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THE ECONOMIC CONSEQUENCES OF CHILDBIRTH.

NEW EVIDENCE FROM PERSONNEL DATA

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Foreword

The disappearance of traditional human capital differences between men and women and the implementation of anti-discrimination laws made children the key reason for the persistence of gender inequalities in the labor market. It is thus surprising how little is known on the causal impact of childbirth on economic outcomes. Current evidence is large, but mostly descriptive. In general, it shows that the association between the birth of a child, participation, hours supplied and earnings is negative for women (Waldfogel (1998), Budig and England (2001), Bertrand (2011), Felfe (2012)), while positive for men (Millimet (2000), Simonsen and Skipper (2012)).

These stylized facts have two main underlying explanations: causation and adverse selection of mothers (Lundborg et al., 2017). Causation means that having children has a negative effect on labor market outcomes for women, but apparently not for men. Adverse selection, instead, suggests that women with children are also those with the poorest labor market potentials, regardless of the motherhood status. Disentangling these effects is of particular interests, mainly for its policy implications. In fact, penalties for mothers are found in all labor markets, from family-friendly frameworks (e.g. Denmark), to institutional contexts that do not provide universal coverage in child-related leaves and services (e.g. the US). Inefficiencies in this type of policies are common and improvements can be done only through a deeper understanding of the real labor market implications of childbirth.

The aim of this work is to provide new, and robust, evidence on the economic consequences of childbirth. To do so, it relies on a new and unique dataset of personnel records on the workforce of

a large French company[1]. This firm accounted for 129,492 employees and collaborators in France in 2013, has plants spread all over the country and a rigid, hierarchical internal structure. Thus, it can be considered as a large internal labor market. The uniqueness, richness and high quality of the data allow to perform a comprehensive analysis on the (causal) effect of the arrival of a child on earnings and careers of male and female employees along the intensive and extensive fertility margins. The main contribution of this work stands in its ability to specifically capture the mechanisms behind the child effects, with a specific focus on measures of individual productivity. In particular, the contributions to the existing literature are twofold. First, to the extensive literature on gender inequality (Blau and Kahn (1992); Altonji and Blank (1999), Bertrand (2011)) and, specifically, on impact of parenthood in the labor market (Angrist and Evans (1998); Millimet (2000); Adda et al. (2017); Kleven et al. (2018); Lundborg et al. (2017)). Second, to the small literature on the functioning of internal labor markets (Baker et al., 1994).

The use of administrative data ensures high quality and extremely precise information, largely reducing the possibility of measurement errors. In this peculiar setting, personnel records allow to improve the current understanding of the economic consequences of childbirth thanks to the availability of detailed information on working hours, absences, causes of absences and career patterns. They also allow to disentangle the child effect on the different components of annual earnings, which is usually not easy to do with survey data.

The main concern of using this dataset is related to external validity of the findings. However, the dimension of the firm under analysis and its presence all over the French territory help mitigating this issue. Another drawback is that this dataset does not allow to investigate labor participation. However, the main aim of this work is to shed light on adjustments in individual behavior within workplaces after the birth of a child, and not to study if childbirth affects participation. Results will be particularly useful for the elaboration of policies aimed at favoring parents' performance in the labor market.

Studying the economic consequences of children along the intensive margins means evaluating the impact of high parity births among individuals who already have children. This is done in Chapter

[1]The dataset has not been previously used for other purposes

2, which analyzes the causal effect of having a third child on earnings among employees who already have two children. Causality is addressed through the exploitation of exogenous variation in fertility induced by twinning at second childbirth.

Instead, working on the consequences of childbirth along the extensive margins means to identify the labor market effects of becoming parents. These are explored in Chapter 3, dedicated to the study of the child effect on individuals who are going to have their first kid. In this case, the empirical strategy is based on the analysis of the trajectories of earnings and careers before and after childbirth and their differences with those of childless comparable individuals.

Results are in line with the most reliable findings of this literature (Lundborg et al. (2017), Adda et al. (2017), Wilner (2016), Bertrand (2011)). No significant effects are found for men. Women, instead, are significantly penalized. The penalty in earnings estimated for having a child (along the extensive margins) is larger than the effect of having additional children among women who already have children (along the intensive margins). Indeed, the penalty from becoming mother is 9% 8 years after childbirth, while the penalty from having a third child among women who already have two children is around 3%.

These results are driven by a significant slowing-down in career improvements and a reduction in pay components linked to individual performance around the timing of first childbirth. But they also suggest that these penalizations likely reflect stereotypes on lower productivity of women with children, since mothers, by the time the child starts school, do no significantly differ from non-mothers in terms of hours worked and absenteeism.

The reminder of the work proceeds as follows. Chapter 1 presents some stylized facts on parents in the European labor market and briefly surveys the main findings of the literature on this stream of research. Chapter 2 is dedicated to the study of the child effect within the company, with a specific focus on the causal impact of the birth of the third child on earnings. Chapter 3 develops an event study around first childbirth to capture the effect of becoming parents on employees' economic performance.

Chapter 1

Parents in the Labor Market

Since the 1960s, women have made major inroads in the labor market, giving rise to what Goldin (2006) called a "quite revolution". This revolution passed through increasing participation rates, stronger identification with careers instead of family, and a better ability to make joint decisions with the spouse. Key factors behind these changes in society and the economy have been females' rising in levels of education, greater availability of market substitutes for household production and improvements in household technology, changes in family structure, and demand shifts that favored specific occupations, like clerical work, where women have been increasingly represented (Blau and Winkler, 2017). However, relevant gender differences in participation and earnings persist and do not seem to decrease. The reason behind this fact is still the most obvious: children. The negative association between motherhood and economic outcomes is strong and widely observed, while for fathers the reverse is true.

This Chapter presents some stylized facts on the relationship between parenthood and labor market outcomes, with a specific focus on Europe (Section 1.1), and a survey of the main findings of the academic literature on this topic (Section 1.2).

I thank Claudio Lucifora, Dominique Meurs, Giovanni Sulis and Elisabetta Lodigiani for helpful comments and thoughtful conversations.

1.1 Some stylized facts from Europe

The individual, social and economic consequences of parenthood have been investigated among scholars of different disciplines, above all psychology, sociology, and economics. Economists, in particular, have tried to assess the impact of childbirth on labor market participation, wages and careers. This stream of literature has traditionally defined the "*Parenthood gap*"[1] as the differential in economic outcomes between parents and non-parents . The basic questions they have tried to answer are: do individuals with children perform differently from their childless counterpart? Why? Are there differences between men and women?

The simplest observation is that parents may differ from non-parents even before childbirth. Individuals who plan to have children may have specific life-cycle preferences that affect their educational and working decisions. In particular, typical gender stereotypes suggest that women are more likely to have stronger preferences for family over career, ending up in paths of less demanding jobs with lower earnings. This is what the "male breadwinner model" suggests. But this view is starting to change, given the fact that, nowadays, in most couples, women are better educated than their partner. The gender gap in schooling has closed, and even reversed, in most developed countries[2]. In Europe, the share of women with a tertiary level of education is higher than that of men, with a gender gap of 9.5%[3]. Higher educational levels imply higher earnings potentials and stronger attachment, also for women, to careers.

Since life-cycle preferences are mostly not observable, what is usually done is trying to analyze the channels through which the birth of a child impacts on individuals' lives. These mechanisms are various, tend to interact each other and have different implications on men and women's economic outcomes.

The first channel is related to child-leaves: maternity, paternity, and parental leave. These leaves lead to breaks in career paths, which, in turn, are associated with losses in human capital and working experience. According to a simple Mincerian framework, this fact likely has a negative

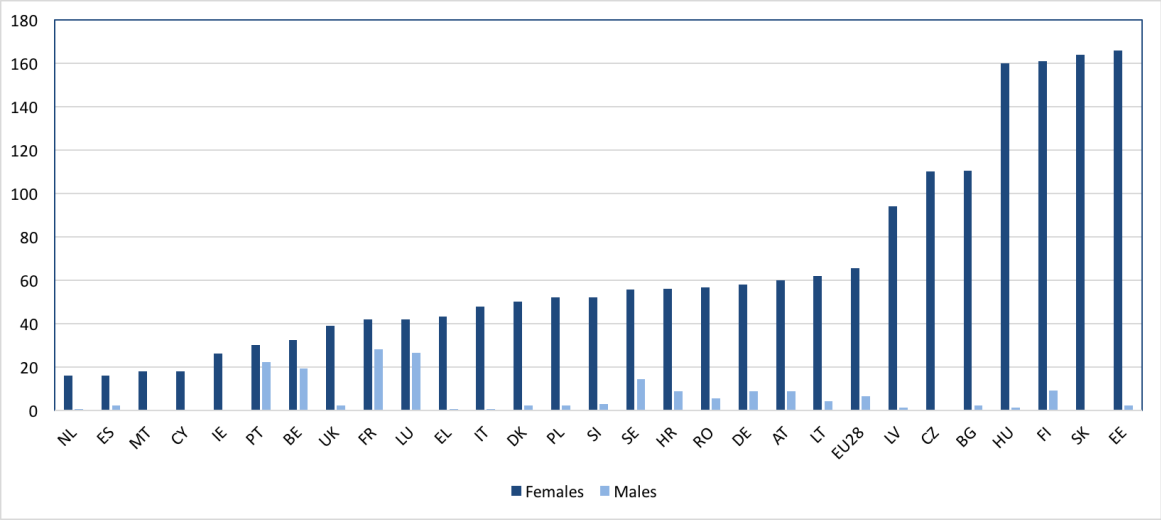
[1] Another stream of literature specifically focuses on the impact of childbirth among partners. This is usually called the "*Family gap*"

[2] Exceptions are, for example, Austria and Germany (OECD Data, Indicators, Population with tertiary education)

[3] `http://ec.europa.eu/eurostat/statistics-explained/index.php/Gender_statistics#Education`

effect on earnings and employment. Figure 1.1 shows the length of total leave (in weeks) available to mothers and fathers in the EU-28 area.

Figure 1.1: **Length of total paid leave available to mothers and fathers (in weeks), EU-28 2016**



Source: OECD, Family database, 2016
The length of total paid leave for mothers includes paid maternity and parental/home care leave.
The length of total paid leave for fathers includes entitlements to paternity leave, "father quotas" or periods of parental leave that can be used only by the father and cannot be transferred to the mother.

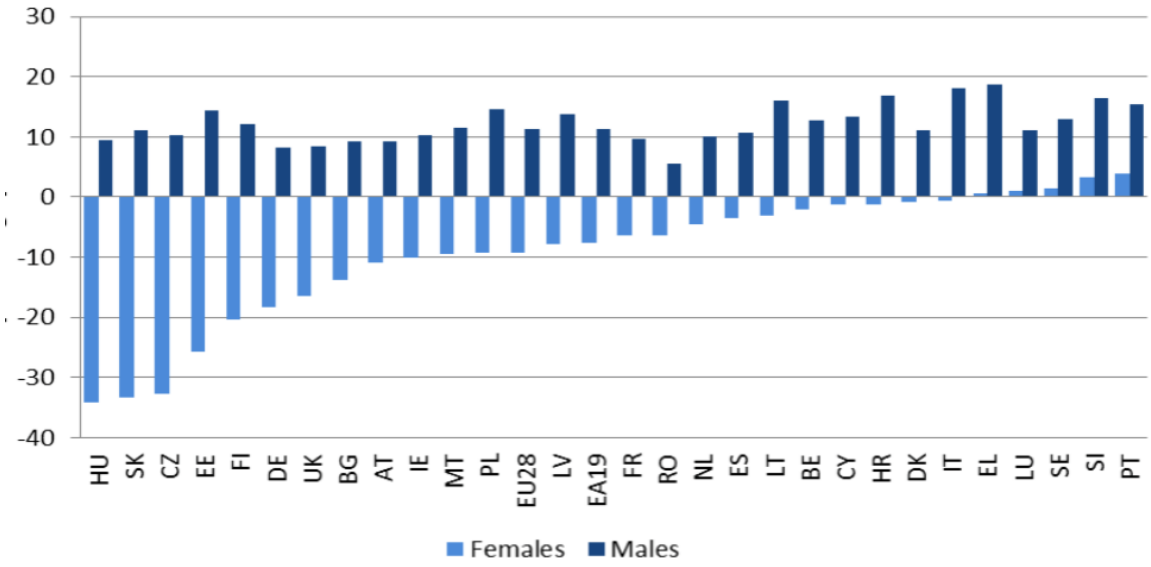
All European countries ensure mandatory maternity leave for mothers of new-born children. Entitlements to paternity leave, instead, are not available in all countries and, in most cases, are not mandatory. The total leave reserved for fathers is far shorter than that reserved for mothers: the EU-28 average length is 6.4 weeks for males versus 67.4 for females. But not only the length of leave is shorter. Also the actual uptake by fathers is extremely low. In a study conducted in 2013 by the European Commission it was estimated that in European countries where paternity leave can be shared among parents, about 40 per cent was taken by the mother, and only 2 per cent by the father[4]. This implies that the incidence, and consequences, of these career interruptions are much stronger for women than men.

After the end of the leave spell, women have to decide if to come back to work. Statistics reveal that the arrival of a child has a negative impact on women's employment rate. Figure 1.2 shows

[4]Van Belle (2013)

how motherhood is negatively associated with participation, as opposed to fatherhood. In some European countries (Hungary, the Czech Republic, Slovakia, Estonia and Finland), the employment rate of women with children under age 6 is more than 20% lower than the employment rate of childless women. It is closed to −20% in Germany and the United Kingdom, between −10% and 0 in the rest of Europe. Fatherhood, instead, seems an incentive to participate more. Positive employment raw gaps between fathers and non-fathers are found in all European countries.

Figure 1.2: **Raw employment gap between parents and non-parents, EU-28 2014**



Source: Labor force participation for women, European Commission, 2014

Some intuitions about the social costs of the penalty in employment for mothers are presented in Figures 1.3, 1.4, and 1.5. OECD data on length of total paid leave available to mothers, employment rates, and labor productivity growth[5] have been used to perform this analysis.

Figure 1.3 shows a simple scatter plot on the relationship between the gap in employment between mothers and non-mothers and the length of total paid leave available for mothers in the EU28. The

[5]OECD definition: "Labor productivity growth is a key dimension of economic performance and an essential driver of changes in living standards. Growth in gross domestic product (GDP) per capita can be broken down into growth in labor productivity, measured as growth in GDP per hour worked, and changes in the extent of labor utilization, measured as changes in hours worked per capita. High labor productivity growth can reflect greater use of capital, and/or a decrease in the employment of low-productivity workers, or general efficiency gains and innovation"

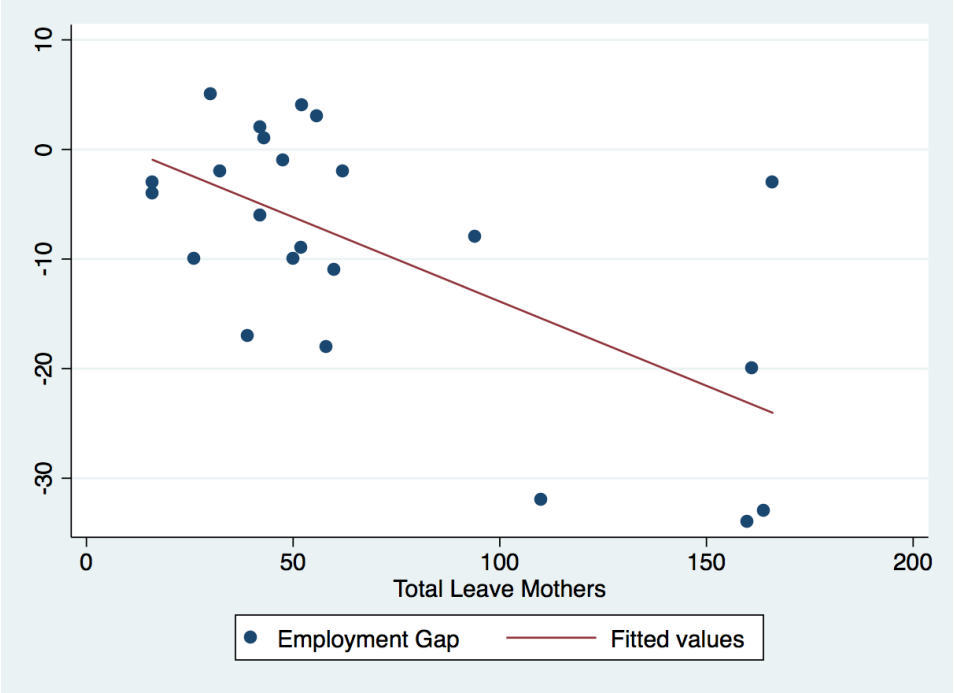
analyzed year is 2014. The main suggestion is a negative correlation: as the length of total paid maternity leave increases, the motherhood employment gap gets worse.

Figure 1.4 shows that higher gaps in employment between mothers and non-mothers are also slightly associated with lower labor productivity growth.

Figure 1.5, instead, shows that there seems to be no correlation between the length of total leave available to mothers and labor productivity growth. Another study on OECD countries (Bassanini and Venn, 2008) has found similar results. In particular, it suggests that the impact of additional weeks of leave on productivity growth[6] is greater in countries with no leave or relatively short periods of leave, as in the US, than in countries that already have generous leave entitlements, as in Europe. Moreover, it explains that an observed positive association between parental leave and productivity growth can be due to changes in the level of employment, rather than changes in individual productivity. For example, firms could reduce total employment if they think additional parental leave will impose costs on hiring workers, leading to higher productivity through composition effects. Over the longer term, firms might substitute capital for labor in order to reduce the potential cost of parental leave, increasing the capital-to-labor ratio and raising labor productivity.

