The Motherhood Training Penalty*

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Abstract

Women experience slower wage growth than men over their lifetimes, a gap often attributed to the "motherhood wage penalty," as childbearing reduces lifetime earnings. This paper connects this penalty to differences in on-the-job human capital acquisition using a pseudo-event study of first childbirth in Europe to document a "motherhood training penalty." Before becoming parents, full-time male and female workers exhibit similar on-the-job training trends, but their trajectories diverge significantly afterward. In the first 1–3 years of parenthood, women are 17%–22% less likely to participate in training, compared to a 3%–8% decline for men. Additional evidence suggests this gap is not due to mothers opting out of training, but rather to employers being less willing to finance it for them.

Keywords: On-the-Job Training, Human Capital Accumulation, Lifecycle Wage Growth, Gender Gaps

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1 Introduction

A well-documented feature of labor markets worldwide is that women earn significantly less per hour on average than men and experience slower wage growth over their lifetimes (Altonji and Blank (1999); Blau and Kahn (2017)). Extensive research has explored the causes of this disparity, with several studies identifying childbearing as a key driver of the lifecycle gender wage gap — often referred to as the "motherhood wage penalty" (Waldfogel (1998); Lundberg and Rose (2000); Budig and England (2001); Anderson et al. (2002); Bertrand et al. (2010); Goldin (2014); Adda et al. (2017); Kleven et al. (2019); Kleven (2022b); Gallen (2023)). Various explanations have been proposed for this motherhood penalty,[1] but direct empirical evidence remains limited, particularly for one widely-cited factor: differences in human capital accumulation between mothers and non-mothers.

In this paper, we establish a direct link between the motherhood wage penalty and on-the-job human capital formation by focusing on on-the-job training, a key input to workers' human capital. We use rich cross-sectional data covering over 40 million people across all European Union (EU) countries and adopt the pseudo-event study approach developed by Kleven (2022a), which uses matching techniques to estimate child penalties from cross-sectional data. Our analysis reveals a "motherhood training penalty": while men and women exhibit similar on-the-job training trends before parenthood, their trajectories diverge significantly in the years that follow. Given the well-documented link between on-the-job training and wage growth (see Heckman et al., 1999; Kluve, 2010; McKenzie, 2017; Card et al., 2018; What Works - Centre for Local Economic Growth, 2016, for reviews), this training gap is an important driver of the motherhood wage penalty over the lifecycle.

We begin by describing our data, sample of interest, and definition of on-the-job training, which captures on-the-job learning activities that occur outside the formal education system and includes key sources of human capital acquisition such as participation in courses, seminars, or conferences. Next, we outline the pseudo-event study methodology developed by Kleven (2022a) to study child penalties using cross-sectional data. In a nutshell, this approach employs matching techniques to construct a pseudo-panel of men and women. Specifically, parents are matched to non-parents based on relevant observable characteristics, creating surrogate observations that approximate parents' characteristics at various event times relative to their first child's birth. The event study then builds on this pseudo-

[1] These explanations include human capital losses during career breaks, self-selection into lower-paying occupations, reduced work effort, employer discrimination, differences in job search behavior, and selection into motherhood itself (see Gough and Noonan (2013); Cukrowska-Torzexska and Matysiak (2020) for reviews).

panel and incorporates age, year, education, and country fixed effects to account for lifecycle patterns, time trends, and country-specific factors.

Using this pseudo-panel approach, we document a sizeable "motherhood training penalty": while men and women exhibit similar on-the-job training trends before parenthood, women are 17% to 22% less likely to engage in training in the 1 to 3 years following childbirth, whereas men are only 3% to 8% less likely to do so. This training gap disappears 4 years after birth.[2] A back-of-the-envelope calculation suggests that, given the sizeable wage returns of on-the-job training,[3] the motherhood training penalty results in a cumulative wage growth loss of 1.24 percentage points over the first three years of motherhood. This suggests that the motherhood training penalty can account for 29.3% of the overall motherhood wage penalty, which has been estimated at around 4% in various settings (Cukrowska-Torzexska and Matysiak, 2020).

We then use additional EU data on workers' desire to participate in on-the-job training and how this training was financed to assess whether mothers actively choose to engage in less training, or whether other factors drive the observed patterns. We highlight two key findings. First, among both participants and non-participants in on-the-job training, mothers are more likely than fathers to express a desire to participate, with the gap being especially pronounced among non-participants. Second, mothers are significantly more likely than fathers to self-finance their training, while employers are considerably less likely to do so. Taken together, these results suggest that the motherhood training penalty is not driven by mothers' choices but by employer decisions. This aligns with the well-known hold-up problem (Acemoglu (1997), Acemoglu and Pischke (1998), Moen and Rosén (2004)), where firms, when making training decisions, anticipate a high likelihood of mothers leaving their jobs — a pattern consistent with the substantial and persistent child penalties in employment (Kleven et al., 2019; Kleven, 2022b; Kleven et al., 2024). Through this mechanism, child penalties in employment contribute to the motherhood training penalty, suppressing wage growth even for mothers who remain in the workforce.[4]

Our paper combines insights from three different bodies of literature. First, we build on the extensive literature on gender inequality in the labor market, particularly studies examining

[2]We further validate our pseudo-panel approach by showing that it also yields parallel employment and hours worked trends prior to childbirth for both men and women.

