earnings suffers the largest penalization for mothers. After childbirth, their bonuses start to fall, reaching a  $-20\%$  within the subsequent 3 years. This gap gets worse over time and is almost  $40\%$  9 years after the event.

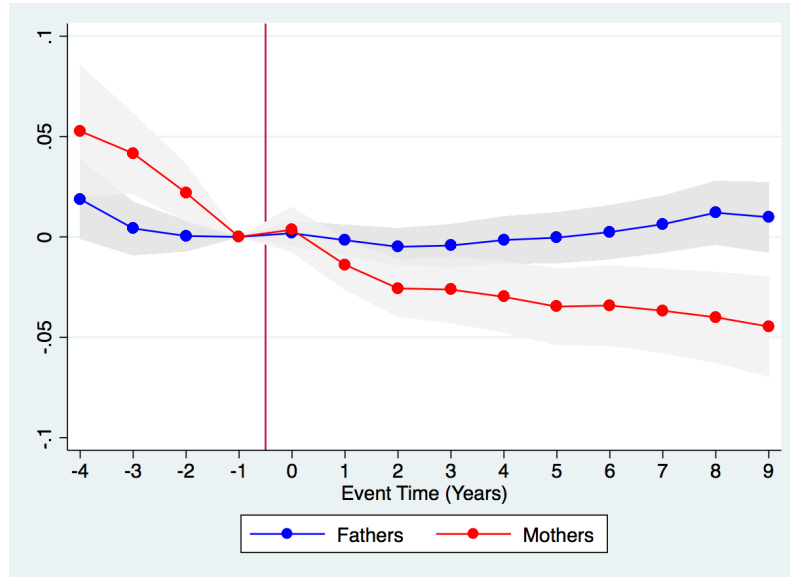
Fathers' individual performance, on the other hand, is not significantly affected by the birth of the first child.

Figure 4: **Bonuses**



Moving to the analysis of careers, Figure 5 displays results on the variable Remuneration Level. Prior to the event, future mothers seem to perform better not only than childless women, but also than men. However, after childbirth things reverse and a negative gap for mothers arises.

Figure 5: Remuneration Level



## 5 Child penalty: underlying mechanisms

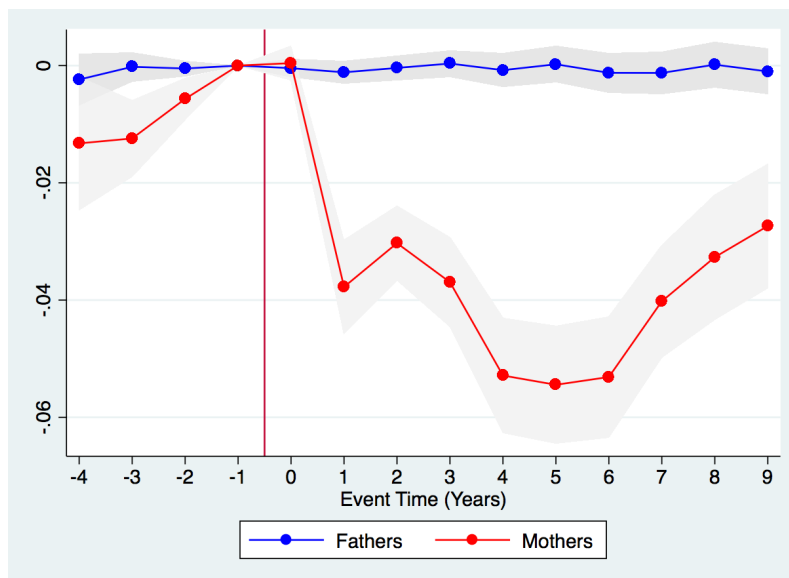
### 5.1 Individual choices: working hours

Results on the event studies show a clear penalty for women after childbirth. The arrival of a child leads to important changes in individuals' labor supply both at the extensive and the intensive margins. We cannot do much on participation. We already noticed that the share of women who leave the company after childbirth is low and mainly motivated to stay active by changing employer. However, we can study the evolution of hours supplied around childbirth. We thus replicate our event study using as dependent variable the log of weekly hours actually worked by the employees.

Results are reported in Figure 6. A significant reduction, around 4%, is found one year after delivery. The subsequent year things seem to slightly improve, likely due to re-enter after maternity leave, but another drop is found from the fourth year after childbirth. This result was not expected, given the large availability of national childcare services for children in pre-school age and the company's contributions to childcare expenses to all employees with children aged less than 3. A catching-up trend starts only 6 years after the event, when children enroll in primary school. However, 9 years after, mothers' hours worked are still 3% lower than those of

non-mothers.