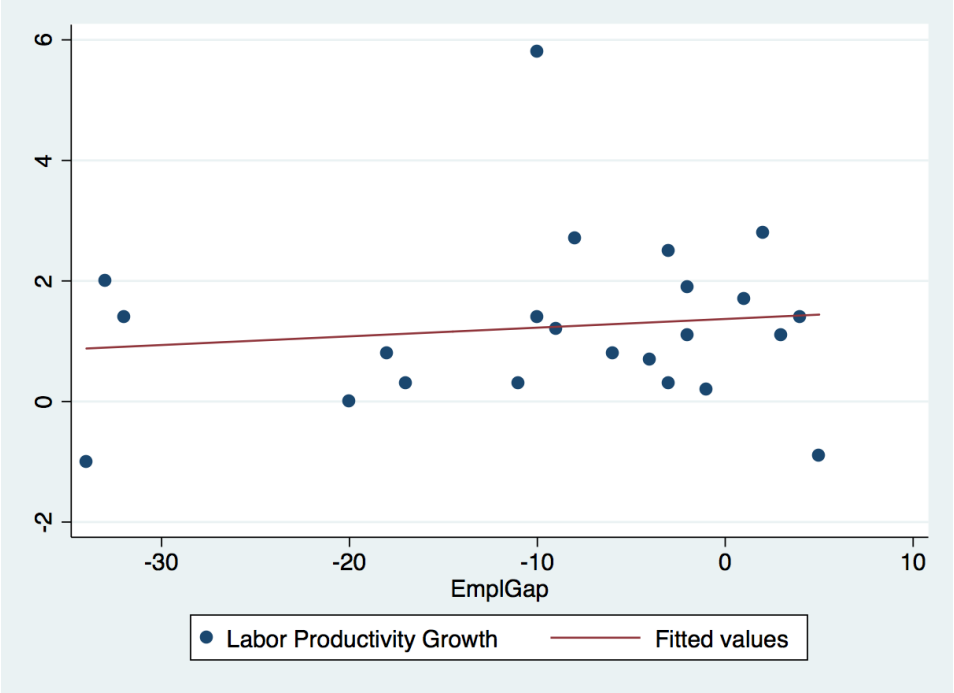
[6]They use multifactor productivity growth as measure of productivity growth. Multifactor productivity (MFP) reflects the overall efficiency with which labor and capital inputs are used together in the production process

Figure 1.3: **Raw motherhood employment gap and length of total paid leave available to mothers - EU28 2014**



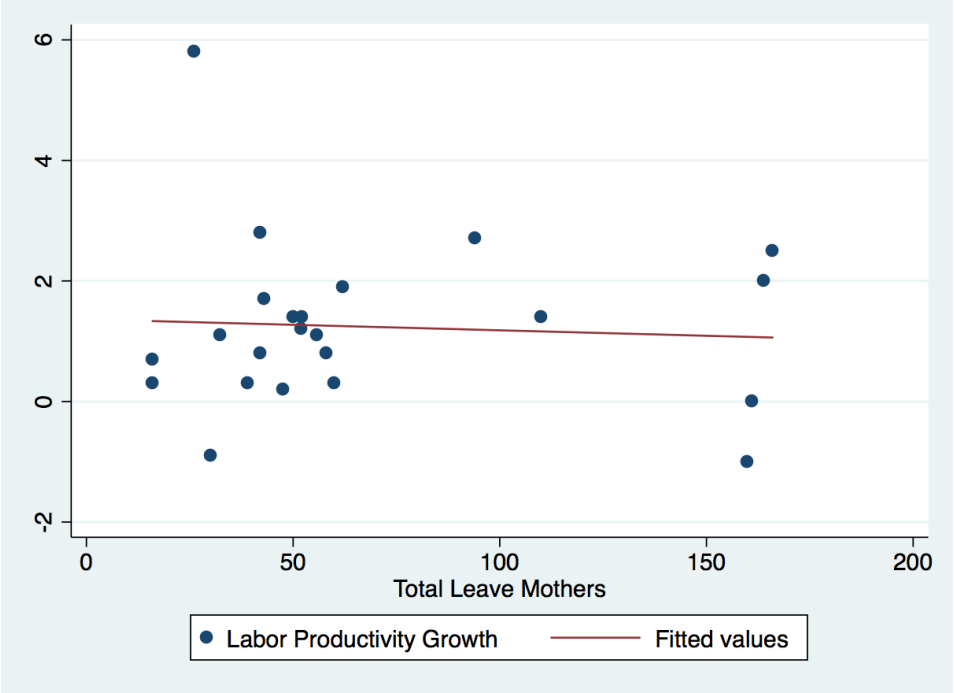
Source: OECD Family Database, 2014

Figure 1.4: **Association between raw motherhood employment gap and labor productivity growth - EU28 2014**



Source: OECD Data, 2014

Figure 1.5: **Association between length of total paid leave available to mothers and labor productivity growth - EU28 2014**

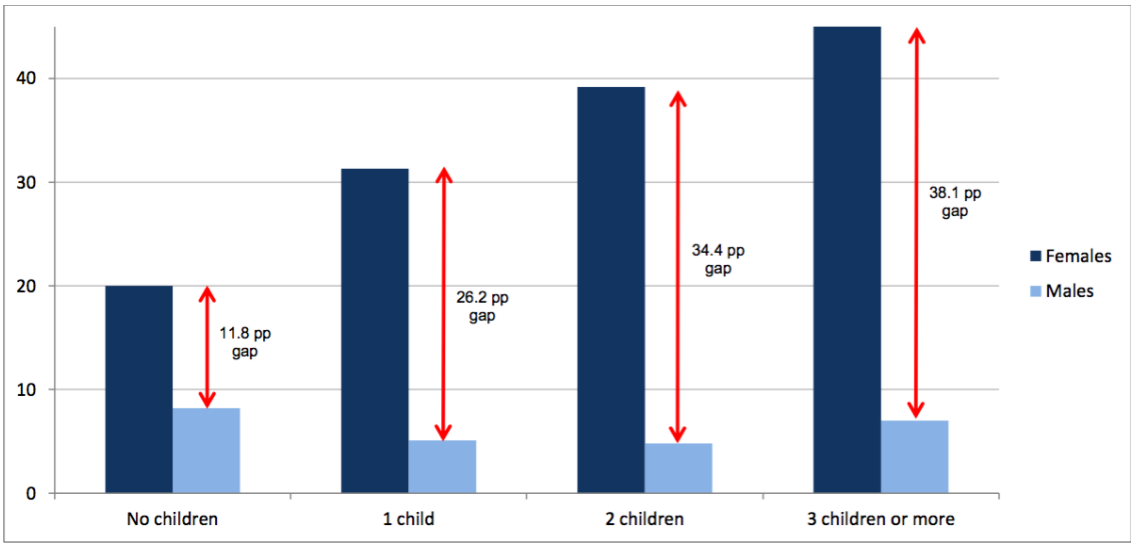


Source: OECD Data, 2014

If women stay active in the labor market, then they face the issue of how many hours to work. Clearly, this decision is closely related to the availability of good childcare services. Unfortunately, provision of this type of services is not common practice, despite some exceptions in Northern European countries. In Southern European countries, access to public nurseries is characterized by long waiting list and the private ones are not able to satisfy the demand for this service because of high enrollment costs. As a result, some parents, and in major measure mothers, tend to reduce their working hours or to trade lower wages for more flexibility in the workplace. Figure 1.6 reports statistics on part-time employment by gender and number of children among employees aged 20-49 in the EU-28 area in 2014. With or without children, women are more likely to work part-time than men. But this gap largely widens by rank of birth. It is around 12% between women and men without children. It increases to 26.2% between men and women with one child, to 34.4% between

those with 2 children and to 38.1% between those with 3 children or more.

Figure 1.6: **Part-time employment by gender and number of children, EU-28 2014**



Source: Eurostat News Release 45/2016

Traditional stereotypes on the gender division of roles, especially with respect to childcare activities, also play a major role in explaining the negative association between motherhood and labor market outcomes. Child rearing is a joyful, but tiring and time-consuming activity. Studies on time use surveys reveal that, in the European Union, mothers spend a daily average of two-and-a-half hours taking care of their children, while fathers one hour. Moreover, employed mothers devote, on average, twice as much time on domestic activities and childcare as employed fathers with small children do (Winqvist and Building, 2004). This simply means that working mothers are more tired, and possibly less productive at work. On the other hand, men, once become parents, are expected to work harder in order to take care of the family's needs.

Since most of women are also mothers[7], the incidence of longer career interruptions, lower participation, larger share of part-time work after childbirth and the higher burden of childcare activities are able to explain most of the residual gender gap in pay observed in Europe. This stood, on

[7]In 2015, the total fertility rate in the EU-28 was 1.58 live births per woman, low, but constant, `http://ec.europa.eu/eurostat/statistics-explained/index.php/Fertility_statistics`

average, at 16.3% in hourly wages in 2015, ranging from 5.5% of Italy and Luxembourg to 26.9% of Estonia [8]. The next section surveys the academic literature on the consequences of motherhood on earnings, specifically looking at the stream of research on the motherhood pay gap.

1.2 The motherhood penalty and the fatherhood bonus. A review of the literature

Gender differences in earnings have been studied by a wide amount of literature (see Altonji and Blank (1999), Goldin (2006), and Bertrand (2011) for a comprehensive review). Virtually all of this work has underlined how women's greater responsibility for children is an important factor in explaining the gender pay gap. Women with children are less likely to be employed and, when they do work, they tend to work fewer hours. As a consequence, they earn lower hourly wages not only than men, but also than childless women. Indeed, the growing interest on differences in earnings between mothers and otherwise comparable women has recently given rise to the stream of research on the *motherhood pay gap*.

Penalties in pay for mothers are found in all countries, despite the institutional framework. Waldfogel (1997) was among the firsts who pointed out that, in the US, during the 80s and 90s, the gap in pay between women and men has been narrowing, while the earnings gap between women with and without children has been widening. She claimed that the lack of family policies could be a major reason for this differential. In fact, the US is the only advanced industrialized country without a national law providing new parents with entitlements to paid family leave[9]. However, also in European countries with generous family-leave policies, like Germany or Denmark, differences in pay between mothers and non-mothers are observed. Using Danish administrative data on the whole population from 1980 to 2013 and an event study methodology, Kleven et al. (2018) find that the arrival of a child leads to a 20% penalty for mothers and that this penalty is able to explain almost 80% of the residual gender pay gap in this country. An event study approach has been used also in a recent work conducted on a sample of Danish childless women who went through in-vitro

[8] `http://ec.europa.eu/eurostat/statistics-explained/index.php/Gender_pay_gap_statistics`

[9] A study by Rossin Slater et al. (2013) showed that in California the implementation of paid leave programs increased the usual weekly work hours of employed mothers by 7%, with similar improvements in wages

fertility treatments found that women who were successfully treated, as compared to those who failed first treatment, earn persistently less because of having children (Lundborg et al., 2017).
Other researchers focused on the relevance of human capital in explaining the motherhood penalty. Women who plan to have children are more likely to reduce their investments in education, work fewer hours and accumulate less working experience over the life-cycle (Adda et al., 2017). Lundberg and Elaina (2000), studying the effects of household specialization at childbirth in the US, found a decrease in wages for wives not continuously participating to the labor force, while no effect was found for those who, instead, did not have long spells in labor market participation. Always in the US, Budig and England (2001) found that women with children earned around 7% less than their female counterpart without children and that roughly one-third of this differential could be explained by years of past job experience and seniority, including whether past work was part-time. Other studies provided evidence of the "work effort hypothesis", which suggests that mothers are more likely to be tired because of child-related duties, and thus less productive in the workplace. Exploiting information on the US National Longitudinal Survey of Young Women from 1968 to 1988, Anderson et al. (2003) empirically tested this hypothesis and concluded that women with children tend to face the highest wage penalty when they first return to work after childbirth and that younger children impose a higher penalty. These patterns are consistent with a work effort explanation. However, in their analysis of the gap across educational group, they also found that college-educated mothers do not face any penalty, although they are supposed to have jobs in which effort is relatively more important. In addition, mothers may compensate lower wages with more family friendly positions that allow them to better combine work and family responsibilities. Nielsen et al. (2004) show that women with children tend to self-select into the public sector in Denmark. Belbo et al. (2009) argue that selection of mothers into family friendly firms could represent up to 7 percentage points of the family pay gap in Germany. Always in Germany, Felfe (2012) studied the changes in women's working conditions around motherhood. She found that women with children tend to change employer, reduce the number of working hours, work at night and increase the request for more flexible schedules. However, her results gave only a limited evidence of a trade-off between wages and job amenities. A gap of 11% persisted among women who neither changed job

nor reduced their working hours, while a gap of 2.9% was found among women who did not change any of the observed dimension. Also Wilner (2016) tried to verify how mothers' preferences for family friendly firms accounted for childbirth-related earnings differential. On a sample of French private sector employees, he estimated the motherhood pay gap by including firm fixed effects on top of workers fixed effects. His findings rejected the firm matching hypothesis as the main explanation for the motherhood penalty, which he estimated as a 2.2% per child in hourly wages.

It should also be mention that employers may reserve different treatments to women because of their motherhood status, discriminating against them. In models based on taste discrimination, employers simply dislike to employ mothers. In models based on statistical discrimination, employers assume that mothers are less productive than non-mothers. To better understand these mechanisms, Correll et al. (2007) developed a laboratory experiment in which they asked participants to evaluate pairs of fictitious job applicants of constant qualifications and background experiences, but different parental status. They found that evaluators rated mothers as less competent and committed to work than non-mothers, and, consequently, were less likely to hire them or offered them lower starting salaries. Moreover, by using application materials adapted from the laboratory experiment, they sent real applications to over six hundred employers to carry out an audit study. They found that prospective employers called mothers back about half as often as childless women.

Results on the effects of fatherhood on earnings are more scarce and puzzling. The predominant idea is that men gain from fatherhood. According to Millimet (2000), firms are willing to increase fathers' wages since they assume that men with children are more reliable and less likely to relocate. This was confirmed in the laboratory results of the Correll et al. (2007)'s study. Fathers were seen as more committed to paid work and advantaged over childless men in several ways, for example being offered higher starting salaries. Simonsen et al. (2008, 2012) estimated a 4%-6% gain in earnings for fathers in Denmark. But other findings question this view. Cools and Strøm (2016), on a panel of employees over the years 1997-2007, found a small wage penalty for men with children in Norway. This penalty was larger for fathers who work full time in the private sector and mostly explained by paternity leave. Instead, Wilner (2016) found that men in France do not enjoy any premium nor suffer any penalty from fatherhood. In fact, they used to gain from fatherhood, but

this bonus has eroded over time, from roughly 5% at first childbirth in 1998 to almost zero at the end of the 2000s.

Chapter 2

The Child Effect within the Firm

This chapter uses unique information on the population of employees of a large French firm to provide causal evidence on the effect of children among individuals who already have children (intensive fertility margins).

An empirical strategy relying on individual fixed effects estimations and a quasi-experimental approach based on twin births allows me to consistently show that female employees suffer a significant penalty from motherhood, while fatherhood has no effects. Mothers of small children, in their thirties, with a secondary level of education are the most penalized. Results point out that their working behavior and individual productivity are strongly associated with children, while that of fathers are not. My findings not only confirm that childcare policies aimed at helping women to stay fully active in the labor market are relevant, but also suggest that a working environment supportive of mothers' productivity may play an important role in reducing the child penalty.

I thank Claudio Lucifora and Dominique Meurs for thoughtful conversations and discussions. I also thank Lorenzo Cappellari, Giovanni Sulis, Elisabetta Lodigiani and participants to PhD seminars at UCSC for helpful comments.

2.1 Introduction

Women have recently done relevant step forwards in the difficult process towards gender equality. In Europe, the gender employment gap decreased from 15% of 2008 to 11.5% of 2016[1]. In the same period, the proportion of women aged 30-34 who had attained tertiary education exceeded that of men by 9.5 percentage points[2]. However, corresponding improvements in earnings had not been observed. The gender pay gap stood at 16.3% in 2014, while in 2010 it was 16.4%[3]. Moreover, women are still largely under-represented among board members of the biggest European publicly listed companies[4].

Economists and sociologists have tried to explain gender differentials in economic outcomes in many ways, from traditional interpretations based on human capital theory (Becker, 1985), to more innovative approaches underlying gender differences in behaviors and attitudes (Bertrand, 2011). But the main reason for the persistence of gender inequalities in the labor market is still the most obvious: children. The birth of a child leads to long-run penalties for women in terms of participation, promotions and earnings that largely explain economic differentials between males and females.

The first empirical evidence of a child penalty for women was given by the seminal work of Waldfogel (1997), who showed a negative relationship between motherhood and earnings both in the US and in the UK. Similar results have been found in Europe: Belbo et al. (2009), Felfe (2012), Adda et al. (2017) for Germany, Simonsen and Skipper (2008), Simonsen and Skipper (2012), Kleven et al. (2018), Lundborg et al. (2017) for Denmark, Wilner (2016) for France. The range of this penalty is between 2 and 7 per cent in hourly wages. On the other hand, fatherhood seems to be positively related to earnings (Millimet (2000), Simonsen and Skipper (2012)). The traditional explanation of this fact is that men with children are usually considered more reliable and less likely to relocate. Recent findings, however, did not confirm this view. Wilner (2016) found no effects of fatherhood

[1]Gender Statistics, Statistics Explained, Eurostat `http://ec.europa.eu/eurostat/statistics-explained/index.php/Gender_statistics`

[2]Gender Statistics, Statistics Explained, Eurostat `http://ec.europa.eu/eurostat/statistics-explained/index.php/Gender_statistics`

[3]2017 Report on Equality between men and women in the EU, European Commission

[4]2017 Report on Equality between men and women in the EU, European Commission

on wages in France, Cools and Strøm (2016) found a negative effect in Norway.

While results for fathers are puzzling, that on mothers consistently show a significant penalty in all countries, despite the institutional context[5]. Different factors interact to explain this evidence. First, women with children tend to have specific, usually unobserved, characteristics. For example, they likely have higher preferences for family, domestic activities and leisure. In most of previous studies (see Budig and England (2001) as a reference), these preferences have been considered as innate and constant over time. A second relevant fact is that, in almost all developed countries, motherhood implies mandatory work interruptions because of maternity leave. These depreciate human capital and working experience. It is also associated with higher absenteeism and lower productivity, since mothers, especially of small children, are likely more tired at work because of childcare activities. This has been called a "work effort" explanation of the motherhood penalty (Anderson et al., 2003), implying that mothers are penalized because they exert lower effort in the workplace. Third, women with children tend to self-select in family friendly firms and sectors (Nielsen et al., 2004). In line with the theory of compensating wage differentials, these women are willing to accept lower earnings in exchange of higher job amenities, such as more flexibility in working schedules (Felfe, 2012). Last, but not least, mothers are more likely to be discriminated (Correll et al., 2007). Employers could be more rigid with mothers in the wage bargaining process and offer them less chances to be promoted to higher occupational levels (Wilner, 2016).

The main problem with research of this type is the likelihood of omitted variable bias in the estimations of the effects of childbirth. Disentangling spurious correlations between children and wages from the causal effect of parenthood is not easy task. To solve the problem of endogeneity of childbirth to labor market outcomes most of the existing literature has relied on conditional-on-observables strategies such as OLS and propensity score matching (e.g. Simonsen and Skipper (2006, 2008)), firm and worker fixed effects (Budig and England (2001), Anderson et al. (2003), Wilner (2016)), and quasi-natural experiments based on twin births (Angrist and Evans (1998), Simonsen and Skipper (2012)) or IVF treatments (Lundborg et al., 2017).

In this work, I exploit unique information on the individual and working characteristics of the

[5]IN OECD countries, the institutional settings range from no provision of paid child-related leave in the US to up to 166 weeks of leave available for mothers in Estonia

population of employees of large firm in France to provide new evidence on the earnings effects of having an additional child among individuals who already have children (intensive fertility margins). To do so, I use two main approaches. I start by estimating individual fixed effects models to capture the generic impact of having an additional child while controlling for individual, time-invariant unobserved heterogeneity. Then, I develop an IV strategy by exploiting an exogenous variation in number of children based on twinning at second childbirth. In this case, I estimate a fixed effects 2SLS model. It is well known that any particular IV strategy provides evidence on individuals affected by the instrument. My estimations give information on the causal effect of third childbirth on the subsample of employees with two children. To support the validity of the instrument, I show that there is no correlation between twin rates and parents' socio-economic characteristics. Then, I face the threat of non-random twin births because of the use of in-vitro fertility (IVF) treatments by studying the child effect by age cohorts. Indeed, statistics for France show that this is a potential concern for women over 40 years old[6].

The main contribution of my work stands in the type of labor market under analysis: an internal labor market. I rely on a unique panel of personnel records from 2005 to 2016 from a large French company. This firm accounted for $129,492$ employees and collaborators in France in 2013. It has plants spread all over the country. Its internal structure is well defined, with a rigid hierarchy identifying employees' career patterns. Given these characteristics, this company can be considered as representative of a large internal labor market, thus reducing concerns of external validity of my findings. To the best of my knowledge, no previous work has been done on the impact of childbirth within a firm, allowing me to better identify the channels through which children affects individuals' earnings. Results will be useful for the definition of policies aimed at reconciling work and family life and improving parents' economic performance.

Results show that fatherhood does not significantly affect earnings, while motherhood has a negative impact. This penalty is robust to the individual fixed effects and fixed effects 2SLS specifications, allowing a causal interpretation of results. Mothers of kids aged less than 6, in their thirties and with a middle level of education are the most penalized. The negative effect of children is particularly

[6]Institut National de la Statistique et des Études Économique

strong on mothers' individual productivity, likely because they are more absent and have slower career improvements.

This Chapter is organized as follows. Section 2.2 illustrates the institutional context and the dataset. Section 2.3 presents the empirical strategies. Section 2.4 describes the samples under analysis. Section 2.5 presents the main findings, while Section 2.6 the robustness checks. Section 2.7 concludes.

2.2 Institutional framework and data

2.2.1 A family-friendly institutional context

Family-related issues have traditionally been collocated at the core of French social and political agenda. This made France the European country with the highest fertility rate, 2 children per woman in 2015[7], and among the public systems with the most generous family policies. Despite reductions in public support for families after the 2008 economic crisis, in 2014 expenditures on childcare and early education services were relatively high: 1.1% of GDP, compared to the OECD average of 0.7%[8].