[3]For example, Frazis and Loewenstein (2005) find that 60 hours of formal training lead to a 3%–5% increase in wages. Similarly, Ma et al. (2024) conduct a comprehensive review of the literature examining the returns to job-related on-the-job training across various settings, and document average wage gains of 5% from typical training programs.

[4]Moreover, the hold-up problem also helps explain why the motherhood training penalty diminishes over time: after several years in the workforce, mothers are less likely to leave, reducing employers' concerns.

the role of parenthood in explaining gender wage growth gaps. This includes work by Waldfogel (1998), Lundberg and Rose (2000), Budig and England (2001), Anderson et al. (2002), Bertrand et al. (2010), Wilde et al. (2010), Fernandez-Kranz et al. (2013), Goldin (2014), Angelov et al. (2016), Erosa et al. (2016), Adda et al. (2017), Kleven et al. (2019), Kleven (2022b), and Gallen (2023), among others, across a variety of contexts and settings. Our paper is especially connected to research that emphasizes the role of human capital in driving the gender wage growth gap (see Gough and Noonan (2013) and Cukrowska-Torzexska and Matysiak (2020) for a review). While much of this literature focuses on the loss of mothers' human capital during child-related career breaks, we focus on the loss of human capital that occurs even when mothers remain in the labor force, driven by reductions in on-the-job training opportunities.

Second, our paper contributes to the labor literature examining the impacts of on-the-job learning opportunities on workers' earnings and employment. Numerous studies have documented the effects of on-the-job training, particularly firm-sponsored training, on worker outcomes across various contexts (see Heckman et al. (1999), Kluve (2010), Card et al. (2018), McKenzie (2017), and What Works - Centre for Local Economic Growth (2016) for general reviews on the impacts of on-the-job training, and Haelermans and Borghans (2012) and Bassanini et al. (2007) for reviews on firm-sponsored training specifically). These studies consistently show that job-related, in-firm training has large and significant effects on the human capital acquisition and wages of both men and women. These findings suggest that the motherhood training penalty we document in this paper may help explain the broader motherhood wage penalty.

Finally, our paper relates to the literature on gender gaps in training across different countries and contexts (Gronau (1988), Altonji and Spletzer (1991), Royalty (1996), Altonji and Blank (1999), Barron et al. (1993), Hamil-Luker (2005), Blau and Kahn (2017), Blundell et al. (2021)). Some studies find that women receive less training than men, though the evidence is mixed.[5] A few studies suggest that the training gap may contribute to the gender wage gap by limiting women's career advancement opportunities, and that this gap may be partially driven by motherhood. For instance, Blau and Kahn (2017) propose that one reason for the gender gap in training is that women are more likely than men to take time off work for childcare, which may reduce their availability for training. Additionally, Booth (1991) and Booth (1993) find that childbearing reduced the likelihood of women receiving training in the 1980s. However, this evidence is primarily correlational and based on older data, reflecting a time when the work landscape for women was quite different. In contrast, we provide

[5]In Appendix A, we provide a comprehensive summary of this literature.

direct evidence using modern methods that the gender training gap is specifically driven by motherhood and arises not from mothers' choices, but from employers' decisions.

The paper is organized as follows. Section 2 introduces our data and sample of interest, and provides a precise harmonized definition of on-the-job training. Section 3 outlines the pseudo-event study methodology and explains how it is implemented in our setting. Section 4 presents the results of our analysis. Finally, Section 5 concludes.

2 Data, sample, and definition of on-the-job training

In this section, we describe our data and sample of interest, and provide a precise definition of on-the-job training as it pertains to our study.

2.1 Data description

Our main data comes from the EU Labor Force Survey (EU-LFS), a large-scale household survey that provides information on labor force participation, job characteristics, socioeconomic traits, family structure, training, and more, for individuals aged 15 and above. The survey is conducted quarterly in all EU member countries, as well as in Norway, Iceland, and Switzerland, covering millions of people across all industries and occupations in each wave. While data collection began in 1983 or 1992 for most countries, our analysis uses data from 2006 to 2021 due to data constraints. Further details on this data and the relevant variables are provided in Appendix B.1. We present summary statistics of this data by gender and parenthood status in Table B.1. Table B.2 lists the years of data availability and the number of observations for each country.