Figure 6: **Weekly Working Hours**



Given the findings on hours worked, we deeper the analysis by analyzing changes in contractual working time among the subsample of fathers and mothers. Before the birth of the child, 67% of future fathers and 52% of future mothers had a full-time employment contract. Around 47% of future mothers had a contract with some reduction in working time (most of them worked 80% of full time), while only 0.11% had a part time contract. After delivery, however, the share of mothers working full time decreases to 47%, while it increases to 3% that of part-time.

Table 1: **Working Time by Contract**

	Fathers	Mothers	Fathers	Mothers
	<i>Pre-Birth</i>		<i>Post-Birth</i>	
<b>Full Time</b>	67.04	52.14	69.17	46.84
<b>Less than Full</b>	32.74	47.74	30.58	50.12
<b>Part Time</b>	0.21	0.11	0.25	3.04

These findings suggest that individual choices on hours worked after childbirth may be a relevant

mechanism that negatively impact earnings. However, the event study on working hours shows a catching-up process that is not found in the earnings' trends.

## **5.2 Firm's choices: promotions, pay and incentives**

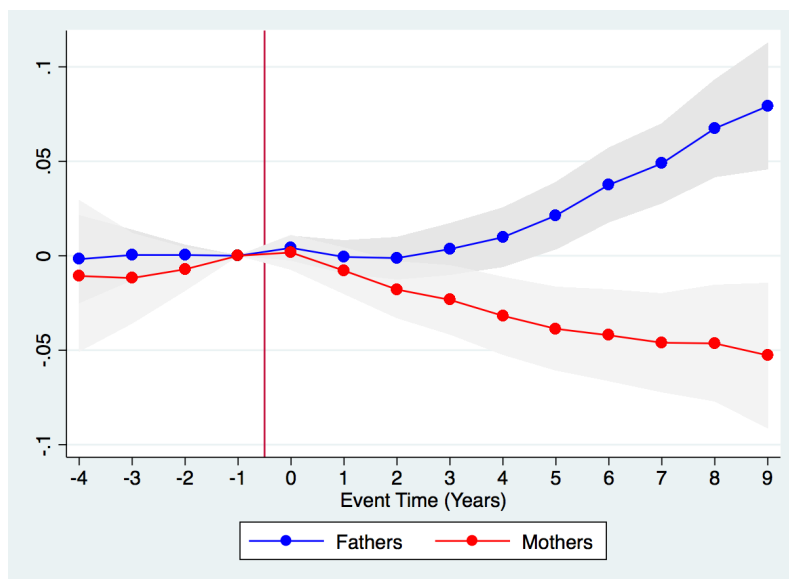
According to Davies and Frink (2014), the myth of the perfect worker began to emerge at the beginning of the 20<sup>th</sup> century, when it was described as “a men completely devoted to his employer, his faithfulness rewarded by promotions” (p. 26). This way of conceiving work has developed over time, with the advent of the “24/7” working culture and the widespread idea that employers implicitly require that work schedule should take precedence over family. This implies that employers' expectations could affect mothers' earnings, especially around the timing of first childbirth. We are able to identify three mechanisms: the chances to be promoted, the structure of pay, and the responses to incentive schemes.

### **5.2.1 Promotions to managerial positions**

We start by looking at the probability of becoming manager. Figure 7 shows that, before childbirth, there are no significant differences between employees who are going to have a child and employees who are not, both among males and females. After childbirth, however, the probability to climb-up the hierarchical structure of the firm decreases for mothers. A gap of 5% persists 9 years after childbirth. The reverse happens to father. Their chances to be promoted to managerial positions are higher, and increasing over time, with respect to non-fathers.



Figure 7: Probability of Becoming Manager



Two major arguments have been developed to justify promotions within the firm. The first is based on tournament theory (Lazear and Rosen (1981), Rosen (1986)). A promotion is the prize allocated to the worker who ranks better than all other candidates. The winner will be moved to a position that involves higher responsibility and earnings. Her probability to win depends on her productivity and this probability is itself an incentive to exert higher effort. The second, based on job assignment models (Gibbons and Waldman, 1999a), views promotions as an instrument for the efficient allocation of the employees within the firm. The firm uses employment at lower hierarchical levels as a screening period during which it learns about employees' abilities and attitudes. According to Pfeifer (2010), both theories predict similar hypothesis on the determinants of promotions. Among these, absenteeism is particularly relevant. Indeed, absenteeism is an important proxy for productivity and work effort. According to the first theory on promotions, an absent employee cannot provide effort, and so her probability of winning the tournament declines. Instead, according to job assignment models, if an employee is absent the firm cannot learn about her productivity and can use absenteeism in the past as a proxy for productivity in the future.