A large network of local Family Allowances Funds (CAFs, *Caisse d'Allocations Familiales*) is responsible for the management of welfare state provisions related to children, which are based on job-protected leaves and childcare services. Child-related leaves include maternity and paternity leave, which can be extended to parental leave. These leaves, together with the description of childcare services, are summarized in Table 2.1. Policies and services ensured before childbirth, during the first three years of the child, and in preschool age (3-6 years) are distinguished. In the first panel, the most relevant features of public provisions are reported. In the second, extra leaves and benefits guaranteed by the firm under study are added.

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.

[7] World Bank

[8] Family Policies, France (2014). Population Europe Resource Finder and Archive

Table 2.1: **Institutional framework**

		Pre - Birth	**Age 0-3**		**Age 3 - 6**
National policies					
				Extension: **Parental leave**	Extension: **Parental leave**
Maternity leave	Eligibility	All working women	All working mothers	All working mothers[a]	All working mothers[a]
	Length[e]	6 (1st or 2nd child), 8 (3rdor+ child)	10 (1st or 2nd child), 18 (3rdor+ child)	1 year[b]	1 year[c]
	Pay	Full wage[d]	Full wage[d]	Allowances depend on income/nr. children	Allowances depend on income/nr. children
				Extension: **Parental leave**	Extension: **Parental leave**
Paternity leave	Eligibility	✗	All working fathers[a]	All working fathers[a]	All working fathers[a]
	Length[f]	✗	11 (single birth), 18 (multiple birth)	1 year[b]	1 year[c]
	Pay	✗	Full wage[d]	Allowances depend on income/nr. children	Allowances depend on income/nr. children
Childcare services			Crèches	Crèches	École maternelle
Firm policies					
				Extension: **Parental leave**	Extension: **Parental leave**
Maternity leave	Eligibility	Employed women	Employed mothers	Employed mothers	Employed mothers
	Length	+4 until 2nd, +2 from 3rd			
	Pay	Full salary	Full salary + premium	Contributions to childcare expenses	Additional monthly pay
				Extension: **Parental leave**	Extension: **Parental leave**
Paternity leave	Eligibility	✗	Employed fathers	Employed fathers	Employed fathers
	Length	✗			
	Pay	✗	Full salary + premium	Contributions to childcare expenses	Additional monthly pay

[a] With at least one year tenure
[b] Renewable from 2 to 5 times
[c] Renewable in specific cases
[d] Last three wages/91.25
[e] Maternity leave is expressed in weeks
[f] Paternity leave is expressed in days

During maternity leave the employment contract is suspended and the woman is entitled to daily allowances paid by social security (the CPAM, *Caisse Primaire d'Assurance Maladie*). Allowances are calculated taking into account the 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[9]. According to the OECD, in 2014 the average payment rate was 93.5% of previous earnings[10]. 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, but it may end beyond this deadline in case of child's hospitalization or mother's death. Payment rules are equal to those of maternity leave.

Maternity and paternity leave can be extended 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 for the birth of one or more children. 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 is not paid by the employer, but 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. According to the OECD, on average, the allowance amounted to 14.6% of previous earnings in 2014. Parental leave can be additional extended for another year in case of child's serious illness, disability or accident.

Children have access to childcare services and preschool from a very young age, which is expected to help parents in balancing work and family life. 48% of the country's children under age three are enrolled in some type of formal care[11]. These include publicly subsidized home-based care, accredited family daycare providers, and nursery (*crèches*). Center-based services run by municipalities, departments or non-profit organizations are called *crèches collectives*. *Crèches parentales* and *crèches familiales*, parents' and families' cooperatives, are similar services where parents and

[9] `https://www.service-public.fr/particuliers/vosdroits/F207`

[10] The average payment rate refers to the proportion of previous earnings replaced by the benefit over the length of the paid leave entitlement for a person earning 100% of average national

[11] Population Europe Resource Finder and Archive

families are involved in daily care. In the public sector are common the *crèches d'entreprise*, company nurseries. Relevant are also the centers providing temporary care for specific number of hours (*haltes garderies*). 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[12]. A universal model of preschool education, the *École maternelle*, is available to all children aged 3-6. The program is fully founded and organized by the State. In many municipalities, enrollments can be made from the age of 2.

The firm of interest can be defined as family friendly. The second panel of Table 2.1 shows that 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. Moreover, 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 get a childbirth premium corresponding to one month full salary. Until the 16^{th} birthday of the child, only mothers are allowed to take 6 days off per-year for child related issues. 2 days can be specifically taken for "sick child". 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.

Another fact worth noticing is that 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[13] and aims to promote 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 the company especially regarded the possibility for parents to work from home through teleworking.

[12] urlhttp://www.caf.fr/ma-caf/caf-du-bas-rhin/offre-de-service/petite-enfance/je-souhaite-placer-mon-enfant-en-creche

[13] Observatoire de l'Équilibre des Temps et de la Parentalité en Entreprise; www.observatoire-equilibre.com

2.2.2 The dataset

The dataset combines different personnel registers of a large manufacturing French firm. According to the French National Institute of Statistics[14], in 2015 the manufacturing sector[15] had 255,000 firms and employed 3 million employees, or a quarter (24.9%) of the employees of all businesses in the mainly non-agricultural and non-financial market sectors.

The firm under study is a large multi-utility French company with plants and offices spread all over the world (Belgium, Brazil, Bulgaria, Canada, Chile, China, Germany, Greece, India, Israel, Laos, Mexico, South Africa, United States).

We have information on employees employed in plants over the French territory only. Figure A2.1 shows how the plants of this company are spread all over the country. In 2005 these employees amounted to 110,542 individuals. In 2007 the firm was subject to a significant structural change: part of its distribution process was split and transformed into a different and independent company. Because of this, I dropped from the dataset all the employees who moved to this new firm. In 2008, after the structural reorganization that occurred in 2007, the total number of employees fell to 56,127 individuals, to increase back to 61,000 in 2016.

The large dimension of this firm gives me a good representative sample of French population, thus mitigating concerns of external validity of my findings. Data cover the period 2005-2016.

The quality of information on employees' individual and working characteristics is very high, largely decreasing the possibility of measurement errors. Individual characteristics include gender, age, nationality, family status, number of dependent children, number of dependent individuals other than children, place of residence, place of work, the highest educational level at the hiring date and diplomas eventually taken during the career. Occupational categories, divisions, tenure, annual number of working hours, type of contract, annual number of hours of absence, and cause of absence are the main working characteristics. Of particular interest is the variable "remuneration level" (RL). This variables summarizes the salary ladder of the firm. The levels range from 30, which is associated

[14] `www.insee.fr`

[15] With manufacturing sector we mean: sections B (extractive industries), C (manufacturing industry), D (production and distribution of electricity, gas, steam and air conditioning), E (water production and distribution, sanitation and water management waste, decontamination) of the NACE Rev. 2 classification

to the base pay of the lowest blue-collar position, to 370, associated, instead, to the base pay of the highest managerial level. Improvements within this hierarchy are due to seniority and promotions. I consider these improvements as a proxy for the career patterns of the employees within the company.

Individual total earnings are decomposed into base salary, bonuses linked to individual productivity, and additional complementary premiums due to extra-hours or night work. The base salary accounts for 2/3 of total earnings, while the other components for the remaining part. Individual bonuses are assigned every year by employees' direct supervisors on the basis on their individual performance. Thus, they can be considered as a proxy for employees' effort at work.

I identify parents as employees with dependent children, so as employees who still have children at home. These employees could have had children before the beginning of the observation period or during the period. In the analysis, I also try to capture the effect of small children by looking only at the birth of a child within the period and identifying kids with less than 6 years old. Employees without children are made up by three categories: those who never had children, those who will have children in the future and those who had children who already left home. This last category may still be subject to previous effect of children.

Three dummies classify employees' family status. The first is couple, which equals one if the individual is married, in cohabitation, or in a PACS (Pact Civil de Solidarieté), such as under a contractual civil union. The second, previously married, equals one if the individual is divorced, separated or widow. The third is a dummy for being single.

Tenure is defined as the number of years of working experience within the firm. I also categorized employees according to their working division. In particular, I focus on the production and commerce/sales divisions. This decision was driven by the fact that firm's reports provide evidence of a over-representation of men among production workers, as opposed to women, who are well represented among sales and trade employees.

2.3 Empirical strategy and identification

I start my empirical exercise by estimating a standard pooled OLS model. This methodology gives me a benchmark of the association between children and earnings. However, it does not address the main concern of the study, the endogeneity of parenthood to labor market outcomes.

Ideally, the best way to capture the causal impact of children on earnings would be to randomize fertility. This randomization would allow me to observe an exogenous variation in employees' number of dependent children. Absent such an experiment, I proceed in two steps. First, I rely on individual fixed effects models to account for workers' unobserved, time-invariant, heterogeneity. Second, I propose twinning at second childbirth as an instrument for total number of dependent children and estimate a fixed effects 2SLS model.

2.3.1 Pooled OLS and individual fixed effects models

My base model is a pooled OLS of the type:

$$Y_{it} = \alpha + \beta Children_{it} + X'_{it}\gamma + \nu_t + \varepsilon_{it} \tag{1}$$

where Y_{it} is the logarithm of gross total annual earnings. $Children_{it}$ is the variable on total number of dependent children. X_{it} contains quadratic specifications in age and tenure. ν_t are year dummies that allow for aggregate time effects. ε_{it} is an idiosyncratic error term. Errors are clustered at the individual level.

I decided to include only a quadratic specification in age and tenure to avoid issues of "bad controls" (Angrist and Pischke, 2009). Standard analyses in this literature usually include controls for marital status, occupational categories, sector of employment and hours worked[16]. However, all these factors are earnings determinants that directly respond to the number of dependent children, my variable of interest. Including such covariates would likely bias the estimations.

In this specification, β provides me an estimate of the per-child effect on total earnings, without accounting for individual unobserved characteristics, such as life-cycle preferences or career orien-

[16] Results available upon request

tation. If these differences are present, this estimation is likely biased.

For this reason, I implement an individual fixed-effects analysis. This methodology allows me to evaluate adjustments in total earnings after a new birth by removing any constant unobserved worker characteristics. My basic specification is of the type:

$$Y_{it} = \beta Children_{it} + X'_{it}\gamma + \nu_t + \theta_i + \varepsilon_{it} \tag{2}$$

The θ_i indicates individual time-invariant unobserved heterogeneity. This error component is allowed to be arbitrarily correlated with $Children_{it}$. The fixed effects transformation is obtained by first averaging Equation (2) over t and then subtracting the transformed model from the basic specification. This transformation removes any time-invariant component, included the θ_i. Errors are clustered at the individual level.

The identifying assumption behind this specification is that, having cleaned-out the potential omitted variable bias due to time-invariant unobserved characteristics, having an additional child is as good as a random event. However, my identifying assumption would be violated if there are relevant time-varying factors that affect both earnings and the decisions of having a child. Because of this, I use twinning at second childbirth as a source of exogenous variation in the number of dependent children to estimate the causal effect of childbirth on earnings along the intensive fertility margins. In line with previous literature (Angrist and Evans, 1998), OLS is expected to over-estimate the true effect of children.

2.3.2 Fixed effects 2SLS analysis

In social sciences, twin births have been largely used to denote an unexpected increase in family size, which allows for causal identification of the impact of fertility on investments in children (the quantity/quality trade-off, see Rosenzweig and Wolpin (1980), Angrist et al. (2010)) or on parents' economic outcomes (Bronars and Grogger (1994), Gangadharan and Rosenbloom (1996), Angrist and Evans (1998)). This strategy relies on the assumption that twin births are random events across individuals, thus representing a good source of exogenous variation in the number of

children. Following this stream of literature, my instrument is an indicator for multiple births at second pregnancy. Findings of this exercise reflect the causal effect of children on earnings for those employee who, because of twinning, had more children than they otherwise would have.

I identify twins by combining two sources of information. The main indicator is a change, in a given year, in the variable on the number of dependent children by more than one unit. To avoid possible mistakes in recording this variable, I also check whether the employee experienced positive hours of paternity/maternity leave in that year. If both variables correspond, then I assume a twin birth has occurred.

The use of this instrument arises different concerns. For example, the existence of an association between having twins and employees' socio-economic characteristics would violate my identification assumption of random twin births. Indeed, it has been found that the distribution of twins in the population is skewed in favor of healthier women, with behaviors that are positively correlated with women's participation to the labor market (Bhalotra and Clarke, 2016). As Table A2.1 shows, I do not find evidence of correlations between twin births and employees' age, educational level and occupational category. But the major threat to my strategy derives from the recent increase in the use of in-vitro fertility (IVF) treatments.

The first live in vitro fertilization born in France was in 1982[17]. Since then, the use of this technique has largely increased. In 2012, 2.9% of births in France were due to medically assisted procreation attempts[18]. It is well known that the use of fertility treatments increases the likelihood of twin births. The decision to undergo this type of treatments is clearly endogenous, suggesting that parents of twins are a particularly selected sample. It has been shown that these concerns apply only to dizygotic twin births an not to monozygotic twin births (Farbmacher et al., 2016). The reason for this is that monozygotic twin births are the result of random and spontaneous division of a single fertilized egg, while dizygotic twins are not. Unfortunately, I do not have enough information to distinguish between the two types of birth. But I can check if there are heterogeneous effects by age cohorts. Indeed, statistics show that the share of deliveries giving birth to twins increases sharply with the age of the mother. In the last ten years, in France, the proportion of double births

[17]Institut National de la Santé et de la Recherce Médicale
[18]Agence de la Biomédecine, rapport médical et scientifique, 2013

increased from 1.5% to 1.7%, and this increase is concentrated in women aged 40 or more. In fact, between 2003 and 2013, while the share of twin births remained relatively stable for all women under 40, it increased from 1.8% to 2.4% for those aged 40 to 44, and from 2.8% to 5.7% for women aged more than 45[19]. These developments are related to the fact that older mothers are more likely to use assisted reproduction. Table A2.1 already showed that there is no correlation between age and twin birth for women. The association for men is small and negative. In a robustness check, I will replicate the analysis by age cohorts. Findings show no significant effects for older parents, mitigating this type of concern.

The first-stage estimate of the twin exercise is:

$$Children_{it} = \alpha Twin_{it} + X'_{it}\gamma + \nu_t + \theta_i + u_{it} \tag{3}$$

where $Children_{it}$ is the variable on employees' number of dependent children and $Twin_{it}$ is an indicator for twinning at second childbirth. It is assumed to be strictly exogenous, conditional on the θ_i. X_{it} includes quadratic in age and tenure, ν_t are year fixed effects.

Table A2.2 in Appendix 2 reports results for the first stage. A multiple second birth increases the average number of dependent children by about one child, both for male and female employees. The Kleibergen-Paap F-statistics[20] suggest that the instrument is not weak, thus not poorly correlated with the endogenous regressor.

The second stage is:

$$Y_{it} = \rho \hat{Children}_{it} + X'_{it}\gamma + \nu_t + \theta_i + \varepsilon_{it} \tag{4}$$

What requires attention in this case is the interpretation of the results. The distinctive econometric feature of the twin estimates is that they generate the average causal effect of treatment on the non-treated. More precisely, following Angrist and Pischke (2009), let Y_{0i} denote potential earnings if an employee has two children, while Y_{1i} if he/she had three. This event is indicated by D_i.

[19] Institut National de la Statistique et des Études Économique, `https://www.insee.fr/fr/statistiques/1379742`

[20] The most common test for weak instruments is an F version of the Cragg-Donald Wald statistic. However, since in my model errors are clustered at the individual level, the Cragg-Donald-based weak instruments test is no longer valid since it assumes i.i.d errors and a correspondingly-robust Kleibergen-Paap Wald rk F-statistic is implemented

Assuming that multiple second births are randomly assigned and that they affect outcomes only by increasing the number of dependent children, then the local average treatment effect using the twin instrument is also the average causal effect on employees who are not treated (i.e. employees with two children)[21]. This is because all employees who have a multiple second birth end up with three children: there are no never-takers in response to the twin instrument. Thus, the subpopulation of compliers affected by the instrument is the entire population with at least two children (2+ *children sample*). The parameter ρ gives the causal effect of going from two to more than two children, allowing for a robust estimation of the child effect along the intensive fertility margins.

2.4 Descriptives

2.4.1 The baseline sample

From the original dataset I selected employees aged less than 50. Selection on age is justified by the need to focus on individuals who still have children at home. The final dataset consists of an unbalanced panel of $50,861$ employees observed up to 12 years, for a total of $363,125$ employee-year observations. Women account for 32% of the firm's workforce. This is in line with the fraction of women working in the manufacturing sector in France, which was 28.6% in 2014 [22].

Table A2.3 gives an overview of the sample under study. 65% of female employees have dependent children and, therefore, have been classified as mothers. The share of fathers is 59%. As expected given the French fertility rate[23], 30% of fathers and 32% of mothers have 2 children. The shares of parents with one child are, respectively 18% and 23%, while that of parents with three or more kids 11% and 10%.

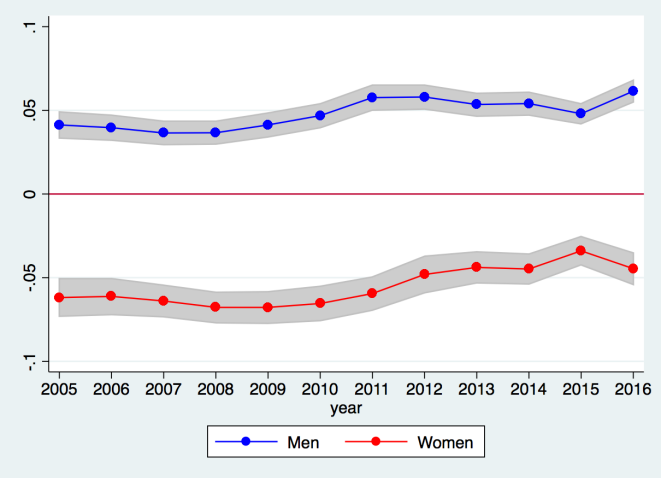
Employees in my sample are aged around 36. 64% of them are in a couple. The shares of singles are 23% among men and 22% among women, while those of divorced/separated are, respectively, 3% and 6%. Males and females are equally represented in managerial positions. However, despite being better educated, a larger share of females is employed in blue-collar positions.

[21] $E[Y_{1i} - Y_{0i}|D_i = 0]$
[22] www.insee.fr
[23] 2 children per woman in 2015, World Bank

On average, both men and women have 10 years of working experience within the firm. Men are over-represented in the production division. Women, instead, are quite balanced among divisions. Females tend to work less than males. They are also more absent. The average length of maternity leave is in line with laws' standards.

Figure 2.1 shows how the raw parenthood pay gap evolved over the period. Each point corresponds to the yearly estimate of a dummy indicating if the employee has at least one child at home on the log of total annual earnings, controlling for age, tenure and educational level. 95% confidence bounds are included. This descriptive analysis shows a positive, and stable, association between parenthood status and earnings for men, negative for women. Figure A2.2 shows the same exercise replicated by age cohorts. The penalization for women is larger, and quite stable, among the $25-29$ and $30-39$ cohorts. This is the timing in which they likely have small children at home. On the other hand, the penalty is closed to zero for mothers in their late forties.

Figure 2.1: **Raw association between children and earnings**



2.4.2 The 2+ children sample

As explained, any IV exercise produces results on the subpopulation of the instrument's compliers. In this case, compliers are made up by all employees with at least two dependent children (150, 112 employee-year observations). The description of this sample is given in Table A2.4.

1% of male and female employees experienced a multiple second birth.

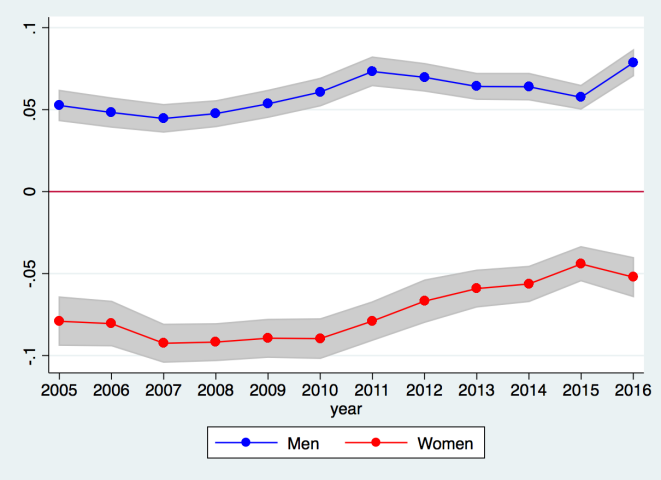
The average number of children in this sample is 2.34 for men and 2.28 for women. Almost all the employees are in a couple. The share of divorced is much larger among women (7% vs 2% of men). The average age is around 39.