A secondary data source we use is the EU Adult Education Survey (EU-AES), which collects information on participation in and financing of education and learning activities, including job-related training. The survey covers approximately 666,000 adults aged 25-64 and was conducted in 2007, 2011, and 2016 across 26, 27, and 28 EU member states, respectively. For our analysis, we focus on the 2011 and 2016 waves, since the 2007 wave was a pilot with significantly different training definitions. Further details on this data and the relevant variables are provided in Appendix B.2. Summary statistics are presented in Table B.3.

2.2 Definition of on-the-job training

We define on-the-job training based on the ISCED (2011) definition of "Non-formal Education and Training." Specifically, our definition focuses on training activities that are separate

from the active workplace and show a high degree of organization by a trainer or institution, such as classroom work, seminars, and workshops, among others.[6]

Our definition of training has two main features. First, it distinguishes training from schooling, meaning that programs such as MBAs, which may contribute to human capital for some workers, are not included. Second, training activities must have a certain level of organization and structure, which distinguishes training from learning-by-doing and informal training activities, such as job rotation, reading journals, visiting museums, or learning through media in an unstructured or unplanned manner.

In our main EU-LFS data, training refers to participation in certain activities, such as courses, seminars, workshops, or private lessons outside the regular education system, within the last 4 weeks. The EU-AES training definition is similar, encompassing participation in courses, seminars, workshops, guided training, or private lessons over the past 12 months. For more details on the definitions of training in each data source, please refer to Appendix B.1 and Appendix B.2.

2.3 Sample of interest

Given our focus on the impact of parenthood, we first restrict our sample of parents to individuals whose age at first birth falls between 25 and 45. To control for the extensive and intensive labor market adjustments following parenthood, we further limit our sample to full-time workers, excluding those who work fewer than 40 hours per week. This allows us to examine the effects of parenthood on training for men and women who remain employed full-time.[7]

3 Pseudo-event study methodology

Child penalties have traditionally been estimated using event studies that rely on high-frequency, long-running panel data. However, since such data is relatively rare and does not usually include on-the-job training information, we follow the pseudo-event study methodology developed by Kleven (2022b) and further detailed in Kleven et al. (2024).[8] This

[6]The International Standard Classification of Education (ISCED) provides standardized definitions to facilitate the comparison of education systems across countries.

[7]However, in Figure C.2, we also present the impact of parenthood on on-the-job training when the sample is not restricted to full-time employed individuals.

[8]For example, the German Socioeconomic Panel (G-SOEP) does not include on-the-job training data, while the US Panel Study of Income Dynamics (PSID) contains on-the-job training information only for the period 1968–1972.

approach allows for the estimation of child penalties using cross-sectional data by employing matching techniques. In this section, we first describe how the event-time pseudo panel is constructed and then explain how it is used for the event study and the quantification of child penalties.

3.1 Construction of pseudo-panel

The pseudo-panel approach converts cross-sectional data into a pseudo-panel of men and women to study their outcomes around the birth of their first child, indexed at event time $t = 0$. Specifically, this approach allocates individuals to specific event times t relative to the first child's birth, where $t = \{-T^-, -T^- + 1, \ldots, -1, 0, 1, \ldots, T^+ - 1, T^+\}$, indicating that t spans T^- periods prior to and T^+ periods after the first child's birth. For parents, event time t is weakly positive ($t \geq 0$) and can be easily calculated using the age of their oldest child. Since we cannot directly allocate individuals to negative event times ($t < 0$), as this would involve assigning event times to childless individuals for whom we do not know when or if they will have children, this method creates surrogate observations for individuals at negative event times by matching on observable characteristics. To fix ideas, and following the example given by Kleven et al. (2024), consider a parent i of age a and demographic characteristics X_i observed at event time $t \geq 0$ in calendar year y. To generate a matching observation at event time $t = -n$, parent i is matched to a childless individual j observed in year $y - t - n$, with age $a - t - n$ and the same demographic characteristics X_i. [9] This process is repeated for every parent at each $t \geq 0$ and for every $n \in \{T^-, \ldots, -1\}$, yielding a pseudo-panel that captures T^- years of pre-child event times.

The set of demographic variables used in the matching procedure includes those employed by Kleven et al. (2024) to study child penalties in employment—namely gender, education, marital status, urban/rural status, and country—along with occupation, given our focus on on-the-job training and the fact that much of this is informed by occupation. Further details on our matching variables and the categories used are provided in Appendix B.1.2.