To better investigate these issues, we replicate our event on the log of annual number of hours of absence to see if there are changes in the absenteeism behavior of mothers around childbirth.

We exclude from the analysis the absences related to maternity or paternity leave. Figure A3 in the Appendix shows the results. A slight increase in the number of hours of absence is found for mothers in the years immediately after delivery, but, then, no significant differences are found with respect to non-mothers. In addition, the gap turns to be in favor of mothers 6 years after delivery. Thus, there is no evidence that the persistence of lower probability of promotions for mothers are due to an increase in absenteeism after childbirth.

Another determinant of promotion is overtime. Goldin (2014) observes that some firms offer disproportionate rewards for working long hours. According to her, this non-linearity in premiums largely hits working women with small children. Thus, another possible explanation for a lower probability of promotions for mothers can be a decrease in extra-time. Figure A4 in the Appendix shows that the amount of overtime hugely drops one year after delivery. However, by the end of the observed period, mothers manage to fully catch-up non-mothers. Again, even if mothers manage to increase back their extra working time, they are not rewarded back in terms of promotions and earnings.

### **5.2.2 Variability of pay**

Changes in the structure of pay can also help explaining mothers' penalty after childbirth. The arrival of a child is a source of instability that may affect the distribution of earnings. Figure A5 in the Appendix shows that the variance of total annual remuneration constantly increases for mothers after childbirth, while that of fathers stays steady.

A large body of literature explains the intertemporal increase in dispersion of earnings in terms of two components. The first is related to changes in quantity and prices of individuals' personal characteristics, while the second captures transitory earnings movements. The pioneer work on this issue is by Gottschalk and Moffitt (1994). In their study on earnings instability in the US labor market, they determined how much of the increase in dispersion of wages of US male workers over the 1970s and 1980s was due to a rise in the dispersion of short-term earnings instability as opposed to a change in the dispersion of permanent earnings. Following their approach, to compute permanent and transitory earnings variances and how they vary around childbirth, we start by subdividing data into two four-year periods: the first before childbirth, the second after. For each year within the two periods, we regress earnings on a quadratic in

age and compute residuals. We define the permanent variance as the variance of the mean of residuals across individuals within the periods. This component represents the dispersion of average individual earnings around a common age-earnings profile. To compute the transitory variance we first calculate, for each individual, the yearly deviations of her log earnings from the mean of residuals. We then compute the variance of these transitory components separately for each individual in each year and then we average them across individuals. This component represents the dispersion of fluctuations around each individual’s age-earnings profile. Results are shown in Table 2. After childbirth, the permanent variance rose for fathers from 0.078 to 0.098, while for mothers, from 0.088 to 0.17. These findings give evidence that dispersion of permanent earnings, linked to changes in how mothers’ characteristics are valued after childbirth, notably rose. Transitory component of variance, instead, not only accounts for a small share of changes in total variance, but also does not significantly vary between the two periods.

Table 2: **Permanent and Transitory Variance of Total Annual Remuneration**

	<b>Pre-Birth</b>	<b>Post-Birth</b>	<b>Pre-Birth</b>	<b>Post-Birth</b>
<i>Permanent</i>			<i>Transitory</i>	
<b>Fathers</b>	0.078	0.098	0.013	0.010
<b>Mothers</b>	0.088	0.170	0.012	0.010

### 5.3 Responses to incentives

Another possible explanation for the motherhood penalty may stand in the the different way mothers respond to firm’s incentives (Lazear, 2000). Some workers may be required to reach specific productivity goals or work during certain time periods to get wage premiums or career improvements. It may be that mothers, after childbirth, are less responsive to this kind of incentives.

To check our hypothesis we divide our employees according their working division. We focus on production and commerce. These divisions likely differ in terms of implementation of incentive schemes. The production is commonly less sensible to incentives, since the work is more manual and easily replaceable. Instead, incentive schemes tend to be more widespread among sales and trade officers. These workers, usually not readily substitutable, are more subject to productivity

goals. We find a confirmation of this fact by looking at the share of individual bonuses, the earnings component more responsive to incentives, among the two divisions. This share is higher among sale and trade employees. Moreover, it is higher for women than for men.