The share of women with a university degree is similar to that of the total sample. But female representation among managers is lower (36%). Moreover, the segregation effect by division is more evident on this sample. Women with at least two kids are better represented among sale and trade employees.

As compared to the total sample of women, females tend to work less and make more hours of absences. Instead, there are no differences in average working hours or absenteeism among the two samples of men. These statistics may suggest that female employees are more involved in child related activities. The hours of maternity leave are higher. This is expected since the law provides more weeks of leave in case of third childbirth.

Figure 2.2 reports the results of the exercise on the raw association between earnings and children, using as indicator having 2 kids or more. These statistics suggest a higher penalization for mothers with two or more children at home.

Figure 2.2: **Raw association between children and earnings - 2+ children sample**



2.5 Results

Table 2.2 shows results of the pooled OLS and fixed effects models on the relationship between earnings and a change in the total number of dependent children. Estimations are made on the baseline sample, all employees aged 20-50.

Results show that, without controlling for individual unobserved time-invariant characteristics, fathers seem to enjoy a "fatherhood bonus" of 3.1% per-child. A premium that is fully eroded when estimating the workers' fixed effects model. The existence of a motherhood penalty, instead, is confirmed in both models. This penalty is 4% per-child when controlling for constant, unobserved life-cycle preferences and career orientation.

Table 2.2: **Children and total annual earnings - OLS and FE estimations**

	(Men) OLS	(Men) FE	(Women) OLS	(Women) FE
Children	0.031***	-0.003**	-0.032***	-0.040***
	(0.002)	(0.001)	(0.003)	(0.002)
Quadratic specification in age and tenure	✓	✓	✓	✓
Individual fixed effects	✗	✓	✗	✓
Time fixed effects	✓	✓	✓	✓
Obs	245406	245406	117178	117178

Errors clustered at individual level in parentheses

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

Table 2.3 reports findings on the child effect on earnings along the intensive fertility margins. Specifically, it shows the impact of having a third child among employees who already have two children by comparing results of a unit fixed effects model and an individual fixed effects 2SLS model that uses twinning at second childbirth as instrument for the number of dependent children. Results for men are not significant in both specifications, suggesting that males' earnings are not

affected by the birth of a third child. Findings on women, instead, clearly point out the existence of a motherhood penalty within the firm along the intensive fertility margins.

In line with the per-child effect found in the previous specification, controlling only for time-invariant individual unobserved heterogeneity, moving from two to three children implies a negative impact on women's earnings of 4.6%. Results on the second stage of the FE 2SLS estimations show that the negative, and causal, effect of a third child on earnings is lower in magnitude, around 3%, and less powerful in terms of significance level, but still there. These results confirm that OLS estimates for women appear to exaggerate the causal effect of children on earnings.

Table 2.3: **Effect of children on total annual earnings - FE and FE 2SLS estimations**

	(Men) FE	(Men) FE 2SLS	(Women) FE	(Women) FE 2SLS
Children	-0.002	0.010	-0.046***	-0.029*
	(0.002)	(0.008)	(0.004)	(0.013)
Quadratic specification in age and tenure	✓	✓	✓	✓
Individual fixed effects	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓
Obs	100643	242092	49345	115664

Results on *Children* in the FE 2SLS columns are obtained by instrumenting the variable on total number of children with an indicator for twinning at second childbirth

Errors clustered at individual level in parentheses

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

2.5.1 Mechanisms

Established that there is a negative effect of children on females' earnings, it is important to understand where does this penalty come from.

First of all, it is likely that mothers of children in pre-school age face higher challenges in reconciling working and family responsibilities. To better investigate this issue, I built an indicator for "small

children", such as children aged between 0 and 6 years old [24]. Table A2.5 reports descriptives on working hours and absenteeism behavior among the subsamples of employees with small children (aged ≤ 6) and employees with older children (aged> 6). While there is no significant difference in working hours among male employees with small children and male employees with older children, females with small kids significantly work less than females with older kids. Women with small children are also more absent from work. The statistics on family related absences give two types of information. First, the number of hours of family leave is double for women as compared to men. Second, while the average number of hours of absences significantly reduces for women as the child grows-up, those related to family leave do not, suggesting that women are still the main responsible for childcare needs even after children enroll school. Table A2.6 reports results of the estimation of Equation (2) on the indicator for small children. Results point out that mothers of kids aged less than 6 are more penalized than mothers of older children.

A second mechanism for the motherhood penalty is related to mothers' productivity at work. In Table A2.7 I show that the negative relationship between children and earnings is particularly strong for the pay components associated with individual bonuses and complementary premiums. This result holds also for men, even if findings are much lower in magnitude. After having controlled for employees' career orientation and innate family/work preferences, the child penalty in these components reaches -12% for women and less than 3% for men. As explained, individual bonuses are assigned each year by the employees' direct manager on the basis of evaluations on individual productivity. Complementary premiums, instead, are linked to extra-hours and night work. These findings are in line with a work-effort explanation of the motherhood penalty. Indeed, they suggest that mothers are, or are believed to be, less productive at the workplace.

This result is particularly relevant. According to Goldin (2014), there exists a non-linearity in rewards linked to individual performance and extra-hours. Employees who work longer tend to be over-rewarded in terms not only of wage premiums, but also promotions.

Promotions in the firm can be described by improvements within the wage ladder. As already explained, each level of this scale (RL) embodies an occupational category and a base salary.

[24] I was able to build this indicator by identifying the year of birth of a new child and then calculating the time distance between each year in the panel and the year of birth

Movements along the RL levels are representative of employees' career patterns. In Table A2.8 I show that the relationship between children and improvements in these career patterns is negative. While for men the result is very small in magnitude, around 0.04%, for women is 2.3%. Mothers fall behind in the progressions within the hierarchical scale of the company. This likely influence not only their current earnings, but also their future economic and career performance within the firm.

2.5.2 Differences by age, family status, educational level, and place of residence

From Tables A2.9 to Table A2.15 I present some heterogeneous effects.

First, I want to check if the effect of parenthood differs by age (Table A2.9). I thus estimated Equation (2) adding interactions between the variable on number of children and age cohorts. I defined 6 cohorts of age: $20-24$, $25-29$, $30-34$, $35-39$, $40-44$, and $45-49$. Results show that for men the association between children and earnings does not differ by age. Instead, I found that mothers in their thirties are the most penalized. Women in this age cohorts likely have small children and experience more than one birth in a relatively short period of time. As a consequence, they have more frequent career interruptions, they tend to be more absent and, in line with a work-effort explanation of the motherhood pay gap, less productive.

Table A2.10 reports the average number of hours of absence by gender and age cohorts. There is a large and significant difference in the absenteeism behavior of men and women by age. This difference is clearly linked to children. While the absences for men are quite stable until they are 45, women experience a large increase in absenteeism between the age $25-39$. In particular, they increase family related leaves. But as they age, female employees decrease the number of hours of leave, likely because their children are now more independent. Men, on the other hand, increase them.

Results on the effects by family status (Table A2.11) are particularly interesting. They show that divorced women with children perform better than mothers in a couple. This finding suggests that women who have to take care alone of their children tend to perform better than women who can

rely on their partner.

Table A2.12 shows results of Equation (2) estimated on different educational level groups: those who have less than a secondary level, those who have a secondary level, and those who have at least a first-level university degree. Findings on men are similar among group and close to zero. Findings on women reveal that women with a secondary level of education experience larger penalties. Interestingly, the child effect is around 4% also for women with at least a first level university degree. To better investigate this type of heterogeneous effect, Table A2.13 presents results on two subgroups of employees: those who had a post-secondary level of eduction (column 1 for men, 3 for women) and those who attended the Grandes Écoles (column 2 for men, 4 for women). Grandes Écoles are higher education establishments, highly selective, that are outside the main framework of the French public university system. Their graduates often dominate the private and public sectors of French society. Results show that the child penalty for mothers holds also within these two subgroups. It is around 4% for women who have a post-secondary degree, 3% for those who went to a Grande École. No significant effect is found for men.

Table A2.14 shows that among female managers, the child penalty is 3.6%.

According to Le Bouteillec et al.(2014), in France many parents are unable to get access to good quality childcare services because of limitation of local coverage. For example, *crèches* represent the most requested service by French parents of children under 3. But their availability is much more frequent in large cities, and in particular in Paris, where their number reaches 38 per 100 children aged 3 or less. The national average is 16 per 100 children[25]. Because of this, I split the sample under analysis focusing on employees living in the Paris region, the Île-de-France, as compared to employees living in other regions. Results on the child effect on the two subgroups are presented in Table A2.15. They show that the child penalty for mothers living outside the Île-de-France is much larger than the penalty for mothers living around Paris.

[25] https://www.ined.fr/fr/publications/population-et-societes/creche-france/

2.6 Robustness checks

I perform three types of robustness checks for the FE model. First, I re-estimated Equation (2) adding additional controls for occupational categories, working hours and divisions. These variables have been excluded from the main model since they likely respond to childbirth, potentially biasing the estimations. Second, I estimated Equation (2) using the log of hourly wages as dependent variable. Third, following Felfe (2012) and Wilner (2016), I estimated a first difference model to get insights on the short-run associations between children and total earnings. Results of these exercises are presented in Tables A2.16, A2.17 and A2.18.

Findings are robust to additional controls for occupational categories, working hours and divisions. As expected, the variable on working hours seems to be the most relevant, since, when including it in the estimation, the motherhood penalty reduces to -1.5%. This result is confirmed by the estimations of hourly earnings. Having an additional child results in a reduction in hourly wages of 1.2% for women and 0.02% for men.

Results on the first difference model show that the short-run penalty of having an additional child for mothers is 1.5%, while for fathers 0.01%. This result is lower in magnitude as compared to FE findings. As explained in Section 2, the firm, within the first year after childbirth, give to parents a child premium corresponding to a full month salary, thus mitigating the negative impact observed in the long-run with the FE estimations.

For the FE 2SLS model, I replicate the exercise by age cohorts to check if there is evidence of differences in the child effect as employees age. This allows me to control for potential threats due to the likelihood of twin birth because of the use of fertility treatments. As shown in Section 2.3, statistics for France report that the share of twins among the population largely increased for individuals aged more than 40, mainly because of the availability of this type of treatments.

Given the relatively small number of twins at second birth (1% of employees), I had to increase the length of the age cohorts. Now I observe individuals aged $20-29$, $30-39$, and $40-49$. I made separate estimations by cohorts and gender. Results on the first stage are presented in Table A2.19. Differences in the size of the first stage across age cohorts measure differences in the probability of

compliance. The first-stage effect of multiple second birth is bigger when employees are less than 40 ($20-29$ and $30-39$ cohorts), suggesting that the desire to have additional children diminishes as they age. Results of the FE 2SLS model show no significant effect for men in any age cohorts. For women, the only significant effect is found for female employees in their thirties. It is not significant for older women (Table A2.20).

2.7 Conclusions

In this work I investigated the impact of children on earnings among the employees of a large company in France. This firm, with plants spread all over the country and a rigid hierarchical structure, can be considered as a large internal labor market, reducing concerns of external validity of my findings.

The main issue related to this type of research is the likelihood of omitted variable bias in the estimates of the effect of childbirth. To deal with it, my empirical strategy relied on fixed effects models to control for time invariant unobserved heterogeneity and on fixed effects 2SLS estimations using an instrument derived from multiple second birth. This strategy allows me to give a causal interpretation of the child effect along the intensive fertility margins. Results clearly point out the existence of a gender bias in the effect of children on earnings. Mothers suffer a significant penalty from childbirth, while no effect is found for men.

My findings have two main policy implication, closely related.

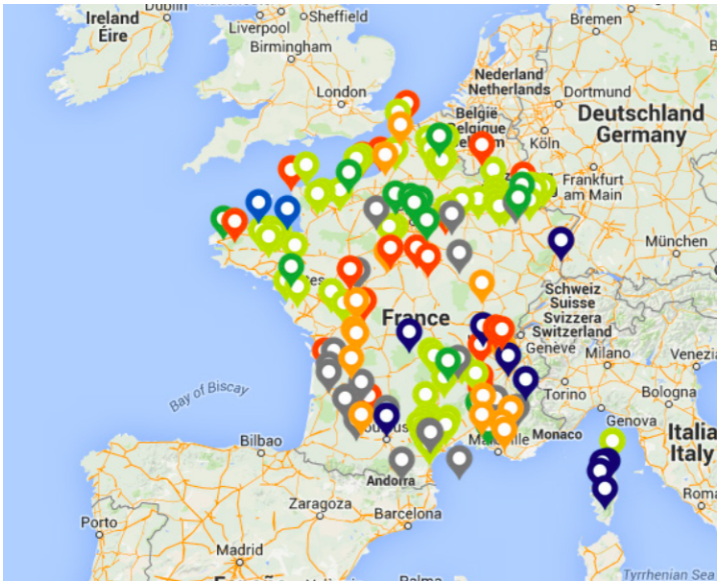
First, the need of a widely available provision of childcare services that allows mothers to stay fully active in the labor market. Evidence that female employees are largely responsible for childcare activities, while male employees are not, is clear. Women's working and absenteeism behavior is strongly associated with children. Interestingly, while female employees tend to reduce their absences as they age, and so as their children grow up, male employees become more absent over time.

The second implication regards the structure and management of the working environment. My findings show that women suffer a considerable reduction in bonuses linked to individual performance when they have a child. Female employees also see a decrease in complementary premiums due to overtime. These results are in line with a work-effort explanation of the motherhood penalty,

which suggests that women with children are, or are believed to be, less productive at the work. But, as Goldin (2014) has pointed out, the concept of productivity is still linked to old schemes that focus on long working hours and the "24/7" business culture. Mothers will be really competitive in the workplace only when their bosses, and colleagues, will recognize the need to support their productivity. This support may take simple, but necessary, forms, as ensuring constant training, setting predictable working hours that allow for school run or developing options to work from home when is needed.

Appendix 2

Figure A2.1: **Map of plants**



Note: Each point in the Map indicates a different plant of the firm over the French territory

Table A2.1: **Correlations between the twin instrument and socio-economic characteristics**

	(Men)	(Women)
	Twin	Twin
Age	-0.008***	-0.002
	(0.002)	(0.002)
Age^2	0.0001***	0.00002
	(0.000)	(0.000)
Secondary	-0.003	-0.0003
	(0.002)	(0.003)
University	-0.002	0.003
	(0.003)	(0.005)
Manager	-0.002	-0.004
	(0.002)	(0.004)
Year fixed effects	✓	✓
Obs	100725	49387

Robust standard errors in parentheses

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

Table A2.2: **Twins first stage**

	(Men) (Children)	(Women) (Children)
Twin	0.823***	0.755***
	(0.040)	(0.043)
Quadratic specification in age and tenure	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Kleibergen-Paap rk Wald F-statistic	258.01	168.40
Obs	100643	49345

This Table shows first-stage effects of twins at second childbirth on number of children.

Errors clustered at individual level in parentheses

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

Figure A2.2: **Raw association between children and earnings by age cohorts**

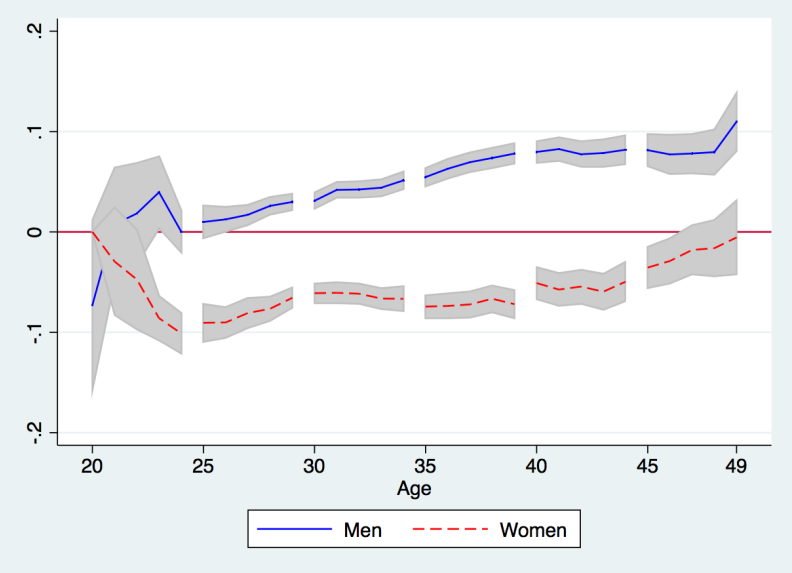


Table A2.3: **Main sample: summary statistics by gender**

	Men					Women				
	Mean	Std. Dev.	Min.	Max.	Obs	Mean	Std. Dev.	Min.	Max.	Obs
Fathers/Mothers	0.59	0.49	0.00	1.00	245778	0.65	0.48	0.00	1.00	117347
1 child	0.18	0.38	0.00	1.00	245778	0.23	0.42	0.00	1.00	117347
2 children	0.30	0.46	0.00	1.00	245778	0.32	0.47	0.00	1.00	117347
3+ children	0.11	0.32	0.00	1.00	245778	0.10	0.31	0.00	1.00	117347
Couple	0.64	0.48	0.00	1.00	245778	0.64	0.48	0.00	1.00	117347
Single	0.18	0.39	0.00	1.00	245778	0.20	0.40	0.00	1.00	117347
Prev married	0.04	0.20	0.00	1.00	245778	0.08	0.28	0.00	1.00	117347
Age	39.03	7.91	19.00	50.00	245778	38.39	7.42	19.00	50.00	117347
Less than secondary	0.22	0.41	0.00	1.00	245778	0.18	0.38	0.00	1.00	117347
Secondary	0.51	0.50	0.00	1.00	245778	0.52	0.50	0.00	1.00	117347
University	0.27	0.44	0.00	1.00	245778	0.30	0.46	0.00	1.00	117347
RL	159.53	60.58	30.00	370.00	245778	154.43	63.76	30.00	370.00	117347
Tenure	15.07	9.68	0.00	39.92	245778	13.21	8.29	0.00	39.42	117347
Blue collar	0.08	0.27	0.00	1.00	245778	0.13	0.34	0.00	1.00	117347
White collar	0.53	0.50	0.00	1.00	245778	0.51	0.50	0.00	1.00	117347
Manager	0.39	0.49	0.00	1.00	245778	0.36	0.48	0.00	1.00	117347
Production	0.71	0.46	0.00	1.00	245778	0.38	0.48	0.00	1.00	117347
Commerce	0.12	0.33	0.00	1.00	245778	0.37	0.48	0.00	1.00	117347
Annual working hours	1460.52	55.35	680.00	1487.50	245778	1418.23	120.35	148.75	1487.50	117347
Annual hours of absence	291.35	174.24	-443.00	3270.40	324885	367.26	285.24	-417.00	2208.00	141836
Paternity/Maternity leave	65.50	14.85	0	202.28	16925	456.35	303.00	0	2052	12246
Total earnings	47947.61	18686.86	50.00	221241.23	245778	40622.14	17462.27	497.75	198157.50	117347
Base pay	37046.04	13055.20	0.00	105800.44	245778	35105.95	13390.78	326.54	105847.91	117347
Bonuses	1878.86	2507.62	0.00	53543.88	245778	1759.43	2282.82	0.00	37604.00	117347
Complementary premiums	9024.17	8189.87	0.00	142979.81	245778	3759.05	5082.56	0.00	95054.39	117347