To provide information about the matching procedure, Table 1 presents summary statistics for men and women matched at event times $t = 0$ and $t = -1$ in the pseudo-panel. By construction, these samples match exactly on education, marital status, urban/rural status, and occupation. Additionally, individuals at $t = -1$ are exactly one year younger than those at $t = 0$, and since we restrict our sample to full-time workers, both samples consist of individuals employed and working 40 or more hours per week. However, these samples do

[9] Similar to Kleven et al. (2024), since a parent can have multiple matches at each negative event time, we create an average of all matches to use as the matched observation.

not match on other labor market outcomes, particularly on-the-job training status. Some of these differences reflect the effect of parenthood, which is the focus of our analysis, while others stem from the fact that the sample at $t = 0$ is observed one calendar year later and is one year older. The specification below isolates the child penalty component by including age, year, education level, and country fixed effects.[10]

Table 1: Descriptive Statistics in the Pseudo-Panel

	Matched Men			Matched Women		
	$\tau = 0$	$\tau = -1$	**Difference**	$\tau = 0$	$\tau = -1$	**Difference**
Fraction engaging in on-the-job training	0.08	0.08	-0.01	0.08	0.12	-0.04
Fraction employed	1.00	1.00	0.00	1.00	1.00	0.00
Mean hours per week usually worked in main job	43.72	43.49	0.23	42.18	42.39	-0.22
Mean hours actually worked in main job in reference week	44.42	44.27	0.15	42.88	43.07	-0.19
Mean age	33.31	32.31	1.00	32.93	31.93	1.00
Fraction married	0.93	0.93	0.00	0.95	0.95	0.00
Fraction urban	0.73	0.73	0.00	0.79	0.79	0.00
Fraction w/ less than primary education	0.00	0.00	0.00	0.00	0.00	0.00
Fraction w/ primary education	0.01	0.01	0.00	0.01	0.01	0.00
Fraction w/ lower-secondary education	0.14	0.14	0.00	0.11	0.11	0.00
Fraction w/ upper-secondary education	0.50	0.50	0.00	0.32	0.32	0.00
Fraction w/ post-secondary education	0.34	0.34	0.00	0.56	0.56	0.00
Fraction managers	0.07	0.07	0.00	0.06	0.06	0.00
Fraction professionals	0.19	0.19	0.00	0.31	0.31	0.00
Fraction technicians and associate professionals	0.13	0.13	0.00	0.12	0.12	0.00
Fraction clerical support workers	0.04	0.04	0.00	0.13	0.13	0.00
Fraction service and sales workers	0.12	0.12	0.00	0.27	0.27	0.00
Fraction skilled agricultural, forestry and fishery workers	0.03	0.03	0.00	0.01	0.01	0.00
Fraction craft and related trades workers	0.22	0.22	0.00	0.02	0.02	0.00
Fraction plant and machine operators and assemblers	0.12	0.12	0.00	0.02	0.02	0.00
Fraction elementary occupations	0.06	0.06	0.00	0.05	0.05	0.00
Number of Observations	34,580	34,580		5,347	5,347	

3.2 Pseudo event-study specification

Using the pseudo-panel data, we estimate the following specification for men and women, respectively:

$$Y_{it}^{g} = \sum_{t=-T^{-}}^{T^{+}} \alpha_t^g D_{it}^{Event} + \sum_{t=-T^{-}}^{T^{+}} \beta_t^g D_{it}^{Age} + \sum_{t=-T^{-}}^{T^{+}} \gamma_t^g D_{it}^{Year} + \sum_{t=-T^{-}}^{T^{+}} \psi_t^g D_{it}^{Educ} + \sum_{t=-T^{-}}^{T^{+}} \phi_t^g D_{it}^{Country} + \upsilon_{it}^{g} \quad (1)$$

where Y_{it}^{g} is the outcome variable (on-the-job training in our case) for individual i of gender $g = w, m$ at event time t, where $t = -T^{-}, -T^{-}+1, \ldots, -1, 0, 1, \ldots, T^{+}-1, T^{+}$. To focus

[10] We further validate the pseudo-panel approach by exactly following the method of Kleven et al. (2024) and showing in Figure C.1 that it yields parallel employment and hours worked trends prior to parenthood for both men and women. These figures also replicate the significant and enduring child penalties in employment borne by women, as documented in Kleven et al. (2019); Kleven (2022b); Kleven et al. (2024).

specifically on the period around the first child's birth and given the significant lifecycle effects of on-the-job training (Ma et al., 2023), we set $T^- = 3$ and $T^+ = 5$. The set of dummies for each event time is captured by D_{it}^{Event} (with the base event time corresponding to the year before childbirth, $t = -1$), and the coefficients α_t^g measure the impact of event time t on the outcome of interest for gender g, relative to the base year. The dummies D_{it}^{Age}, D_{it}^{Year}, D_{it}^{Educ}, and $D_{it}^{Country}$ control for age, year, education level, and country-specific effects, respectively.[11]

The estimated level effects are then converted into percentage effects by calculating:

$$P_t^g = \frac{\hat{\alpha}_t^g}{\mathbb{E}\left[\tilde{Y}_{it}^g | t\right]}, \tag{2}$$

where P_t^g captures the percentage child penalty effect at event time t, $\hat{\alpha}t^g$ is the estimated coefficient αt^g from the regression above, and $\mathbb{E}\left[\tilde{Y}_{it}^g | t\right]$ represents the predicted outcome from Equation (1) absent the event-time child penalty effects.