Table 3: **Share of Bonuses by Division**

	<b>Men</b>	<b>Women</b>
<b>Total</b>	0.012	0.016
<b>Production</b>	0.011	0.012
<b>Commerce</b>	0.019	0.021

We start our investigation by replicating our event study by division, focusing on bonuses. Results are reported in Figure A6 in the Appendix. Mothers in the commerce division experience a large drop in total annual earnings the first years after childbirth. Two years after delivery, the reduction in bonuses is close to 50% with respect to childless women. In the production division the gap is around 20%. By the end of our observation period, however, there are no relevant differences between the two divisions. Fathers, instead, largely out-perform their childless counterpart in the commerce division. Thus, if we consider bonuses as a response to incentives, we find that fathers in the commercial sectors react by improving their productivity after childbirth, while mothers not.

## 6 Robustness checks

In a robustness check, we select a balanced sample of employees who experienced the birth of the first child. In details, we focus only on parents and balance the sample around the childbirth window 2007 – 2009. The main characteristics of this strategy is that each individual in the sample receive the treatment and is observed for the same number of years during the panel. Two important consequences derive. First, this specification does not require the use of controls, and so, of fixed effects. Second, since we are balancing around the time of the event, we lose

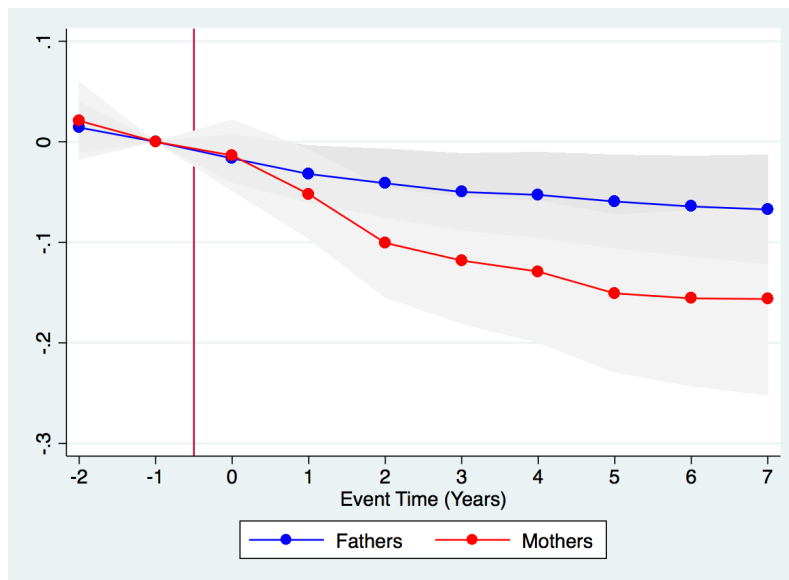
event-time observations. Our event-time function now ranges from  $-2$  to  $+7$ :

$$Y_{its} = \sum_{s=-2}^7 \gamma_s 1\{s = S_{it}\} + \sum_j \delta_j 1\{j = age_{it}\} + \nu_t + \varepsilon_{its} \quad (3)$$

The only difference with respect to Equation (2) is that we are not including fixed effects. The omitted category is the event time dummy at  $s = -1$ . Results should now be interpreted with respect to the year immediately before childbirth.

In Figure 8 we present findings on total annual remuneration, while in Figure A7 and A8 in the Appendix those on individual bonuses and remuneration level. The motherhood penalty is confirmed. Mothers not only are disadvantaged as compared to non-mothers, but 7 years after childbirth they are still earning 10% less with respect to the year immediately before delivery. It is interesting the fact that also fathers seem to be slightly penalized with respect to the year prior childbirth, even if at much lower magnitude as compared to mothers.

Figure 8: **Total Annual Remuneration - Balanced Sample**



## 7 Conclusion

Using a panel of personnel records from 2005 to 2016, we developed an event study with the use of control groups to capture the effects of first childbirth on the dynamic trajectories of

remunerations and careers among male and female employees of a large firm in France.

Despite the family-friendly institutional context, results show a clear penalty for women in terms of wages and career paths after first childbirth. Fathers' outcomes, instead, are not significantly affected.

As possible explanations of these results, we observe that, immediately after childbirth, mothers reduce working hours, increase hours of absence and largely diminish extra-time. However, by the time children enroll school, we find clear evidence of a catching-up trend. A pattern that, instead, is not found in earnings and promotions. Mothers' pay is also more volatile after childbirth. In particular, our results suggest an increase in the permanent component of variance, that linked to the way our firm values and rewards mothers' characteristics. Finally, we found a large drop in bonuses, especially in the commerce division. This finding suggests that mothers, as opposite to fathers, are less responsive to productivity incentives.