Table A2.4: **The 2+ children sample: summary statistics by gender**

	Men					Women				
	Mean	Std. Dev.	Min.	Max.	Obs	Mean	Std. Dev.	Min.	Max.	Obs
Twin	0.01	0.10	0.00	1.00	100725	0.10	0.09	0.00	1.00	49387
Children	2.34	0.62	2.00	12.00	100725	2.28	0.53	2.00	10.00	49387
Couple	0.90	0.30	0.00	1.00	100725	0.83	0.38	0.00	1.00	49387
Single	0.01	0.08	0.00	1.00	100725	0.03	0.17	0.00	1.00	49387
Prev married	0.02	0.13	0.00	1.00	100725	0.07	0.25	0.00	1.00	49387
Age	39.21	4.93	21.00	50.00	100725	38.58	4.76	22.00	50.00	49387
Less than Secondary	0.11	0.31	0.00	1.00	100725	0.09	0.28	0.00	1.00	493874
Secondary	0.57	0.49	0.00	1.00	100725	0.57	0.49	0.00	1.00	49387
University	0.32	0.47	0.00	1.00	100725	0.33	0.47	0.00	1.00	49387
RL	170.77	64.56	30.00	370.00	100725	163.26	68.85	30.00	370.00	49387
Tenure	13.91	6.50	0.00	38.87	100725	12.75	5.73	0.00	37.49	49387
Blue	0.06	0.23	0.00	1.00	100725	0.13	0.33	0.00	1.00	49387
White	0.51	0.50	0.00	1.00	100725	0.48	0.50	0.00	1.00	49387
Manager	0.43	0.50	0.00	1.00	100725	0.39	0.49	0.00	1.00	49387
Production	0.70	0.46	0.00	1.00	100725	0.34	0.47	0.00	1.00	49387
Commerce	0.13	0.34	0.00	1.00	100725	0.42	0.49	0.00	1.00	49387
Annual working hours	1459.92	56.34	680.00	1487.50	100725	1382.21	151.92	148.75	1487.50	49387
Annual hours of absence	292.18	159.70	-268.51	3227.00	136353	396.82	304.60	-203.00	2208.00	49387
Paternity/Maternity leave[a]	66.16	15.00	0.00	202.28	8423	558.56	290.18	0.00	2052.00	5133
Total Earnings	53330.98	20979.64	11276.18	221241.23	100725	42440.53	19685.55	2536.78	184089.36	49387
Base pay	40718.61	14499.13	8122.25	106876.23	100725	36835.65	115199.59	2436.98	105380	49387
Bonuses	2389.25	2962.08	0.00	50098.38	100725	2038.11	2571.84	0.00	37604.00	49387
Complementary premiums	10224.78	9042.52	0.00	142979.81	100725	3569.75	5227.54	0.00	86653.73	49387

a in hours

Table A2.5: **Working time and absenteeism - employees with small children as compared to employees with older children**

	Child$\leq$ 6	Child$>$ 6	Difference in mean
Men			
Annual working hours	1459.81	1459.9	0.09
Annual hours of absences	291.04	286.72	4.31***
Family related absences	23.22	14.64	8.58***
Women			
Annual working hours	1397.33	1402.10	-4.77***
Annual hours of absences	351.41	340.85	10.56***
Family related absences	40.47	42.21	-1.74***

Small is an indicator for having a child with less than 6 years old

Annual hours of absences do not account for paternity or maternity leave

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

Table A2.6: **Small children and total annual earnings**

	(Men)	(Women)
	Ln Earnings	Ln Earnings
Small	0.008***	-0.024***
	(0.002)	(0.002)
Quadratic specification in age and tenure	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	154460	80990

Small is an indicator for having a child with less than 6 years old

Errors clustered at individual level in parentheses

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

Table A2.7: **Children and earnings components**

	Men			Women		
	Base	Bonuses	Complementary	Base	Bonuses	Complementary
Children	0.002***	-0.031***	-0.016**	-0.028***	-0.117***	-0.116***
	(0.000)	(0.003)	(0.005)	(0.001)	(0.006)	(0.013)
Quadratic specification in age and tenure	✓	✓	✓	✓	✓	✓
Individual fixed effects	✓	✓	✓	✓	✓	✓
Time effects	✓	✓	✓	✓	✓	✓
Obs	245404	183815	243529	117178	81167	114911

Errors clustered at individual level in parentheses

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

Table A2.8: **Children and RL: progression within the hierarchy of the firm**

	Men	Women
	Ln RL	Ln RL
Children	-0.004***	-0.023***
	(0.001)	(0.001)
Quadratic specification in age and tenure	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	245406	117178

Errors clustered at individual level in parentheses

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

Table A2.9: **Children and total annual earnings by age cohorts**

	Men	Women
	Ln Earnings	Ln Earnings
Children	0.004	0.017
	(0.006)	(0.020)
25-29	0.050***	0.011**
	(0.002)	(0.004)
30-34	0.082***	0.031***
	(0.003)	(0.005)
35-39	0.080***	0.016**
	(0.003)	(0.006)
40-44	0.054***	-0.017*
	(0.004)	(0.007)
45-49	0.011*	-0.059***
	(0.005)	(0.008)
Children·$(25-29)$	-0.004	-0.054**
	(0.006)	(0.018)
Children·$(30-34)$	-0.006	-0.071***
	(0.006)	(0.020)
Children·$(35-39)$	-0.005	-0.062**
	(0.006)	(0.020)
Children·$(40-44)$	-0.001	-0.045*
	(0.006)	(0.020)
Children·$(45-49)$	0.003	-0.025
	(0.006)	(0.020)
Quadratic specification in tenure	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	243862	116543

The reference category is having a child between 20 and 24 years old

Errors clustered at individual level in parentheses

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

Table A2.10: **Absenteeism by age cohort**

	20-24	25-29	30-34	35-39	40-44	45-49
Men						
Annual hours of absence	238.20	268.23	291.35	291.23	293.24	301.99
Family related absences	27.26	30.76	24.66	17.75	15.16	18.93
Women						
Annual hours of absence	277.41	354.17	427.88	386.18	358.06	339.94
Family related absences	34.01	39.67	41.79	41.66	41.21	37.89
Difference in mean						
Annual hours of absence	-39.21***	-85.94***	-136.53***	-94.94***	-64.81***	-37.95***
Family related absences	-6.75***	-8.91***	-17.12***	-23.91***	-26.04***	-18.96***

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

Table A2.11: **Children and total annual earnings by family status**

	Men	Women
	Ln Earnings	Ln Earnings
Children	-0.003**	-0.039***
	(0.001)	(0.002)
Single	0.001	0.007*
	(0.002)	(0.004)
Prev married	-0.011*	-0.006
	(0.005)	(0.008)
Children·Single	-0.004	-0.004
	(0.003)	(0.004)
Children·Prev married	-0.001	0.014***
	(0.002)	(0.004)
Quadratic specification in age and tenure	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	220758	106785

The reference category is having a child in a couple

Errors clustered at individual level in parentheses

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

Table A2.12: **Children and total annual earnings by educational level**

	Men			Women		
	Less Secondary	Secondary	University	Less Secondary	Secondary	University
Children	0.001	-0.003**	-0.001	-0.017**	-0.052***	-0.037***
	(0.003)	(0.001)	(0.001)	(0.006)	(0.002)	(0.002)
Quadratic specification in age and tenure	✓	✓	✓	✓	✓	✓
Individual fixed effects	✓	✓	✓	✓	✓	✓
Time effects	✓	✓	✓	✓	✓	✓
Obs	23135	142593	79678	10175	66319	40684

Errors clustered at individual level in parentheses

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

Table A2.13: **Children and total annual earnings: post secondary education and Grandes Écoles**

	(Men)	(Men)	(Women)	(Women)
	Post sec	Grandes Écoles	Post sec	Grandes Écoles
Children	-0.001	0.0001	-0.041***	-0.030***
	(0.002)	(0.003)	(0.003)	(0.005)
Quadratic specification in age and tenure	✓	✓	✓	✓
Individual fixed effects	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓
Obs	49463	20949	25972	8560

Errors clustered at individual level in parentheses

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

Table A2.14: **Children and total annual earnings: managers**

	(Men)	(Women)
Children	-0.002	-0.036***
	(0.001)	(0.002)
Quadratic specification in age and tenure	✓	✓
Individual fixed effects	✓	✓
Time fixed effects ✓	✓	
Obs	96316	45612

Errors clustered at individual level in parentheses

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

Table A2.15: **Children and total annual earnings by place of residence**

	(Men) Île-de-France	(Men) Outside Île	(Women) Île-de-France	(Women) Outside Île
Children	0.001	-0.004***	-0.024***	-0.045***
	(0.002)	(0.001)	(0.003)	(0.002)
Quadratic specification in age and tenure	✓	✓	✓	✓
Individual fixed effects	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓
Obs	41068	204338	32537	84641

Standard errors in parentheses

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

Table A2.16: **Children and total earnings: controlling for category, working hours and divisions**

	Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)
Children	-0.002**	-0.002**	-0.003***	-0.039***	-0.015***	-0.040***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Quadratic specification in age and tenure	✓	✓	✓	✓	✓	✓
Individual fixed effects	✓	✓	✓	✓	✓	✓
Time effects	✓	✓	✓	✓	✓	✓
Obs	245406	245406	245406	117178	117178	117178

(1)= Controlling for occupational categories

(2)= Controlling for working time

(3)= Controlling for divisions

Errors clustered at individual level in parentheses

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

Table A2.17: **Children and hourly wages**

	Men	Women
	Ln Hourly	Ln Hourly
Children	-0.002**	-0.012***
	(0.001)	(0.001)
Quadratic specification in age and tenure	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	245406	117178

Errors clustered at individual level in parentheses

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

Table A2.18: **Children and total earnings - first difference estimations**

	Men	Women
	D.Ln Earnings	D.Ln Earnings
D.Children	-0.001*	-0.015***
	(0.001)	(0.001)
Quadratic specification in age and tenure	✓	✓
Year fixed effects	✓	✓
Obs	208461	97675

Robust standard errors in parentheses

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

Table A2.19: **Twins first stage by age cohorts**

	(20-29)	(30-39)	(40-49)
	Children	Children	Children
Men			
Twin	1.324***	1.079***	0.415***
	(0.244)	(0.055)	(0.059)
Obs	56781	111532	75549
Women			
Twin	1.070***	1.027***	0.297**
	(0.219)	(0.088)	(0.106)
Obs	22650	58087	35806

Errors clustered at individual level in parentheses

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

Table A2.20: **Fixed effects 2SLS estimations by age cohorts**

	(20-29)	(30-39)	(40-49)
	Ln Earnings	Ln Earnings	Ln Earnings
Men			
Children	-0.028	-0.001	-0.001
	(0.023)	(0.012)	(0.014)
Obs	53862	107235	72991
Women			
Children	-0.042	-0.038*	-0.013
	(0.028)	(0.018)	(0.038)
Obs	21081	56010	34359

Errors clustered at individual level in parentheses

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

Chapter 3

Children, Earnings and Careers in an Internal Labor Market. An Event Study

Using a 12-years panel of personnel records from a large French company, we find that becoming mother (extensive fertility margins) largely affects labor market outcomes. Instead, fatherhood does not significantly impact on men's wages or careers. An event study approach with the use of non-parents as control group enables us to show that, prior to childbirth, future mothers' earnings are in line with that of non-mothers. However, one year after birth, they start to fall, reaching -9% in total pay and -30% in individual bonuses. This drop is persistent: 8 years after childbirth there is no evidence of a catching-up trend. Mothers also have lower chances to climb-up the hierarchy of the firm and be promoted to managerial positions. A decomposition of the motherhood penalty shows that these "missed promotions", likely due to an increase in absenteeism during the child's pre-school age, are the main determinants of mothers' lower outcomes within the firm.

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3.1 Introduction

Parenthood leads to huge changes in all spheres of life. Individuals who become parents for the first time need to reorganize their entire working and leisure lives, with relevant consequences for their economic outcomes. It is nothing new that women face most of the challenges that the arrival of the first child implies. They are less likely to stay active in the labor market. If employed, they tend to work fewer hours and earn lower wages not only than men, but also than childless women (Sigle Rushton and Waldfogel, 2007). It has been estimated that during her career, a typical working mother with a medium level of education loses roughly half the earnings she would have had without having a child (Joshi and Davies, 2000).

A growing body of literature is now focusing on the wage differential between women with children and otherwise comparable women, the so called *motherhood pay gap*. Pay penalties for mothers have been found both in the US (Waldfogel (1997), Budig and England (2001), Anderson et al. (2003), Bertrand (2011)), and Europe (Simonsen and Skipper (2012) for Denmark, Felfe (2012) for Germany, Wilner (2016) for France)[1]. These penalties range from 2% to 7% in hourly wages. Traditionally, they have been explained within a human capital framework: mothers earn less because they make lower investments in education, have more career breaks and tend to work more part-time. Moreover, they are believed to bring less effort to the labor market because of the burden of childcare activities. But it can also simply be that women with children are different from childless women in relevant ways that are associated with their earnings potential. For example, they may have higher preferences for family over career[2].

Most of the literature on the motherhood pay gap focuses on the effect of having an additional

[1]The existence of penalties for mothers in all labor markets rises questions on the effectiveness of child-related policies. For example, there is no unique provision of maternity leave in the US, while in Germany mothers are allowed to take 3 years of leave after childbirth. But similar motherhood pay gaps are found in both countries. Norther European countries are usually praised for offering 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 gap in pay (Kleven et al. (2018), Lundborg et al. (2017))

[2]In order to address causality in interpretation of findings on the motherhood pay gap, these unobserved differences are usually assumed to be time-invariant (Budig and England, 2001). Other techniques used to disentangle the causal effect of childbirth from the association between children and earnings have been conditional-on-observables strategies such as OLS and propensity score matching (e.g. Simonsen and Skipper (2006, 2008)), firm and worker fixed effects (Budig and England (2001), Anderson et al. (2003), Wilner (2016)), and quasi-natural experiments based on twin births (Angrist and Evans (1998), Simonsen and Skipper (2012)) or IVF treatments (Lundborg et al., 2017)

child among women who already have children (intensive fertility margins). But very few works have specifically looked at the labor market impact of turning into motherhood (extensive fertility margins)[3]. The aim of this paper is to contribute to this specific stream of literature by giving a more comprehensive picture of the economic consequences of having the first child. In particular, we want to investigate how becoming parent is related to adjustments in individual behaviors at the workplace and what is the impact of these adjustments on economic outcomes.

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. In 2013 this company accounted for $71,000$ employees. Adding external collaborators, it reached a whole workforce of $129,492$ individuals in France. Given its dimension and rigid, hierarchical internal structure, it can be considered as a large internal labor market, thus mitigating concerns of external validity of our findings. To our knowledge, no previous studies have been done on the impact of parenthood on earnings and careers of men and women within a firm. This allows us to make a new contribution to the scarce literature on the economic effect of having a child. Indeed, the records at our disposal allow us to focus on precise measures of individual productivity (bonuses linked to performance, absenteeism) not available in survey data. Moreover, we are among the few able to provide empirical findings on the economic consequences of becoming father[4].

To study the child effect at the extensive fertility margins we develop an event study around the timing of first childbirth. Our preferred specification includes a control group of non-parents in the estimation sample. This strategy allows us to add individual fixed effects in our estimations, solving the underidentification problem typical of event studies designs.

Our results suggest a clear penalization in total earnings for becoming mother. Instead, we do not find any significant effect of fatherhood. The motherhood penalty can be explained by three main factors: lower hours worked, "missed promotions", and "missed bonuses". During the child's pre-school age, mothers work around 4% less with respect to non-mothers. This reduction in

[3]Lundborg et al. (2017) develop a new IV strategy based on IVF induced fertility variation to estimate the causal effect of having children on women's career in Denmark

[4]Results on the impact of fatherhood on earnings are scarce and puzzling. There is some evidence of a "fatherhood bonus" ($4\% - 6\%$ in Denmark (Simonsen and Skipper, 2012)), but also evidence of no effect in France (Wilner, 2016), or even of a negative effect in Norway (Cools and Strøm, 2016)

working hours is due to a shift from full-time to part-time contracts in the years immediately after delivery. Only when children enroll school, 6 years after childbirth, mothers tend to come back to full-time, starting to catch up non-mothers. The majority of mothers likely opt for part-time contracts because of lack of discretion in adjusting working schedules. We find evidence that this lack of flexibility has a long and negative impact on their productivity, and, as a consequence, on their earnings. For example, among managers, who have the chance to adjust their working time more easily, the gap in earnings between mothers and non-mothers is lower and disappears by the time children start school. Lack of flexibility also means more requests for leaves, thus an increase in absenteeism. We find evidence of a rise in the number of hours of absence for mothers in the first years after delivery. This increase in absenteeism has two main consequences. First, a block in the progressions within the hierarchical ranks of the firm. These "missed promotions" are able to explain the largest part of the motherhood penalty, since they indicate a slowing down for mothers, as compared to childless women, in the career patterns within the firm. Second, they lead to lower bonuses. These bonuses are linked to individual productivity and are particularly relevant in the firm's division in which mothers represent the majority of the workforce: the commercial. In this division, productivity goals linked to specific incentive schemes play an important role, penalizing women who turn into motherhood, since they likely have lower chances to work long, and particular, hours (Goldin, 2014).

This Chapter is organized as follows. Section 3.2 describes the institutional background and data. Section 3.3 presents the empirical strategies and the estimation samples. Section 3.4 shows the main results. Section 3.5 explains the underlying mechanisms of the child penalty for mothers. In Section 3.6 we present some heterogeneous effects. In Section 3.7 we propose a decomposition of the motherhood penalty. In Section 3.8 we perform two placebo tests. Section 3.9 concludes.

3.2 Institutions and data

3.2.1 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 children per woman in 2015[5], and among the public systems that offer good opportunities to balance working and family life. Despite reductions in public support for families after the 2008 economic crisis, in 2014 expenditures on childcare and early education services were relatively high: 1.1% of GDP , compared to the OECD average of 0.7%[6].

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 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[7].

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 extended 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

[5] World Bank
[6] Family Policies, France (2014). Population Europe Resource Finder and Archive
[7] `https://www.service-public.fr/particuliers/vosdroits/F207`

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[8]. 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[9].

A universal model of preschool education, the *École maternelle*, is available to all children aged 3-6. The program is fully founded 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 second childbirth, 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 get a childbirth premium. The premium consists in a full month salary. Only mothers are allowed to take 6 days off per-year for child-related reasons. They can take 2 additional days for "sick child". 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[10] and aims promoting working environments in which employees with children can easily reconcile professional and family lives. More than 500 firms in France have

[8] Population Europe Resource Finder and Archive

[9] urlhttp://www.caf.fr/ma-caf/caf-du-bas-rhin/offre-de-service/petite-enfance/je-souhaite-placer-mon-enfant-en-creche

[10] Observatoire de l'Équilibre des Temps et de la Parentalité en Entreprise; www.observatoire-equilibre.com

already signed it. The effort of our company especially regarded the possibility for parents to work from home through teleworking.

3.2.2 Data

Our analysis is based on personnel records for the population of employees of a large manufacturing company in France. In 2013 this firm accounted for a workforce of 129, 492 individuals. Figure A3.1 shows that the plants of this firm are spread over the whole county, giving us a good representative sample of French population. Considering also foreign plants and external collaborators, the number of employees rose to 159, 112 in 2016. Given its dimension and, as we will describe, its internal structure, this company can be considered as a large internal labor market, reducing concerns of external validity of our findings.

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 transfered to the new firm.

The final dataset consists of an unbalanced panel of 54, 861 employees, for a total of 363, 125 individual-year observations. The share of women is around 32%.

Table A3.1 reports summary statistics by gender. Both male and female employees are, on average, around 36 years old. Women are better educated (34% of them has at least a first level degree) and equally represented in managerial positions. However, they tend to work less hours than men and make more annual hours of absence (380 versus 267).

59% of males and and 65% of females are parents, i.e. have one or more dependent children. On average, they have 1 child. Most of them is in a couple (64%). A larger share of women is divorced

(6%).

Career paths in our firm can be easily described by one variable: *Remuneration Level* (RL), which summarizes the salary ladder of the company. Indeed, the firm's hierarchical structure is described by 370 different ranks, each one corresponding to a different RL. RL 30 indicates the lowest blue collar rank, RL 370 the highest managerial position. The average RL for men is 156, while for women 153.