4 Results

We now present our results. First, we report the findings from our pseudo-event study, documenting the existence of a motherhood training penalty using the EU-LFS. Next, we explore the drivers of this penalty, using the EU-AES dataset.

4.1 Documenting the motherhood training penalty

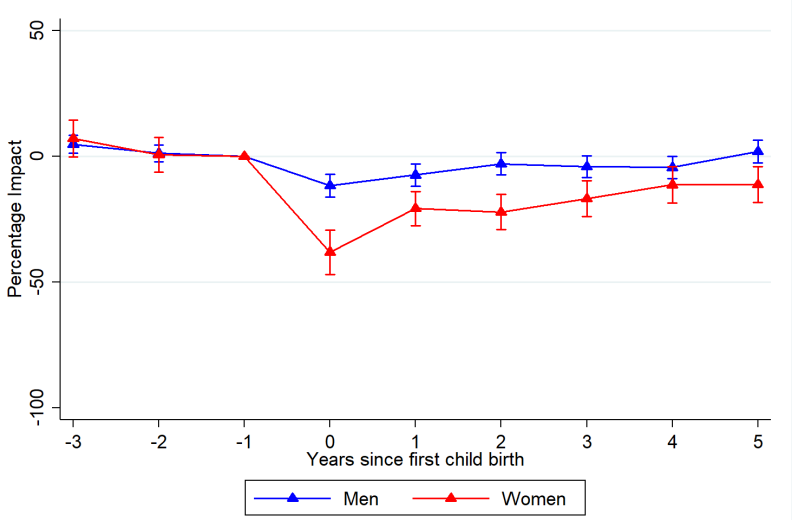
We present the results of our pseudo-event study estimating the impact of first childbirth on men's and women's participation in on-the-job training activities in Europe in Figure 1. This figure shows that men and women have similar on-the-job training trends before parenthood, but diverge significantly in the years following childbirth, suggesting the existence of a "motherhood training penalty."

Unsurprisingly, the largest effect for both men and women, as well as the largest gap between the two, occurs at event time 0, the year the first child is born. This likely stems from postnatal parental leave, which keeps parents, especially breastfeeding mothers, away from the

[11] Although occupation is used as a matching variable to ensure that comparisons are made between parents and non-parents with similar jobs, we exclude occupation fixed effects from our baseline specification. This is because occupational shifts may occur after childbirth, and controlling for occupation could introduce post-treatment bias. However, in Figure C.3, we show that our results remain remarkably similar when occupation fixed effects are included.

office and unable to engage in on-the-job training. However, although parenthood continues to reduce both men's and women's participation in on-the-job training in the years following their first child's birth, this reduction remains much more pronounced among women. Specifically, women are 17%–22% less likely to engage in on-the-job training during the 1–3 years after becoming mothers, while men are only 3%–8% less likely to do so. The training penalty for both men and women, as well as the gap between the two, largely disappears 4 years after the first birth.[12]

Figure 1: Impact of first child birth on the participation of men and women on on-the-job training activities (EU-LFS)



Notes: This figure presents pseudo-event studies of the impact of first child birth on the participation of men and women on on-the-job training activities using pooled data from all countries in the EU-LFS following the sample refinements described in Section 2.3, and the specification in Equation (1). The series depict the percentage impact of child birth (P_t^m and P_t^w in Equation (2)) at each event time t relative to the base event time corresponding to the year before child birth, $t = -1$. The error bars depict 95% confidence intervals based on robust standard errors.

Given the significant wage returns to on-the-job training documented in various settings, this motherhood training penalty can help explain the broader motherhood wage penalty. To illustrate this, we conduct a back-of-the-envelope calculation to assess the predicted impact of the documented motherhood training penalty on wages. For this calculation, we draw on the results of Ma et al. (2024), who provide a comprehensive review of the literature on the returns to job-related on-the-job training across different contexts, documenting average wage gains of 5% from typical training programs. Our results suggest that women are, on average, 20% less likely to engage in on-the-job training in the 1–3 years following

[12]In Figure C.2, we extend the analysis to include all individuals and all employed individuals regardless of hours worked, rather than restricting to full-time workers. In both cases, the motherhood training penalty is larger than in the full-time sample, as many women reduce their work hours or leave the labor force after becoming mothers.