While family-friendly policies play a fundamental role in reconciling work and family, our results point out that the main explanation for the motherhood penalty stands in constraints posed by current working culture and "how business is done" (Blau and Winkler, 2017). The negative incidence of a reduction in working hours and an increase in absenteeism, even if just for the first years after childbirth, is strong and persists even when a clear catching-up in hours is found. Mothers' pay is more uncertain after childbirth. Productivity incentives, likely linked to long and particular working hours (Goldin, 2014), cannot be successfully pursued by women with small children.

## References

- J. Altonji and R. M. Blank. Race and Gender in the Labor Market. in ashenfelter, o. and card, d. *Handbook of Labor Economics*, 3:3143–3259, 1999. North Holland: Elsevier Science Publishers.
- D. J. Anderson, M. Binder, and Krause K. The Motherhood Wage Penalty Revisited: Experience, Heterogeneity, Work Effort, and Work-Schedule Flexibility. *Industrial and Labor Relations Review*, 56(2):273–293, 2003.
- J.D. Angrist and N.E. William. Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size. *The American Economic Review*, 88(3):450–477, 1998.

- G. Baker, M. Gibbs, and B. Holmstrom. The Internal Economics of the Firm: Evidence from Personnel Data. *The Quarterly Journal of Economics*, 109(4):881–919, 1994.
- M. Bertrand. *New Perspectives on Gender*, chapter in Handbook of Labor Economics. Elsevier, Amsterdam, 2011.
- M. Bertrand, C. Goldin, and L. F. Katz. Dynamics of the Gender Gap for Young Professionals in the Financial and Corporate Sectors. *American Economic Journal: Applied Economics*, 2: 228–255, 2010.
- F. Blau and L. Kahn. The Gender Earnings Gap: Learning from International Comparisons. *American Economic Review*, 82:533–538, 1992.
- F. D. Blau and A.E. Winkler. Women, Work and Family. *NBER Working Paper N.w23644*, 1: 18–39, 2017.
- K. Borusyak and X. Jaravel. Revisiting Event Study Designs. *Working Paper 445541*, 2016.
- M.J. Budig and P. England. The Wage Penalty for Motherhood. *American Sociological Review*, 66(2):204–225, April 2001.
- A.R. Davies and B. D. Frink. The Origins of the Ideal Worker: the Separation of Work and Home in the United States From the Market Revolution to 1950. *Work and Occupations*, 1: 18–39, 2014.
- P. Doeringer and M. Piore. *Internal Labor Markets and Manpower Analysis*. Lexington, Mass, Heath, 1971.
- C. Dustmann, J. Adda, and K Stevens. The Career Costs of Children. *CESifo Working Paper N.6158. Forthcoming Journal of Political Economy*, 2016.
- C. Felfe. The Motherhood Wage Gap: What about Job Amenities? *Labour Economics*, 19: 59–67, 2012.
- R. Gibbons and M. Waldman. Careers in Organizations: Theory and Evidence, Orley Ashenfelter and David E. Card (eds.). *Handbook of Labor Economics*, 3B:2373–2437, 1999a. Amsterdam: North-Holland.

- C. Goldin. A Grand Gender Convergence: its Last Chapter. *American Economic Review*, 104(4):1091–1119, 2014.
- P. Gottschalk and R. Moffitt. The Growth of Earnings Instability in the US Labor Market. *Brooking Papers on Economic Activity*, 2:217–254, 1994.
- H. J. Kleven, C. Landais, and J.E. Søgaaard. Children and Gender Inequality: Evidence fom Denmark. Unpublished, 2017.
- E. P. Lazear. Performance Pay and Productivity. *American Economic Review*, 90(5):1346–1361, 2000.
- E. P. Lazear and S. Rosen. Rank-Order Tournaments as Optimal Labor Contracts. *Journal of Political Economy*, 89:841–864, 1981.
- D. L. Millimet. The Impact of Children on Wages, Job Tenure, and the Division of Household Labour. *The Economic Journal*, 110(462):C139–C157, 2000.
- C. Pfeifer. Determinants of Promotions in an Internal Labour Market. *Schmalenbach Business Review*, 62:342–358, 2010.
- S. Rosen. Prices and Incentives in Elimination Tournaments. *American Economic Review*, 76:701–715, 1986.
- M. Simonsen and L. Skipper. The Family Gap in Wages: what Wombmates Reveal. *Labour Economics*, 19:102–112, 2012.
- J. Waldfogel. The Effects of Children on Women’s Wages. *American Sociological Review*, 62:209–217, 1997.
- L. Wilner. Worker-Firm Matching and the Family Pay Gap: Evidence from Linked Employer-Employee Data. *Journal of Population Economics*, 29(4):991–1023, 2016.