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 premiums 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.

3.3 The event study: impact of first childbirth

We want to study how becoming parent affects earnings and careers of the employees of a large company. To do so, we develop an event study design. This methodology allows us to follow changes in economic outcomes around the event "*birth of the first child*".

3.3.1 Non parametric event study set up

Consider a panel of $i = 1, .., N$ individuals for whom a specific outcome Y_{it} is observed for $t = 1, ..., T$ *calendar times* (e.g. years). In an ideal setting, every individual receives a treatment in some time periods r (e.g. some specific years within the panel), and stays treated forever.

Let define $s = t - r$ the *relative event time*: it indicates, for each individual, the relative distance between the calendar time and the event time.

Within this framework, the dynamic effect of the event on the observed outcome can be estimated from:

$$Y_{it} = \sum_{s=-\infty}^{\infty} \gamma_s + \eta_i + \nu_t + \varepsilon_{it} \tag{1}$$

where γ_s are coefficients on indicators for time relative to the event, which occurs at $s = 0$. For $s < 0$ they show pre-event trends. For $s >= 0$, they capture the effective treatment effects, the dynamic impact of the event on the outcome of interest. η_i and ν_t are individual and time fixed effects, ε_{it} is a random noise. $s \pm \infty$ indicates the longest time window around the event.

Usually $\gamma_{s=-1}$, the relative time prior to the occurrence of the event, is the omitted category. For the model to hold, a standard assumption is that $Y_{it,s=-1} = \eta_i + \nu_t + \varepsilon_{it}$. Since the treatment effects are homogeneous across i and t and depend only on s, $Y_{it,s\neq-1} - Y_{it,s=-1} = \gamma_s$ identifies the dynamic causal impact of the event on the outcome of interest.

Given this set up, we face a well-known problem of underidentification (Dobkin et al. (Fortchoming) and Borusyak and Jaravel (2017)). For each individual i, the calendar time t is simply the sum of the time in which the event happens, r, and the relative event time, s. There is a perfect linear relationship between these effects. Since individual fixed effects subsume event time fixed effects (r), they cannot be included and estimated along the full set of calendar time t and relative event time s fixed effects. It is impossible to observe independent variation in these variables.

To solve this issue, we develop two empirical strategies. The first consists in dropping the unit fixed effects and balancing the sample of employees who experience the birth of the first child around the event time. Without individual fixed effects there is no underidentification problem.

The second strategy is based on a model that includes a control group in the estimation sample. The presence of a control group solves the underidentification issue because the control group can be used to estimate the year effects independently of the causal effect of treatment (Borusyak and Jaravel, 2017). Our control group is made up by all employees who, during the period, never have children.

3.3.2 Empirical strategies and identification

We focus on individuals who become parents by selecting a subsample of employees who experience the birth of the first child within a specific time window: 2007-2009. This selection was driven by the need to have enough childbirths to develop the analysis and a relatively large time span before and after the event. Since we want to capture the child effect along the extensive fertility margins, we additionally drop all employees who will have other children after the first one. We observe $2,479$ first childbirths for a total of $24,894$ employee-year observations.

In the first strategy we will focus only on this subsample. In the second, we will include a control group made of non-parents.

First strategy: balanced sample of parents

We start our analysis by focusing only on the sample of employees who enter parenthood, and balancing around the childbirth window $2007 - 2009$. The main characteristics of this strategy is that each individual receives the treatment and is observed for the same number of years during the panel.

For each parent we set $s = 0$ for the years of the event (2007, 2008, or 2009) and index all the other years relative to that years. Then, we balance around the event time $s = 0$. As a consequence, our specification includes all parents that we are able to observe from -2 years before childbirth to $+7$ years after.

In our main analysis, we want to capture the dynamic impact of first childbirth on total annual earnings. We estimate the following equation separately for men and women:

$$Y_{it} = X_{it}\alpha + \sum_{s=-2}^{7} \gamma_s + \nu_t + \varepsilon_{it} \tag{2}$$

Y_{it} is the log of annual earnings for individual i at time t. X_{it} is a series of age cohort dummies that allow us to control for underlying life-cycle trends. γ_s is our set of event time indicators. ν_t are year fixed effects. Robust standard errors are used.

Our reference category is the event time indicator prior to birth, $\gamma_{s=-1}$. Thus, the event time

coefficients measure the impact of the first child relative to the year just before childbirth.

The assumption behind this strategy is that, controlling for underlying life-cycle and time trends, the timing of childbirth is as good as random. A major concern arise within this framework: our identification is violated if there is an individual-specific component of the error term that is correlated with the timing of childbirth.

The inclusion of unit fixed effects allows us to address it. Because of this, we develop a second strategy that accounts for individual time-invariant unobserved heterogeneity. To develop this strategy, we include in the estimation sample a control group of non-parents, solving the underindentification problem previously described.

Second strategy: model with a control group

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 $19,319$ childless employees, for a total of $91,847$ employee-year observations.

Since in this case 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. Since at the two extreme points of the relative event time function we have too few individuals to carried out a consistent analysis, we restrict s to range from -3 to $+8$.

We run the following regression separately for men and women:

$$Y_{it} = X_{it}\alpha + \sum_{s=-3}^{8} \gamma_s \cdot T_i + \eta_i + \nu_t + \varepsilon_{it} \tag{3}$$

Y_{it} is the log of annual earnings for individual i at time t. X_{it} is a vector of age cohort dummies. T_i is equal to 1 if the individual is in the treatment group. γ_s are our coefficients of interest, estimating the outcome at a given s relative to the control group. The omitted category is $\gamma_{s=-1}$. η_i are individual fixed effects, ν_t are time effects. Errors are clustered at the individual level.

Our identifying assumption is that, conditional on life-cycle patterns, time trends and time invari-

ant characteristics between treated and control units, the timing of childbirth is as good as random. The individual fixed effects allow us to control for constant individual-specific components of the error term correlated with the timing of childbirth. However, our assumption would be violated if there were time-varying shocks that are both correlated with the timing of childbirth and Y_{it}. For example, an unexpected promotion could impact on both the decision to have the child and earnings. The high quality of information at our disposal help mitigating these concerns. We are able to examine patterns in outcomes in the years up to childbirth to give more evidence of the validity of our identifying assumption. Attrition, which in our setting can potentially be due to exit from the firm because of the birth of the child, is another possible violation of our identification strategy. We show that the share of employees who leave the company after childbirth is extremely low and does not represent a potential concern.

This is our most preferred specification, since it allows us to better control for selection into treatment and individual time-invariant unobserved heterogeneity.

3.3.3 The estimation sample: treatment and control units

In Table A3.2 we report descriptives on our estimation sample. Employees in our treatment group are older than those in the control group, both among males and females. At first childbirth, men are around 32 years old, women 31. Most of parents are in a couple. However, the share of single mothers is quite high, 23%. Women are better educated than men. In particular, the better educated group is represented by non-mothers.

The majority of mothers is employed in a white-collar position. Non-mothers are well represented among managers (46%). Indeed, they have the highest RL. Parents have longer tenure than non-parents. While the majority of mothers are employed in the commerce division, most of non-mothers work in the production.

Mothers tend to work lower hours than non-mothers. They are also more absent from work. Not accounting for maternity leave, they make, on average, 360.08 annual hours of absence, while non mothers 291.62. The average length of maternity leave is in line with law's standards. The average number of hours of paternity leave is around 65.

5% of mothers leave the company during the period. This fact can represent a possible source of attrition in our data. However, the number is too small (89 women) to represent a threat to our strategy. As Figure A3.2 shows, around 64% of them move to another company, while 25% go on parental leave. More than 50% of these women leave the company within the first 2 years after delivery. Table A3.3 shows descriptives on fathers and mothers at the timing of separation from the firm. On average, fathers leave 4 years after the birth of the first child, mothers 2 years after. Most of them are in a couple. The majority of mothers have a blue-collar position (47%), while fathers are well represented among managers (43%). Most of mothers (84%) are employed in the commerce division. Before leaving, they tend to work fewer hours than the mothers who stay in the firm and are much more absent from work (481 hours per year, on average, versus 360 of mothers who stay).

Figures A3.3, A3.4 and A3.5 show average values of total earnings, individual bonuses and RL over the period. The small gaps in means in the pre-event window times suggest that there are no large differences between the treatment and control units before childbirth. After, instead, these differentials tend to increase both for men and women. A "fatherhood bonus" seems to take place. Mothers, on the other hand, seem to get penalized during the years immediately after childbirth. However, by the end of the period, they menage to catch up non-mothers.

3.4 Results on total annual earnings

Panel A of Figure A3.6 shows the event time coefficients γ_s estimated from Equation (2) on the balanced sample of parents. Panel B, instead, plots the γ_s estimated from Equation (3) on the sample with the control group. The outcome of interest is total annual earnings. 95% confidence intervals are included. The vertical red line indicates the timing of birth.

Findings of both models show the same patterns. Before the birth of the child, the event time indicators are not significantly different from zero, suggesting the absence of pre-trends. Employees' earnings, despite gender or parental status, evolve in the same way until the event "birth of the first child". After the event, however, we find a clear penalization for mothers.

This penalty does not seem to be immediate: at event time 0 results are still not significant. This

may be due to the fact that our firm gives to new parents, both males and females, a childbirth premium corresponding to a full one month salary. It is just one year after birth that mothers' total pay starts to fall: -4% with respect to the year just before childbirth, -6% with respect to non-mothers. What is relevant is that it does not increase back. Results on Panel A indicate that 7 years after delivery mothers are earning around 13% less than the year before childbirth. Results on Panel B show that 8 years after childbirth mothers are earning 9.5% less than non-mothers. In both models, slightly positive or non significant effects are found for employees who become fathers.

3.5 Underlying mechanisms

Findings on the event studies show a penalty for mothers in terms of total annual earnings. In this section we investigate the channels through which this penalty may arise: impact of different components of earnings, working hours, career patterns and absenteeism. To analyze these outcomes we rely on the empirical strategy that includes the control group in the estimation sample, since it allows us to estimate the model with individual fixed effects. Thus, all the results presented in the following sections are estimated from Equation (3).

3.5.1 Earnings components

Table A3.4 reports results of the estimation of Equation (3) on occupation base pay and bonuses linked to individual productivity. Results are presented for fathers as opposed to non-fathers and mothers as opposed to non-mothers. 0 is the event time in which first childbirth occurs.

Again, before the birth of the child, there are no significant differences between our treatment and control units. Focusing on occupation base pay, we find some positive effect for fathers between 3 and 6 years after childbirth. This is likely due to an increase in extra-time in the years immediately after the arrival of the child, a standard result for men (Millimet, 2000). Mothers, instead, suffer a drop of 5.6% one year after delivery. A gap with non-mothers that gets worse over time, reaching -8% 8 years after. But the largest penalization for mothers is in individual bonuses: -30% two years after the event, with no evidence of a catching-up.

3.5.2 Working hours

The arrival of the first child leads to important changes in individuals' labor supply. Since our results are all conditional on staying employed in the firm, we can study the evolution of hours supplied around childbirth. We thus replicate our event study using as dependent variable the log of annual hours actually worked by the employees.

Results are reported in Figure A3.7. A significant reduction, around 5%, is found one year after delivery. The subsequent year things start to improve, probably because of the re-enter after maternity leave. During children's pre-school age, the pattern of working hours of mothers is stable, with a gap of 4% with non-mothers. When children enroll school, however, a clear catch-up trend arises. 8 years after the event, the differential in working hours between mothers and non-mothers is 2%. No effect is found on fathers.

Given these findings, we deeper the study on working hours by analyzing changes in contractual working time after first childbirth on the subsample of mothers (Table A3.5). It is clear that most of the decrease in working hours can be explained by a sharp increase in the share of part-time contracts between event time 0 and 1: +5.33%. During pre-school years, most of mothers opt for a working contract that accounts for 80% of full time hours. When the child starts primary school, 6 years after delivery, we observe an increase back to full-time contracts.

These findings suggest that individual choices on hours worked after childbirth may be a relevant mechanism that negatively impacts earnings. However, the event study on working hours shows a catching-up process that is not found in earnings' trends.

According to Le Bouteillec et al.(2014), in France many parents are unable to get access to good quality childcare services because of limitation of local coverage. For example, *crèches* represent the most requested service by French parents of children under 3. But their availability is much more frequent in large cities, and in particular in Paris, where their number reaches 38 per 100 children aged 3 or less. The national average is 16 per 100 children[11]. Because of this, I split the sample under analysis focusing on employees living in the Paris region, the Île-de-France, as compared to employees living in other regions. Figure A3.8 shows how supply of working hours

[11] https://www.ined.fr/fr/publications/population-et-societes/creche-france/

changes if the mother lives in a area of high coverage of childcare facilities, the Île-de-France, or not. Results support the idea that women living in areas where child care services are more present tend to reduce less their working hours during the first years after delivery. However, by the time the child starts school, no differences are found among the two group of mothers.

3.5.3 Career paths and absenteeism

According to Davies and Frink (2014), the myth of the perfect worker began to emerge at the beginning of the 20^{th} 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 thus want to study how career patterns diverge between employees who have children and employees who do not by looking at the trajectories of the variable RL.

Table A3.6 shows that, before childbirth, there are no significant differences within the hierarchical rank of the firm between employees who are going to have a child and employees who are not. After childbirth, however, mothers, constantly slow down with respect to non-mothers. By cumulating this penalty over the post-birth period, this implies that mothers, 8 years after delivery, end up at 5 lower levels with respect to childless women within the hierarchy of the company. In Table A3.7 we additionally show that mothers constantly see reduced their probability to enter the highest managerial positions. 8 years after childbirth the chances to become a manager for a woman with a child is 9% lower with respect to a childless woman.

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.

We find confirmation of this fact in our firm. Absences are remunerated at full salary, so they do not directly impact on wages, but they do affect the career patterns of employees. A rise in the number of hours of absences has two main consequences. A stop in annual improvements along the RL ranks and/or a reduction in individual bonuses.

To better investigate this issue, we replicate our event study on the log of annual hours of absence to see if there are changes in the absenteeism behavior of mothers around childbirth as compared to non-mothers (Figure A3.9). We distinguish between total hours of absence, including maternity and paternity leave, from other sources of absenteeism (mainly family leaves, sick leaves and holidays). We do find a confirmation that mothers tend to increase their hours of absence in the years immediately after delivery. Not accounting for maternity leave, in the pre-school years of the child, mothers make around 20% more hours of absences with respect to non-mothers. These include 6 days per-year that are guaranteed to mother of small children and additionally 2 days of leave for "sick child". Only when children enroll school we do not observe significant differences between mothers and non-mothers in terms of absenteeism.

3.6 Heterogeneous effects: differences by occupations and divisions

In this section we study some heterogeneous effects to better understand how temporal flexibility at work and responses to firms' incentives can help explaining mothers' penalty in earnings.

According to Blau and Winkler (2017), women in manual occupations and service positions are those most penalized from childbirth. This type of jobs provides less flexibility in working time, as compared to professional jobs. We find evidence of these findings by analyzing the different impact of the birth of the first child on the subsamples of managers and non-managers (Table A3.8). Our results clearly point out that mothers in non-managerial positions are more penalized. For them, the gap with non-mothers is larger and more persistent (-9% 8 years after delivery). Mothers in managerial positions, instead, not only are less penalized, but also menage to fully catch-up non-mothers by the timing children enroll school.

These findings can be explained by the fact that mothers in non-managerial positions have less discretion in the organization of working time. So, after childbirth, they are more likely to opt for part-time or reduced working contracts. Indeed, after childbirth, the difference in contractual working hours among the two groups is huge: 89.97% of mothers in managerial position has a full time contract, while only 49.47% of mothers in non-managerial positions has so.

We know that the majority of mothers is employed in the commerce divisions (56%), while most of non-mothers in the production (42%). We thus want to check if there are differences in the impact of first childbirth among the two divisions. This type of exercise may also shed light on another important mechanism, that of responses 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 promotions. It may be that mothers, after childbirth, are less responsive to this kind of incentives. The two divisions under analysis represent a good example to investigate this issue. The production is commonly less sensible to incentives, since the type of work is more manual and easily replaceable. Instead, incentive schemes tend to be more widespread among sales and trade officers. These workers, usually non 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 (Table A3.9). The share is higher among sales and trade workers. Moreover, it is higher for women than for men. In Table A3.10 we present results of the estimations of our event time coefficients on individual bonuses on the subsamples of employees working in the production and commerce divisions. Our findings clearly point that

mothers in the commerce division are the most penalized, suggesting a lower responses to incentives after childbirth.

3.7 Decomposition of the motherhood penalty

We have observed that the main mechanisms that help us explaining a negative impact of the first child for female employees as compared to childless women are a reduction in working hours, lower chances for mothers to climb-up the hierarchy of the firm due to an increase in absenteeism, and lower bonuses. In this section we propose a decomposition of the motherhood penalty to understand the relative weight of these mechanisms. In particular, our main interest stands in explaining how the penalty observed between mothers and non mothers can be decomposed into "less hours", "missed promotions" and "missed bonuses".

We start by defining the mean motherhood penalty after childbirth as:

$$\Delta_p = [E(Y_{it|Mother} - E(Y_{it|NonMother})]$$

calculated on the basis of the linear regression model, estimated separately for mothers and non-mothers:

$$Y_{it} = X_{it}\beta + \varepsilon_{it}$$

where Y_{it} is the log of total annual earnings. X_{it} includes the variables of interest on total annual hours worked, RL and total annual individual bonuses.

We follow a standard Oaxaca (1973) decomposition:

$$\begin{aligned}\Delta_p = &[E(X_{Mother}) - E(X_{NonMother})]'\beta_{NonMother} + \\ &+ [E(X_{NonMother})]'(\beta_{Mother} - \beta_{NonMother}) + \\ &+ [E(X_{Mother}) - E(X_{NonMother})]'(\beta_{Mother} - \beta_{NonMother})\end{aligned}$$

where the first component amounts for the part of the penalty that is due to differences in predictors between mothers and non-mothers (the explained part of the gap), and the other two components to differences in coefficients and interactions between predictors and coefficients (the unexplained part of the gap).

We are aware that, in the right-side of the equation, we are including earnings determinants that directly respond to childbirth. But the aim of this exercise is to show how much each mechanism contributes to explain the motherhood penalty, as if we were calculating an accounting identity:

$$\frac{dEarnings}{dChild} = \frac{\partial Earnings}{\partial Hours} \cdot \frac{dHours}{dChild} + \frac{\partial Earnings}{\partial RL} \cdot \frac{dRL}{dChild} + \frac{\partial Earnings}{\partial Bonus} \cdot \frac{dBonus}{dChild} \tag{4}$$

Results of our exercise are presented in table A3.11. The average motherhood penalty is around 12%. Of these, almost 10% can be explained by our predictors. "Missed promotions", lower chances for mothers to improve their rank within the firm (embodied by the variable RL), are able to explain the largest part of the gap. As we have shown, differences between mothers and non-mothers in career patterns are likely due to an increase in the hours of absences that mothers face the first years after childbirth. Even if absences are paid at full salary, they have a negative impact on the probability to be promoted. A reduction in working hours is the second mechanism able to explain the penalty. The reduction in working hours is due to the increase in part-time work, especially for mothers in non-managerial positions, during pre-school age of the child. The "missed bonuses" are able to explain a lower portion of the gap. However, we have seen that only mothers in the commercial divisions are largely penalized in terms of individual bonuses, likely because of lower response to firm's incentives.

3.8 Placebo tests

We run two types of placebo tests. In the first we randomly assign births to male and female employees in our control group of non-parents. In the second, we analyze the impact of medium-length sick leave on earnings and RL to understand which are the consequences of this type of leave as compared to maternity and family leaves.

3.8.1 Random births for the control group

In our first test we focus on our control group. Among them, we randomly assign a childbirth in our event time window 2007-2009. To do so we simply randomly assign a dummy variable and consider the employees who got 1 as "parents", the treated units, and those who got a 0 non-parents, the control units. Then, we replicate our event time study (estimation of Equation(3)) on this sample. Results on total earnings and RL are presented in Tables A3.12 and A3.13. As expected, results for women are not significant at any event time.