motherhood. Meanwhile, 40% of childless workers typically engage in on-the-job training annually, as indicated by the summary statistics in Table B.3. Using these figures, we estimate aggregate wage growth losses of 0.4 percentage points per year for mothers during this period, which amounts to a cumulative loss of 1.24 percentage points in wage growth over three years. This suggests that the motherhood training penalty can account for 29.3% of the overall motherhood wage penalty, which has been estimated at around 4% on average (Cukrowska-Torzexska and Matysiak, 2020).[13]

4.2 Drivers of the motherhood training penalty

We now investigate the underlying drivers of the motherhood training penalty. Previous research has found that motherhood affects employment status, hours worked, and occupational choices, which may potentially explain the decrease in training. However, by focusing on full-time employees and demonstrating that our results are robust to the inclusion of occupation fixed effects (see Figure C.3), we can rule out these explanations. Using data from the EU-AES, we explore alternative drivers of the motherhood training penalty, such as mothers' and fathers' desire to participate in on-the-job training and how this training is financed.[14] This allows us to assess whether mothers actively choose to engage in less training or whether other factors—such as employer decisions or the compatibility of available training opportunities with the demands of motherhood—drive the observed patterns.

First, in Figure 2, we categorize employed mothers and fathers based on whether they participated in on-the-job training in the past 12 months and whether they desired training in each case. We find that, among both participants and non-participants, mothers are more likely than fathers to report wanting to participate in training, with the gap being especially pronounced among non-participants.[15]

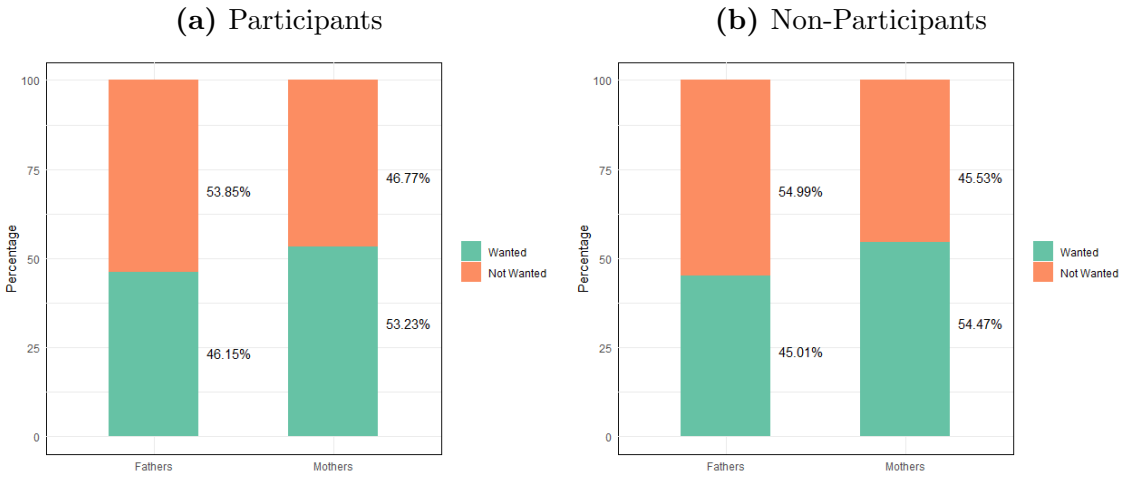
In Figure 3, we focus on employed mothers and fathers who participated in on-the-job training in the past 12 months and examine how their training was financed. We find that mothers are significantly more likely than fathers to self-finance their training. While

[13]Furthermore, given the link between job-related on-the-job training and productivity documented by several studies (see Ma et al. (2024) for a review), the motherhood training penalty we document can also help explain the recent findings of Gallen (2023), who reports a sizable productivity gap between mothers and their counterparts.

[14]Full definitions of these variables are provided in Appendix B.2.1.

[15]In Figure D.1, we further show that the composition of training types is similar for mothers and fathers among participants. This suggests that the motherhood training penalty is not driven by certain training formats being incompatible with the demands of motherhood. Among participants, mothers are just as likely as fathers to engage in "inflexible" training types, such as courses and seminars, as well as more flexible formats like guided on-the-job learning.