## Appendix



Table A1: Summary Statistics by Gender

	Men					Women				
	Mean	Std. Dev.	Min.	Max.	Obs	Mean	Std. Dev.	Min.	Max.	Obs
Parent	0.621	0.485	0	1	353410	0.656	0.475	0	1	15252
Children	1.90	0.81	1	10	219505	1.78	0.74	1	10	99993
Couple	0.696	0.46	0	1	353410	0.642	0.479	0	1	152520
Single	0.183	0.387	0	1	353410	0.197	0.398	0	1	152520
Prev married	0.042	0.201	0	1	353410	0.084	0.278	0	1	152520
Age	39.039	7.91	20	50	353410	38.391	7.417	20	50	152520
Less than High School	0.22	0.415	0	1	353410	0.177	0.382	0	1	152520
High School	0.509	0.5	0	1	353410	0.52	0.5	0	1	152520
Graduates and Postgraduates	0.268	0.443	0	1	353410	0.299	0.458	0	1	152520
Tenure	15.065	9.077	0	49.01	353410	13.209	8.281	0	45.17	152520
Managers	0.387	0.487	0	1	353410	0.361	0.48	0	1	152520
Commerce	0.121	0.326	0	1	353410	0.369	0.483	0	1	152520
Production	0.655	0.476	0	1	353410	0.349	0.477	0	1	152520
RL	27.916	12.105	2	68	353410	26.89	12.744	2	68	152520
Weekly Hours	34.365	1.303	16	35	353410	33.369	2.833	3.5	35	152520
Annual Absences (Hours)	291.367	174.237	-443	3270.4	32489	367.284	285.247	-417	2208	141851
Occupation Pay	46614.156	16743.87	50	230325.313	353410	38957.699	15408.46	497.75	183957.5	152520
Bonuses	1750.624	2401.055	0	53543.879	353410	1641.122	2221.984	0	37604	152520
Total Pay	48364.693	18536.176	50	232925.313	353410	40598.635	17196.811	497.75	198157.5	152520

Table A2: Estimation Sample: Main Characteristics

	Fathers	Non Fathers	Mothers	Non Mothers
<b>Age</b>	34.96	35.24	33.96	35.95
	(5.94)	(9.12)	(5.61)	(8.64)
<b>Age at childbirth</b>	31.75	.	30.27	.
	(5.91)	(.)	(5.57)	(.)
<b>Less than High School</b>	0.07	0.19	0.04	0.17
	(0.26)	(0.38)	(0.20)	(0.37)
<b>High School</b>	0.61	0.51	0.61	0.47
	(0.49)	(0.50)	(0.49)	(0.49)
<b>University Degree</b>	0.32	0.30	0.35	0.35
	(0.46)	(0.45)	(0.47)	(0.48)
<b>Manager</b>	0.38	0.36	0.39	0.41
	(0.48)	(0.48)	(0.49)	(0.48)
<b>First RL</b>	21.81	22.58	21.71	23.15
	(11.26)	( 11.33)	(12.11)	(11.20)
<b>Last RL</b>	32.92	28.12	31.40	29.82
	(12.36)	(11.96)	(14.13)	(13.07)
<b>Tenure</b>	11.49	11.60	9.90	10.98
	(5.58)	(11.78)	(5.04)	(8.91)
<b>Production</b>	0.70	0.69	0.38	0.42
	(0.46)	(0.46)	(0.48)	(0.49)
<b>Commerce</b>	0.14	0.12	0.44	0.32
	(0.34)	(0.33)	(0.50)	(0.37)
<b>Exit</b>	0.01	0.01	0.04	0.02
	(0.11)	(0.21)	(0.20)	(0.17)
<b>Weekly Working Hours</b>	34.26	34.40	33.29	34.24
	(1.40)	(1.32)	(2.79)	(1.89)
<b>Annual Absences (Hours)</b>	287.99	281.95	335.52	299.34
	(150.92)	(202.29)	(222.37)	(241.75)
<b>Paternity/Maternity Leave (Hours)</b>	65.48	.	422.94	.
	(13.73)	(.)	(292.77)	(.)
<b>Obs</b>	18225	85868	8795	34713