3.8.2 The impact of sick leaves

Our findings suggest that the main channel through which mothers get penalized after childbirth is an increases in the hours of absences that negatively impact their chances of promotions. To check if this mechanism is correct, in our second placebo test we focus on employees who experience a medium length period of sick leave, between one and three months, during the years 2007-2009. We then follow their main economic outcomes (earnings and RL) around this event. In this case, our control group is made up by the employees who in the reference period experienced less than one month of sick leave. We remember that we are controlling for time-invariant unobserved differences between the two groups.

Results of the estimation of Equation (3) on this sample are presented in Tables A3.14 and A3.15. Findings show a clear penalization for medium length sick leaves both for men and women, thus suggesting that the indirect mechanism of absences has relevant economic consequences within the firm.

3.9 Conclusions

Using a panel of personnel records from 2005 to 2016, we developed an event study with the use of a control group to capture the effects of becoming parent (extensive fertility margins) on the dynamic trajectories of earnings 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.

Two are the main mechanisms that stands behind the motherhood penalty: a reduction in working hours and an increase in absenteeism.

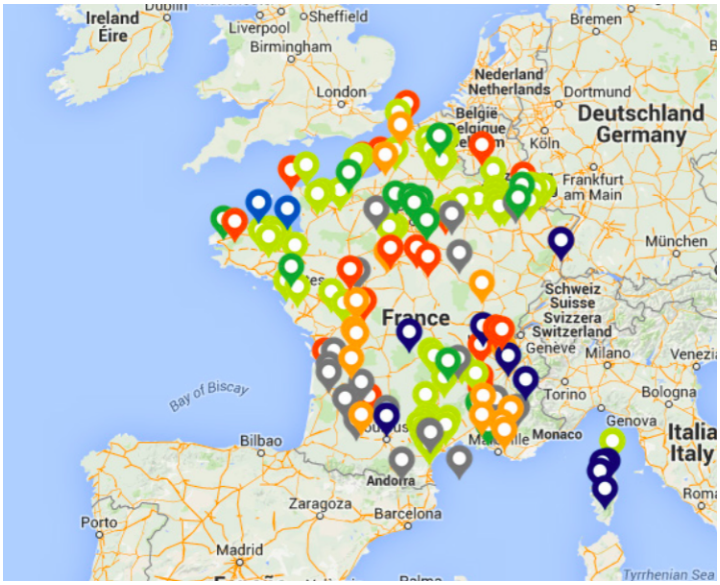
The reduction in working hours has a direct impact on earnings. However, by the time children start school, we observe a clear catch-up trend in hours that is not found in wages. The lower number of hours worked for mothers can be explained by a large increase in part-time working contracts after the birth of the child. This is likely due to mothers' lack of discretion in adjusting their working time. Indeed, we have shown that among managers, who have more flexible working schedules, mothers suffer lower penalization in terms of earnings and fully catch-up non mothers by the time the child enrolls school.

Absenteeism does not directly impact on earnings since, in our firm, the hours of absence are paid at full salary. However, they have two indirect consequences. First, they lead to a block in improvements within the wage ladder of the company. Second, they reduce individual bonuses. We find clear evidence of these two indirect mechanisms. 8 years after childbirth, mothers stand 5 levels back with respect to non-mothers in the firm's hierarchy. They also have lower chances to be promoted to managerial positions. The gap in individual bonuses reaches 30% and is particularly large in the commerce division, that more subject to productivity goals.

While family-friendly policies play a fundamental role in reconciling work and family, our results point out that the main explanation for having children for women stands in constrains 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 pre-school age of the child, is strong and persists even when a clear catching-up in hours is found. Productivity incentives, likely linked to long and particular working hours (Goldin, 2014), cannot be successfully pursued by women around the timing of first childbirth.

Appendix 3

Figure A3.1: **Map of plants**



Note: Each point in the Map indicates a different plant of the firm over the French territory

Table A3.1: **Summary statistics by gender**

	Men					Women				
	Mean	Std. Dev.	Min.	Max.	Obs	Mean	Std. Dev.	Min.	Max.	Obs
Parent	0.59	0.49	0.00	1.00	245778	0.65	0.48	0.00	1.00	117347
Children	1.14	1.14	0.00	12.00	245778	1.19	1.06	0.00	10.00	117347
Couple	0.64	0.48	0.00	1.00	245778	0.64	0.48	0.00	1.00	117347
Single	0.23	0.42	0.00	1.00	245778	0.22	0.41	0.00	1.00	117347
Prev married	0.03	0.16	0.00	1.00	245778	0.06	0.24	0.00	1.00	117347
Age	35.52	6.85	20.00	50.00	245778	35.84	6.44	20.00	50.00	117347
Less than Secondary	0.09	0.29	0.00	1.00	245778	0.09	0.28	0.00	1.00	117347
Secondary	0.58	0.49	0.00	1.00	245778	0.57	0.50	0.00	1.00	117347
University	0.32	0.47	0.00	1.00	245778	0.34	0.47	0.00	1.00	117347
RL	156.25	62.18	30.00	370.00	245778	153.55	65.26	30.00	370.00	117347
Tenure	10.89	8.06	0.00	29.99	245406	10.37	6.41	0.00	29.99	117178
Blue Collar	0.09	0.29	0.00	1.00	245778	0.15	0.36	0.00	1.00	117347
White Collar	0.52	0.50	0.00	1.00	245778	0.46	0.50	0.00	1.00	117347
Manager	0.39	0.49	0.00	1.00	245778	0.39	0.49	0.00	1.00	117347
Production	0.70	0.46	0.00	1.00	245778	0.37	0.48	0.00	1.00	117347
Commerce	0.13	0.34	0.00	1.00	245778	0.40	0.49	0.00	1.00	117347
Annual Working Hours	1461.39	54.72	680.00	1487.50	245778	1418.30	122.77	148.75	1487.50	117347
Annual Hours of Absences	286.90	171.31	-268.51	2591.00	217281	380.30	298.48	-203.00	2208.00	106562
Total Earnings	47947.61	18686.86	50.00	221241.23	245778	40622.14	17462.27	497.75	198157.50	117347
Occupation Pay	46068.82	16807.27	50.00	211444.12	245778	38862.94	15629.49	497.75	183957.50	117347
Bonuses	1878.86	2507.62	0.00	53543.88	245778	1759.43	2282.82	0.00	37604.00	117347

Table A3.2: **Estimation sample: descriptives**

	Fathers	Non Fathers	Mothers	Non Mothers
Age	35.46	31.35	35.07	32.71
	(5.40)	(6.77)	(5.55)	(6.83)
Age at Birth	32.11	.	30.87	.
	(4.66)	.	(4.75)	.
Couple	0.70	0.24	0.59	0.29
	(0.46)	(0.43)	(0.49)	(0.46)
Prev married	0.03	0.02	0.04	0.03
	(0.16)	(0.12)	(0.20)	(0.17)
Single	0.13	0.66	0.23	0.60
	(0.33)	(0.47)	(0.42)	(0.49)
Less than Secondary	0.08	0.07	0.04	0.06
	(0.27)	(0.25)	(0.19)	(0.25)
Secondary	0.63	0.57	0.75	0.50
	(0.48)	(0.49)	(0.43)	(0.50)
University	0.25	0.21	0.19	0.28
	(0.43)	(0.41)	(0.39)	(0.45)
Blue collar	0.12	0.12	0.21	0.15
	(0.33)	(0.33)	(0.40)	(0.35)
White collar	0.53	0.49	0.52	0.39
	(0.50)	(0.50)	(0.50)	(0.49)
Manager	0.35	0.38	0.28	0.46
	(0.48)	(0.49)	(0.45)	(0.50)
Tenure	11.53	7.38	10.51	7.61
	(5.16)	(10.01)	(4.82)	(6.02)
RL	151.04	144.82	140.26	152.44
	(61.71)	(58.76)	(63.17)	(62.60)
First RL	124.21	128.49	116.73	135.15
	(57.70)	(55.39)	(58.53)	(59.30)
Last RL	176.48	160.64	161.89	169.52
	(64.21)	(62.74)	(67.91)	(66.90)
Commerce	0.21	0.13	0.56	0.33
	(0.41)	(0.33)	(0.50)	(0.47)
Production	0.59	0.69	0.24	0.42
	(0.49)	(0.46)	(0.43)	(0.49)
Annual Working Hours	1454.44	1464.14	1420.33	1460.76
	(65.53)	(53.43)	(112.05)	(70.86)
Annual Hours of Absences	287.44	268.36	360.08	291.62
	(167.71)	(192.99)	(263.34)	(238.93)
Paternity/Maternity Leave	64.62	.	405.33	.
	(12.41)	.	(275.79)	.
Exit	0.03	0.02	0.05	0.02
	(0.16)	(0.13)	(0.21)	(0.16)
Obs	3963	64972	2965	26875

Figure A3.2: **Reasons for exit - mothers**

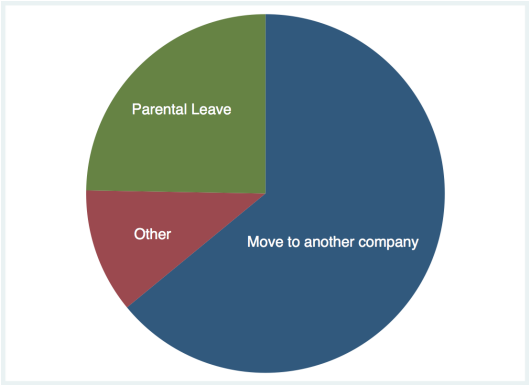
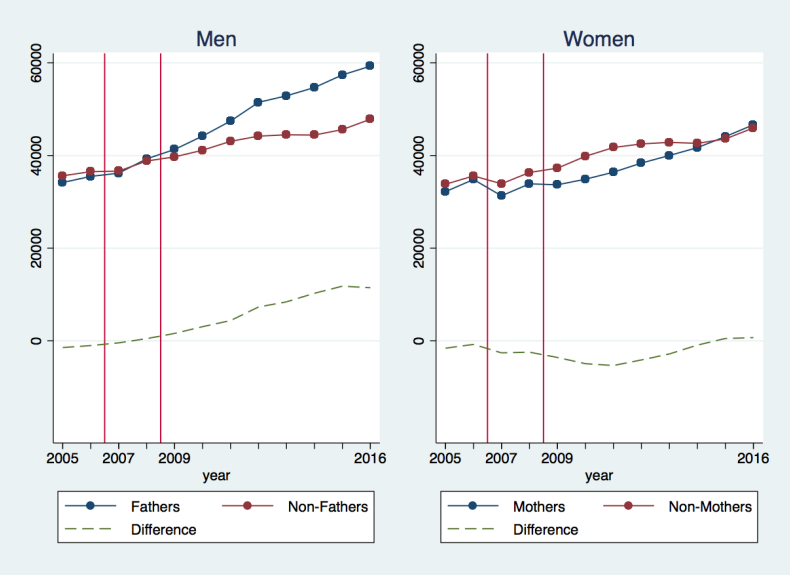


Table A3.3: **Descriptive statistics: fathers and mothers at the timing of exit**

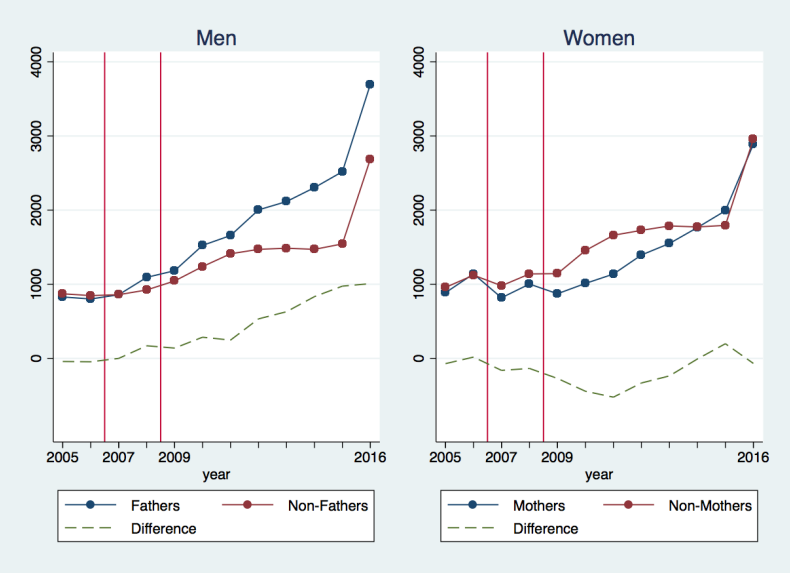
	(Fathers)	(Mothers)
Age	36.26	32.35
	(5.53)	(4.74)
Couple	0.78	0.66
	(0.42)	(0.48)
Prev married	0.02	0.02
	(0.15)	(0.15)
Single	0.06	0.11
	(0.25)	(0.32)
Less than Secondary	0.10	0.03
	(0.30)	(0.18)
Secondary	0.51	0.83
	(0.50)	(0.38)
University	0.30	0.11
	(0.46)	(0.32)
Blue-collar	0.14	0.47
	(0.35)	(0.50)
White-collar	0.44	0.38
	(0.50)	(0.49)
Manager	0.43	0.15
	(0.50)	(0.36)
Tenure	11.62	9.33
	(5.32)	(4.04)
RL	158.24	109.21
	(65.86)	(55.88)
First RL	134.41	89.38
	(63.50)	(54.84)
Last RL	158.24	109.21
	(65.86)	(55.88)
Commerce	0.44	0.84
	(0.50)	(0.37)
Production	0.20	0.04
	(0.40)	(0.21)
Annual working hours	1456.76	1365.73
	(47.63)	(170.23)
Annual hours of absences	269.23	481.66
	(109.76)	(354.15)
Paternity/Maternity leave (hours)	64.51	382.27
	(15.69)	(283.35)
Obs	94	89

Figure A3.3: **Average annual earnings**



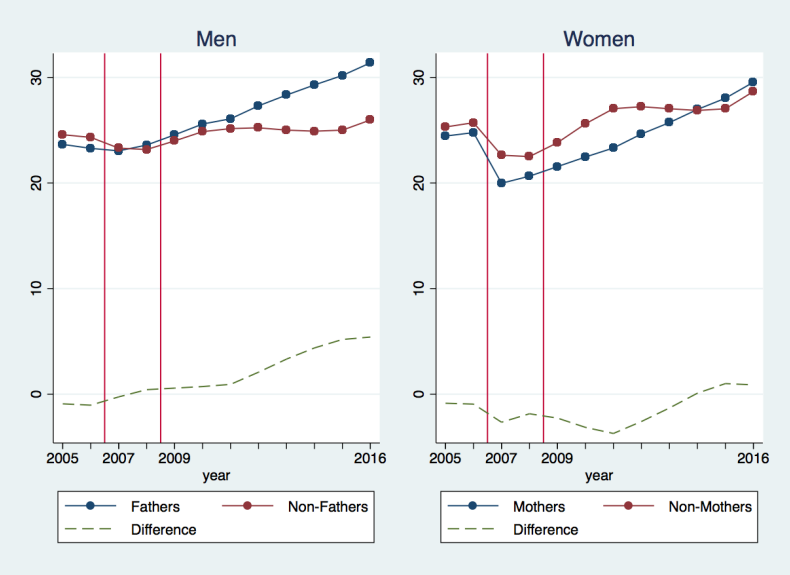
Note: The vertical lines delimit the window in which first childbirth is observed

Figure A3.4: **Average annual bonuses**



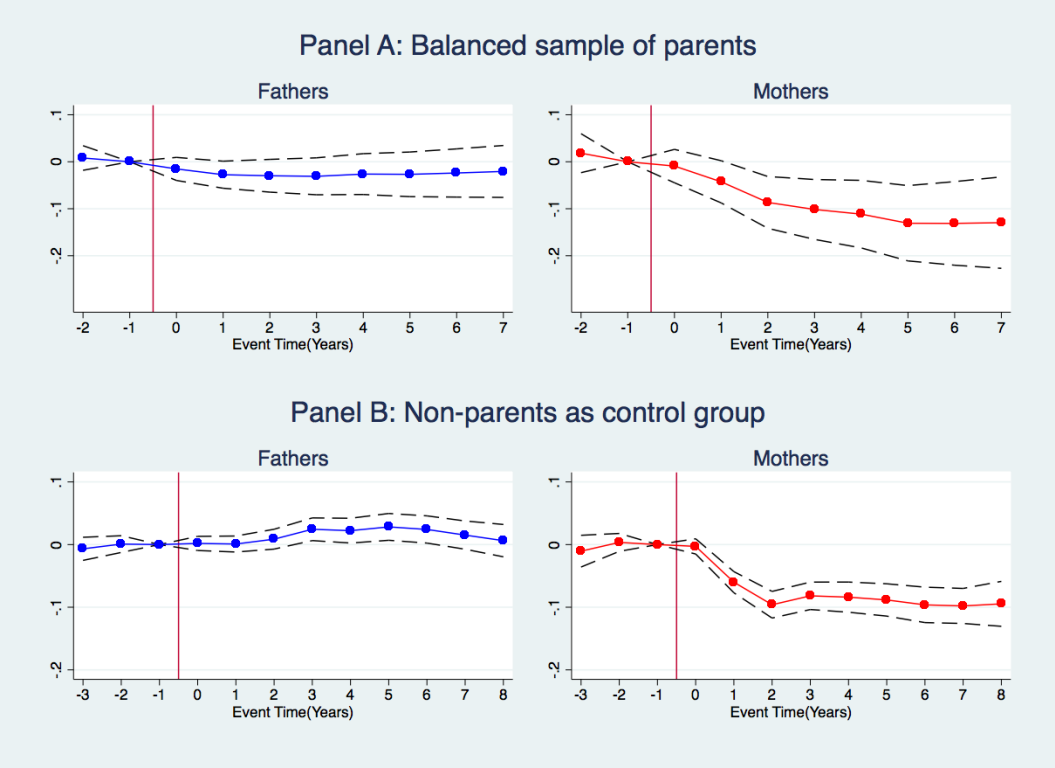
Note: The vertical lines delimit the window in which first childbirth is observed

Figure A3.5: **Average RL**



Note: The vertical lines delimit the window in which first childbirth is observed

Figure A3.6: **Total annual earnings by event time**



Note: The vertical lines indicate the timing of first childbirth. Panel A: each point represents the estimated coefficient γ_s from Equation (2) on the balanced sample of employees who turn into parenthood. Panel B: each point represents the estimated coefficient γ_s from Equation (3) on the sample that includes employees without children as control units. The dependent variable is the log of total annual earnings. 95% CI included.