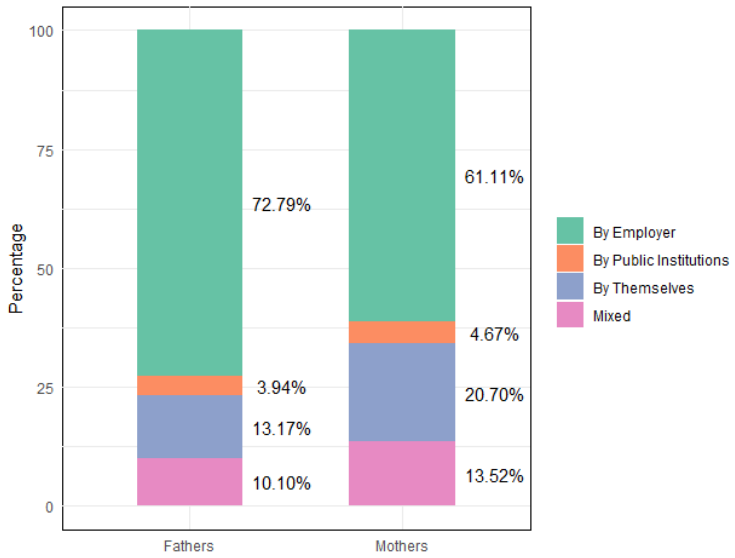
Figure 2: Training Desirability among Mothers and Fathers (EU-AES)



Notes: This figure presents the share of mothers and fathers who did or did not want to participate in training, distinguishing between those who engaged in on-the-job training in the past 12 months and those who did not. Data comes from the EU-AES 2011 and 2016 surveys, and focuses on employed individuals.

public institutions are slightly more likely to support training for mothers, employers are considerably less likely to do so.

Figure 3: Training Financing for Mothers and Fathers (EU-AES)



Notes: This figure presents the share of mothers and fathers with different financing sources for on-the-job training among those who participated in training in the past 12 months. Data comes from the EU-AES 2011 and 2016, and focuses on employed individuals.

Taken together, these results suggest that the motherhood training penalty is driven by employers' choices. This aligns with the widely discussed hold-up problem in the training literature (Acemoglu (1997), Acemoglu and Pischke (1998), Moen and Rosén (2004)), which suggests that firms underinvest in training when workers are likely to leave after being

trained. This concern is particularly pronounced for mothers, as employers anticipate the substantial and persistent child penalties in employment (Kleven et al., 2019; Kleven, 2022b; Kleven et al., 2024), which lead many women to exit the labor force after childbirth. Through this mechanism, child employment penalties contribute to the motherhood training penalty, suppressing wage growth even for mothers who remain employed.[16]

5 Conclusions

This paper provides empirical evidence linking the motherhood wage penalty to on-the-job human capital formation by documenting a "motherhood training penalty." Using rich European cross-sectional worker-level data and a pseudo-event study of first childbirth, we find that full-time employed men and women follow similar on-the-job training trends before parenthood, but diverge significantly in the years following. Specifically, women are 17%—22% less likely to engage in on-the-job training during the 1–3 years after becoming mothers, while men are only 3%–8% less likely to do so. By examining workers' desire to participate in on-the-job training and how it is financed, we provide suggestive evidence that this gap is not driven by mothers opting out of training, but rather by employers providing less training to mothers.

Our findings underscore the importance of addressing the training gap to reduce the motherhood wage penalty, and, by extension, the gender wage gap. These results have two key implications. First, policies that encourage on-the-job training could disproportionately benefit women, particularly mothers, and help reduce gender inequities in the labor market. Second, given the crucial role firms play in offering training, policymakers should explore strategies to incentivize firms to provide more training opportunities to mothers. Specifically, understanding whether policies such as training subsidies can foster gender equality in both training and the broader labor market is a promising avenue for future research.

References

Acemoglu, D. (1997). Training and Innovation in an Imperfect Labour Market. The Review of Economic Studies, 64(3):445. ISBN: 00346527.

Acemoglu, D. and Pischke, J.-S. (1998). Why Do Firms Train? The Quarterly Journal of Economics, 113(1):79–119.

[16]Moreover, the hold-up problem also helps explain why the motherhood training penalty diminishes over time: after several years in the workforce, mothers are less likely to leave, reducing employers' concerns.

Adda, J., Dustmann, C., and Stevens, K. (2017). The Career Costs of Children. Journal of Political Economy, 125(2):293–337.

Albert, C., García-Serrano, C., and Hernanz, V. (2010). On-the-job training in Europe: Determinants and wage returns. International Labour Review, 149(3):315–341.

Almeida, R. K. and Faria, M. (2014). The wage returns to on-the-job training: evidence from matched employer-employee data. IZA Journal of Labor and Development, 3(19).

Altonji, J. G. and Blank, R. M. (1999). Chapter 48 Race and gender in the labor market. In Handbook of Labor Economics, volume 3, pages 3143–3259. Elsevier.

Altonji, J. G. and Spletzer, J. R. (1991). Worker Characteristics, Job Characteristics, and the Receipt of On-the-Job Training. Industrial and Labor Relations Review, 45(1):58.

Anderson, D. J., Binder, M., and Krause, K. (2002). The Motherhood Wage Penalty: Which Mothers Pay It and Why? The American Economic Review, 92(2,):354 –358.

Angelov, N., Johansson, P., and Lindahl, E. (2016). Parenthood and the Gender Gap in Pay. Journal of Labor Economics, 34(3):545–579.