Figure A1: Reasons for Exit - Mothers

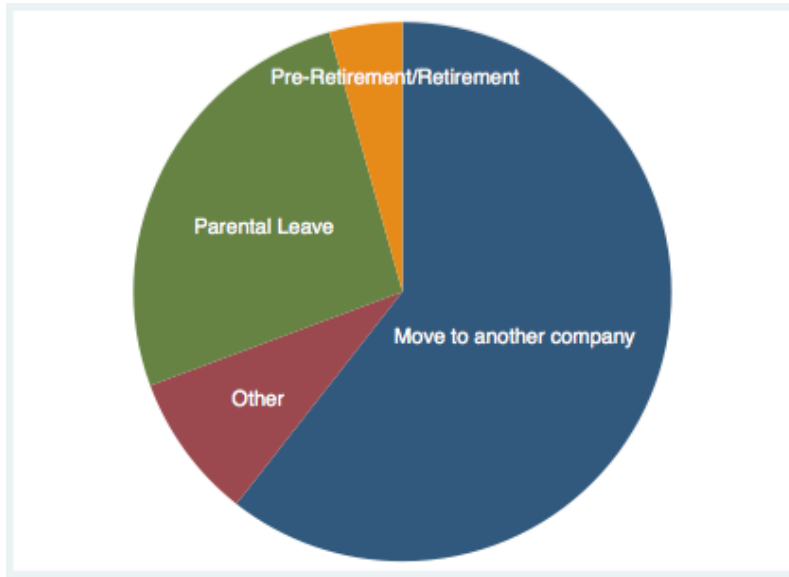


Figure A2: Total Annual Remuneration - Managers and Not Managers

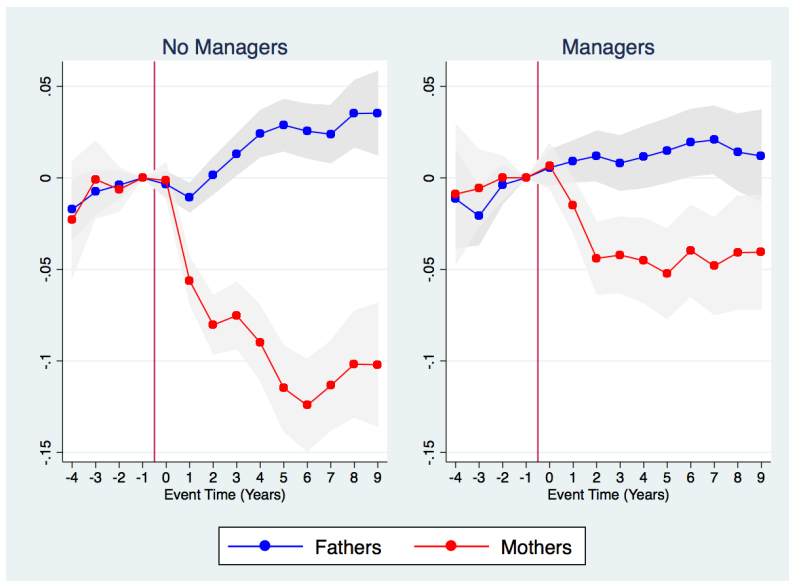


Figure A3: Annual Hours of Absence

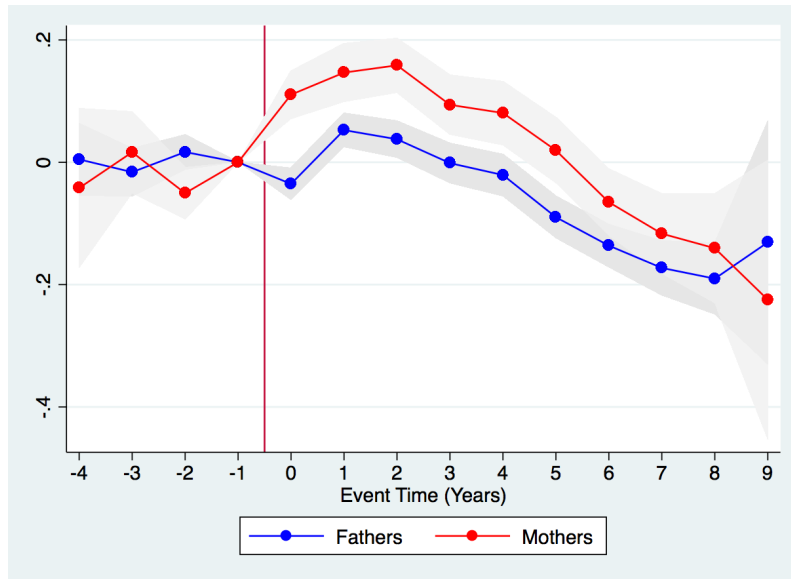


Figure A4: Extra-Time