Table A3.4: **Occupation pay and bonuses by event time**

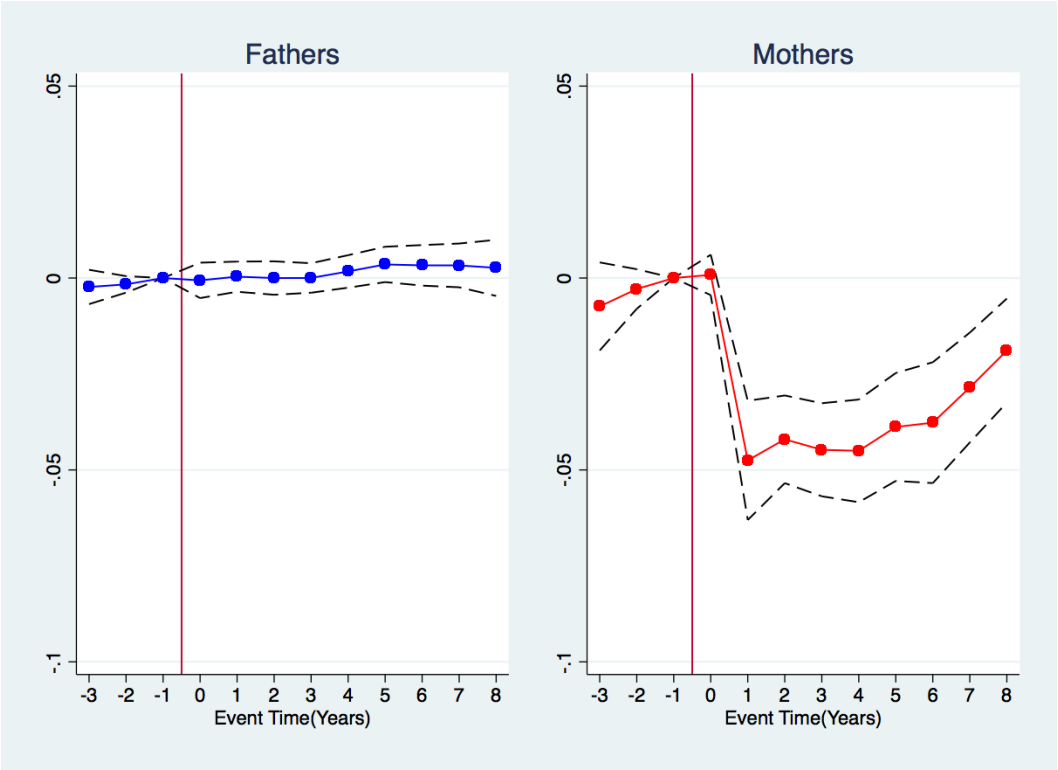
	(Fathers) Occupation Pay	(Fathers) Bonuses	(Mothers) Occupation Pay	(Mothers) Bonuses
-3 years	-0.007	0.055	-0.006	-0.110
	(0.01)	(0.08)	(0.01)	(0.09)
-2 years	0.001	-0.0001	0.005	0.003
	(0.01)	(0.06)	(0.01)	(0.06)
0	0.002	0.013	-0.001	-0.019
	(0.01)	(0.06)	(0.01)	(0.07)
+1 year	-0.0003	0.071	-0.056***	-0.081
	(0.01)	(0.06)	(0.01)	(0.07)
+2 years	0.009	0.025	-0.086***	-0.302***
	(0.01)	(0.06)	(0.01)	(0.08)
+3 years	0.024**	0.019	-0.071***	-0.283***
	(0.01)	(0.06)	(0.01)	(0.08)
+4 years	0.021*	0.033	-0.075***	-0.229**
	(0.01)	(0.06)	(0.01)	(0.08)
+5 years	0.028**	0.032	-0.078***	-0.303***
	(0.01)	(0.06)	(0.01)	(0.08)
+6 years	0.025*	0.021	-0.087***	-0.247**
	(0.01)	(0.06)	(0.01)	(0.08)
+7 years	0.017	0.013	-0.085***	-0.385***
	(0.01)	(0.07)	(0.01)	(0.08)
+8 years	0.009	-0.005	-0.081***	-0.287**
	(0.01)	(0.08)	(0.02)	(0.09)
Age cohorts	✓	✓	✓	✓
Individual fixed effects	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓
Obs	68591	53653	29653	21416

0: timing of first childbirth

Clustered standard errors at the individual level in parentheses

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

Figure A3.7: **Annual working hours by event time**



Note: The vertical lines indicate the timing of first childbirth. Each point represents the estimated coefficient γ_s from Equation (3) on the sample that includes employees without children as control units. The dependent variable is the log of total annual hours worked. 95% CI included.

Table A3.5: **Share of mothers by contractual working time after childbirth**

	Full time	80% full time	Part time
0	42.40	57.49	0.31
+1 year	40.48	53.52	5.54
+2 years	36.40	59.19	4.41
+3 years	36.59	59.06	4.35
+4 years	40.30	55.14	4.56
+5 years	44.09	51.97	3.94
+6 years	50.83	44.17	5.00
+7 years	55.79	39.49	4.72
+ 8 years	59.85	37.12	3.03

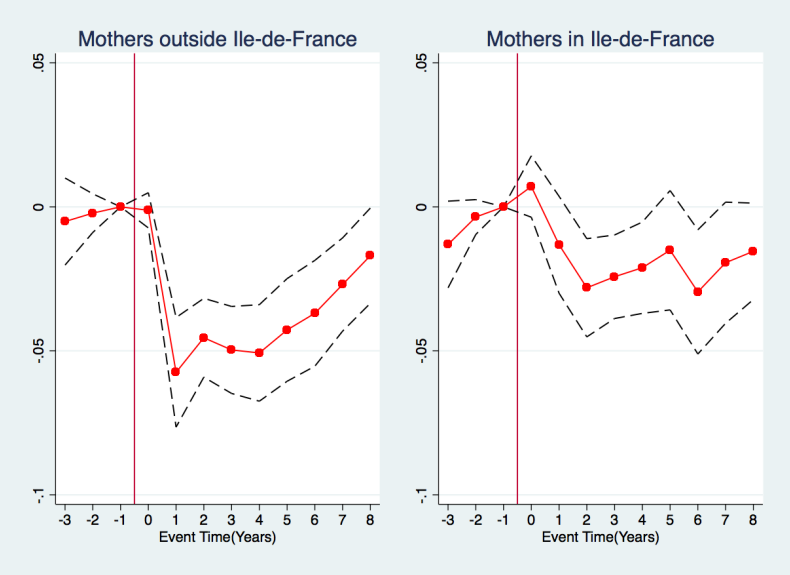
0: timing of first childbirth

Full time= 100% of working hours

80% full time= 80%-99% of working hours

Part time= 50% or less of working hours

Figure A3.8: **Annual working hours by place of residence**



Note: The vertical lines indicate the timing of first childbirth. Each point represents the estimated coefficient γ_s from Equation (3) on the sample that includes employees without children as control units. The dependent variable is the log of total annual hours worked. 95% CI included.

Table A3.6: **RL rank by event time**

	(Fathers)	(Mothers)
	RL	RL
-3 years	-0.985	-0.192
	(0.83)	(1.04)
-2 years	-0.968*	0.972
	(0.44)	(0.50)
0	0.120	0.305
	(0.38)	(0.45)
+1 year	0.398	-1.955***
	(0.45)	(0.52)
+2 years	0.346	-3.565***
	(0.52)	(0.59)
+3 years	0.956	-3.101***
	(0.65)	(0.71)
+4 years	1.128	-3.200***
	(0.72)	(0.78)
+5 years	1.710*	-3.597***
	(0.73)	(0.88)
+6 years	1.528	-3.732***
	(0.80)	(0.97)
+7 years	1.578	-4.709***
	(0.90)	(1.12)
+8 years	2.032	-5.372***
	(1.09)	(1.30)
Age cohorts	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	68846	29773

0: timing of first childbirth

Clustered standard errors at the individual level in parentheses

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

Table A3.7: **Probability to become manager by event time**

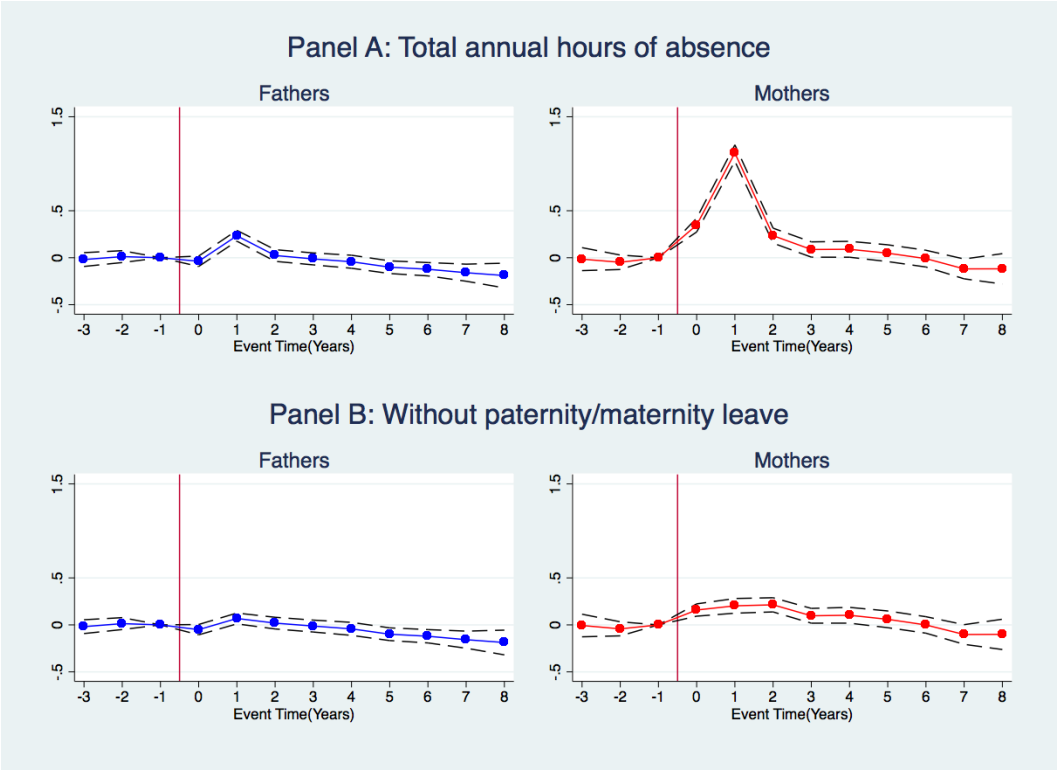
	(Fathers)	(Mothers)
	RL	RL
-3 years	0.012	-0.017
	(0.02)	(0.03)
-2 years	0.005	0.007
	(0.01)	(0.01)
0	0.007	-0.011
	(0.01)	(0.01)
+1 year	0.017	-0.022*
	(0.01)	(0.01)
+2 years	0.025	-0.039**
	(0.02)	(0.01)
+3 years	0.023	-0.044**
	(0.02)	(0.02)
+4 years	0.020	-0.044*
	(0.02)	(0.02)
+5 years	0.005	-0.051*
	(0.02)	(0.02)
+6 years	-0.004	-0.061**
	(0.02)	(0.02)
+7 years	-0.010	-0.073**
	(0.02)	(0.02)
+8 years	-0.046*	-0.088**
	(0.02)	(0.03)
Age cohorts	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	68846	29773

0: timing of first childbirth

Clustered standard errors at the individual level in parentheses

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

Figure A3.9: **Annual hours of absence by event time**



Note: The vertical lines indicate the timing of first childbirth. Panel A: each point represents the estimated coefficient γ_s from Equation (3) in a model with total annual hours of absences as dependent variable. Panel B: each point represents the estimated coefficient γ_s from Equation (3) in a model with annual hours of absences, without accounting for maternity/paternity leave, as dependent variable. In both cases, the sample included employees without children as control units. 95% CI included.

Table A3.8: **Total earnings by event time - Non-managers and managers**

	(Fathers) No Manager	(Fathers) Manager	(Mothers) No Manager	(Mothers) Manager
-3 years	-0.011	-0.002	-0.003	0.008
	(0.01)	(0.02)	(0.01)	(0.02)
-2 years	0.003	-0.009	0.002	0.013
	(0.01)	(0.01)	(0.01)	(0.01)
0	0.001	0.010	-0.004	-0.089
	(0.01)	(0.01)	(0.01)	(0.01)
+1 year	-0.009	0.031**	-0.070***	-0.026
	(0.01)	(0.01)	(0.01)	(0.01)
+2 years	0.001	0.031	-0.100***	-0.077**
	(0.01)	(0.02)	(0.01)	(0.02)
+3 years	0.018	0.030	-0.088***	-0.054**
	(0.01)	(0.02)	(0.01)	(0.02)
+4 years	0.019	0.024	-0.091***	-0.050*
	(0.01)	(0.02)	(0.01)	(0.02)
+5 years	0.018	0.048*	-0.089***	-0.051*
	(0.01)	(0.02)	(0.02)	(0.02)
+6 years	0.025	0.031	-0.100***	-0.041
	(0.01)	(0.02)	(0.02)	(0.02)
+7 years	0.009	0.031	-0.090***	-0.044
	(0.01)	(0.02)	(0.02)	(0.02)
+8 years	0.0072	0.010	-0.091***	-0.021
	(0.02)	(0.02)	(0.02)	(0.03)
Age cohorts	✓	✓	✓	✓
Individual fixed effects	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓
Obs	42522	26324	16587	13186

0: timing of first childbirth

Clustered standard errors at the individual level in parentheses

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

Table A3.9: **Share of bonuses by division**

	Men	Women
Total	0.012	0.016
Production	0.011	0.012
Commerce	0.019	0.021

Table A3.10: **Bonuses by event time - production and commerce divisions**

	(Fathers) Bonuses Prod	(Fathers) Bonuses Com	(Mothers) Bonuses Prod	(Mothers) Bonuses Com
-3 years	-0.035	0.0001	-0.273	-0.076
	(0.11)	(0.19)	(0.15)	(0.14)
-2 years	-0.0001	0.025	0.062	-0.033
	(0.09)	(0.12)	(0.15)	(0.10)
0	-0.032	0.079	0.005	-0.019
	(0.08)	(0.13)	(0.14)	(0.10)
+1 year	0.032	0.121	0.047	-0.085
	(0.07)	(0.14)	(0.13)	(0.12)
+2 years	-0.084	0.189	-0.253	-0.385*
	(0.08)	(0.14)	(0.15)	(0.15)
+3 years	-0.100	0.176	-0.282	-0.311**
	(0.07)	(0.14)	(0.15)	(0.12)
+4 years	-0.115	0.196	-0.092	-0.390**
	(0.07)	(0.15)	(0.14)	(0.13)
+5 years	-0.107	0.247	-0.196	-0.426***
	(0.07)	(0.15)	(0.14)	(0.11)
+6 years	-0.125	0.124	-0.175	-0.380***
	(0.07)	(0.17)	(0.15)	(0.11)
+7 years	-0.121	0.210	-0.122	-0.474***
	(0.07)	(0.21)	(0.14)	(0.11)
+8 years	-0.119	0.230	-0.028	-0.345*
	(0.09)	(0.19)	(0.17)	(0.14)
Age cohorts	✓	✓	✓	✓
Individual fixed effects	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓
Obs	37990	5574	9977	5602

0: timing of first childbirth

Clustered standard errors at the individual level in parentheses

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

Table A3.11: **Decomposition of the motherhood penalty**

Penalty	-0.118***
Explained	*-0.107****
RL	-0.059***
Annual Working Hours	-0.028***
Bonuses	-0.011***
Unexplained	*-0.011***

Errors clustered at individual level in parentheses

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

Additional controls include age, year and education dummies

These are results of a twofold decomposition that uses non mothers as norm.

Results are robust to a threefold decomposition:

penalty=-0.118^{***}; endowments=-0.107^{***}; coefficients=-0.029^{***}; interactions=$+0.018^{**}$

Table A3.12: **Random births - total annual earnings by "event time"**

	(1)	(2)
	Control Men	Control Women
-3 years	-0.002	-0.010
	(0.01)	(0.01)
-2 years	-0.002	-0.003
	(0.00)	(0.01)
0	0.006	0.00004
	(0.00)	(0.01)
+1 year	0.010	0.006
	(0.01)	(0.01)
+2 years	0.010	0.012
	(0.01)	(0.01)
+3 years	0.005	0.004
	(0.01)	(0.01)
+4 years	-0.002	-0.004
	(0.01)	(0.01)
+5 years	-0.014	-0.002
	(0.01)	(0.01)
+6 years	-0.025**	-0.005
	(0.01)	(0.01)
+7 years	-0.031***	-0.011
	(0.01)	(0.01)
+8 years	-0.038***	-0.014
	(0.01)	(0.01)
Age cohorts	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	64596	26760

0: timing of random assignment of childbirth

Clustered standard errors at the individual level in parentheses

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

Table A3.13: **Random births - RL by "event time"**

	(1)	(2)
	Control Men	Control Women
-3 years	-0.817	-0.268
	(0.72)	(1.02)
-2 years	-0.372	-0.058
	(0.30)	(0.43)
0	0.308	-0.181
	(0.28)	(0.42)
+1 year	1.108**	0.231
	(0.39)	(0.58)
+2 years	0.757	0.393
	(0.48)	(0.72)
+3 years	0.424	0.630
	(0.55)	(0.82)
+4 years	0.151	0.710
	(0.58)	(0.88)
+5 years	-0.201	0.340
	(0.61)	(0.93)
+6 years	-0.495	0.515
	(0.63)	(0.98)
+7 years	-0.433	-0.157
	(0.68)	(1.07)
+8 years	-0.809	-0.201
	(0.80)	(1.25)
Age cohorts	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	64596	26760

0: timing of random assignment of childbirth

Clustered standard errors at the individual level in parentheses

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

Table A3.14: **Sick leave and total annual earnings by event time**

	(1)	(2)
	Men	Women
-3 years	0.001	-0.001
	(0.01)	(0.01)
-2 years	0.002	0.005
	(0.00)	(0.01)
0	-0.009**	0.029***
	(0.00)	(0.00)
+1 year	-0.016***	0.006
	(0.00)	(0.01)
+2 years	-0.026***	-0.010
	(0.00)	(0.01)
+3 years	-0.027***	-0.021***
	(0.00)	(0.01)
+4 years	-0.033***	-0.035***
	(0.01)	(0.01)
+5 years	-0.035***	-0.047***
	(0.01)	(0.01)
+6 years	-0.042***	-0.062***
	(0.01)	(0.01)
+7 years	-0.049***	-0.079***
	(0.01)	(0.01)
+8 years	-0.051***	-0.064***
	(0.01)	(0.01)
Age cohorts	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	216119	96199

0: timing of medium-length (1-3 months) sick leave period

Clustered standard errors at the individual level in parentheses

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

Table A3.15: **Sick leave and RL by event time**

	(1)	(2)
	Men	Women
-3 years	1.396**	1.324
	(0.43)	(0.81)
-2 years	1.110***	1.287***
	(0.28)	(0.37)
0	0.554*	1.600***
	(0.22)	(0.26)
+1 year	-0.713**	0.602*
	(0.25)	(0.30)
+2 years	-1.661***	-0.308
	(0.28)	(0.34)
+3 years	-2.434***	-1.527***
	(0.29)	(0.36)
+4 years	-2.810***	-1.967***
	(0.31)	(0.38)
+5 years	-3.358***	-2.797***
	(0.33)	(0.39)
+6 years	-3.714***	-3.779***
	(0.35)	(0.41)
+7 years	-4.634***	-5.363***
	(0.40)	(0.45)
+8 years	-5.091***	-5.584***
	(0.48)	(0.53)
Age cohorts	✓	✓
Individual fixed effects	✓	✓
Time fixed effects	✓	✓
Obs	216119	96199

0: timing of medium-length (1-3 months) sick leave period

Clustered standard errors at the individual level in parentheses

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

General conclusions

Using a unique 12-years panel of personnel records from a large company in France, this work investigated the economic consequences of childbirth along the intensive and extensive fertility margins. The literature on the child effect along the intensive margins is well established, but mostly descriptive, with few works addressing causality of the child effects. This issue was explored in Chapter 2, dedicated to the estimation of the causal impact of having a third child among employees with two children. Instead, research on the labor market effects of having children is less developed and lacks of studies on company data with specific measures of adjustments individual behavior at the workplace. This topic was developed in Chapter 3, in which an event study approach was used to follow the trajectories of earnings and careers of new parents around the timing of first childbirth. Results show that the labor market effect of having a child is negative and large for women, null for men. More importantly, the penalty for becoming a mother is long-lasting: 8 years after the birth of the first child women in the firm are earning around 9% less than comparable childless female employees. This penalization is larger than the reduction in total pay estimated along the intensive fertility margins. Having a third child has a negative causal effect on earnings of around 3% among women with two dependent children. Again, no significant effect is found for fathers. These results are in line with previous findings in this field (Lundborg et al., 2017).

The main message of this work is that a family friendly institutional context, mainly based on generous leave policies, is not enough to sustain mothers after childbirth. A key solution stands in the definition of a working environment effectively supportive of mothers' productivity. Indeed, results suggest that the penalty for having a child is long-lasting not because mothers persistently

change their working attitude. In this sense, they fully catch-up non-mothers in hours supplied and absenteeism behavior by the time the child is enrolled in school. What stands behind is that they are probably expected to be less productive. They face slower career improvements and get lower individual premiums even when they come back to work full-time and take the same time-off from work than non-mothers. Future research should address this point by rigorously looking at the role of stereotypes in explaining the persistence of penalties for mothers in the labor market.

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