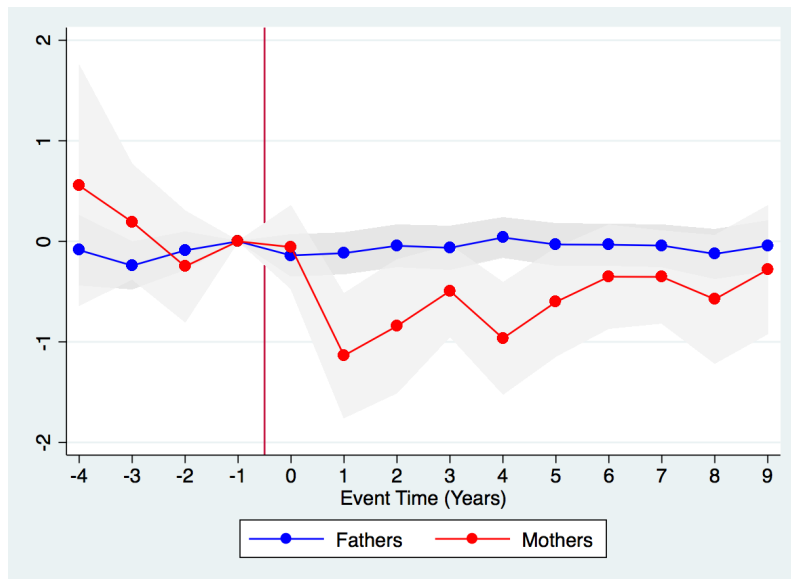


Figure A5: Variance of Total Annual Remuneration

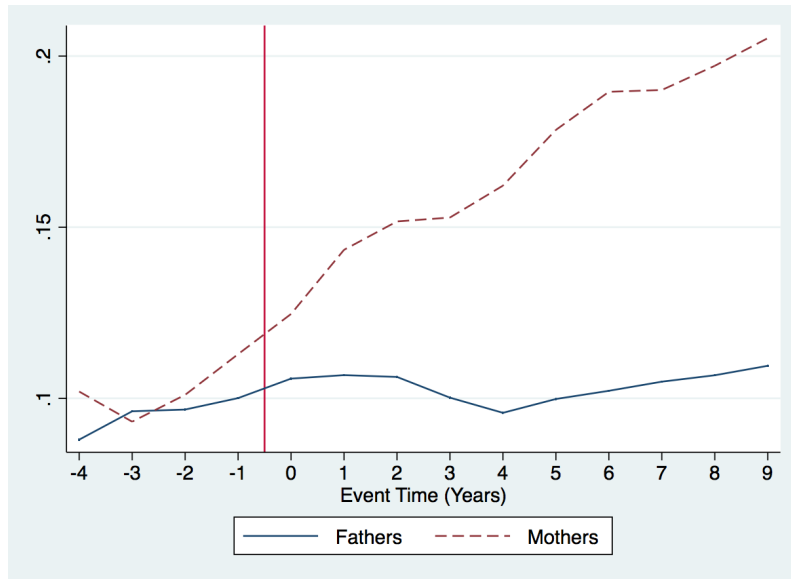


Figure A6: Bonuses by Division



Figure A7: Bonuses - Balanced Sample

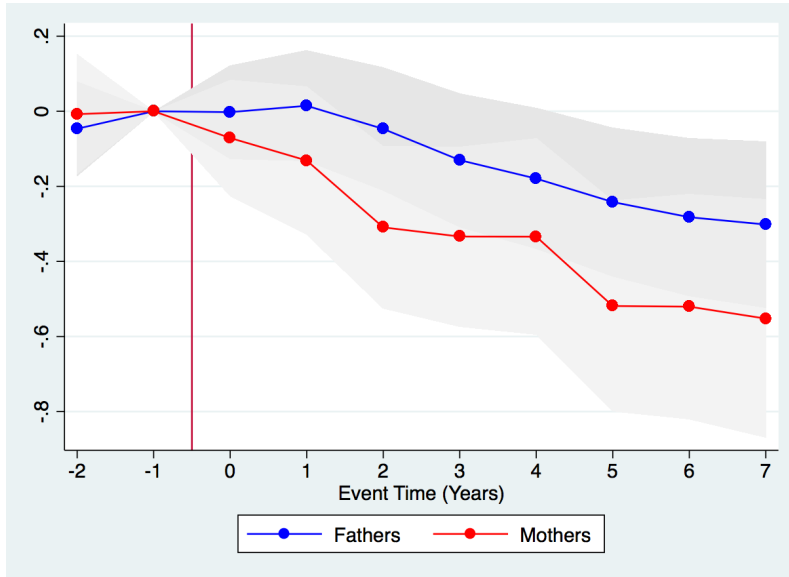


Figure A8: Remuneration Level - Balanced Sample