Barron, J. M., Black, D. A., and Loewenstein, M. A. (1993). Gender Differences in Training, Capital, and Wages. The Journal of Human Resources, 28(2):343.

Bassanini, A., Booth, A., Brunello, G., De Paola, M., and Leuven, E. (2007). Workplace Training in Europe. In Brunello, G., Garibaldi, P., and Wasmer, E., editors, Education and Training in Europe. Oxford Scholarship Online.

Bertrand, M., Goldin, C., and Katz, L. F. (2010). Dynamics of the Gender Gap for Young Professionals in the Financial and Corporate Sectors. American Economic Journal: Applied Economics, 2(3):228–255.

Biesebroeck, J. V. (2007). Wage and Productivity Premiums in Sub-Saharan Africa. NBER Working Paper Series.

Bishop, J. H. (1994). The Impact of Previous Training on Producitivity and Wages. In Lynch, L. M., editor, Training and the Private Sector, pages 161–200. University of Chicago Press, Chicago.

Blau, F. D. and Kahn, L. M. (2017). The Gender Wage Gap: Extent, Trends, and Explanations. Journal of Economic Literature, 55(3):789–865.

Blundell, R., Costa-Dias, M., Goll, D., and Meghir, C. (2021). Wages, Experience, and Training of Women over the Life Cycle. Journal of Labor Economics, 39(S1):S275–S315.

Booth, A. L. (1991). Job-Related Formal Training: Who Receives It and What Is It Worth? Oxford Bulletin of Economics and Statistics, 53(3):281–294.

Booth, A. L. (1993). Private sector training and graduate earnings. Review of Economics & Statistics, 75(1):164–170.

Budig, M. J. and England, P. (2001). The Wage Penalty for Motherhood. American Sociological Review, 66(2):204.

Card, D., Kluve, J., and Weber, A. (2018). What works? A meta analysis of recent active labor market program evaluations. Journal of the European Economic Association, 16(3):894–931.

Cukrowska-Torzexska, E. and Matysiak, A. (2020). The motherhood wage penalty: A meta-analysis. Social Science Research, 88-89.

Dieckhoff, M. and Steiber, N. (2009). In search of gender differences in access to continuing training: Is there a gender training gap and if yes, why?

Duncan, G. J. and Hoffman, S. (1979). On-The-Job Training and Earnings Differences by Race and Sex. The Review of Economics and Statistics, 61(4):594.

Erosa, A., Fuster, L., and Restuccia, D. (2016). A quantitative theory of the gender gap in wages. European Economic Review, 85:165–187.

Fernandez-Kranz, D., Lacuesta, A., and Rodriguez-Planas, N. (2013). The Motherhood Earnings Dip: Evidence from Administrative Records. The Journal of Human Resources, 48(1):169–197.

Frazis, H. and Loewenstein, M. A. (2005). Reexamining the returns to training: Functional form, magnitude, and interpretation. Journal of Human Resources, 40(2):453–476.

Gallen, Y. (2023). Motherhood and the Gender Productivity Gap.

Gibson, J. (2003). Do Lower Expected Wage Benefits Explain Ethnic Gaps in Job-related Training? Evidence from New Zealand. Motu Working Paper Series.

Goldin, C. (2014). A Grand Gender Convergence: Its Last Chapter. American Economic Review, 104(4):1091–1119.

Gough, M. and Noonan, M. (2013). A Review of the Motherhood Wage Penalty in the United States: Motherhood Wage Penalty. Sociology Compass, 7(4):328–342.

Goux, D. and Maurin, E. (2000). Returns to firm-provided training: Evidence from French worker-firm matched data. Labour Economics, 7(1):1–19. ISBN: 3314117604.

Gronau, R. (1988). Sex-Related Wage Differentials and Women's Interrupted Labor Careers-the Chicken or the Egg. Journal of Labor Economics, 6(3):277–301.

Haelermans, C. and Borghans, L. (2012). Wage effects of on-the-job training; a meta-analysis. British Journal of Industrial Relations, 50(3):502–528.

Hamil-Luker, J. (2005). Women's wages: Cohort differences in returns to education and training over time. Social Science Quarterly, 86(SPEC. ISS.):1261–1278.

Heckman, J. J., Lalonde, R. J., and Smith, J. A. (1999). The economics and econometrics of active labor market programs. Handbook of Labor Economics, 3(1):1865–2097.

Kleven, H. (2022a). The Geography of Child Penalties and Gender Norms: A Pseudo-Event Study Approach. NBER Working Paper.

Kleven, H. (2022b). The Geography of Child Penalties and Gender Norms: Evidence from the United States. NBER Working Paper.

Kleven, H., Landais, C., and Leite-Mariante, G. (2024). The Child Penalty Atlas. NBER Working Paper.

Kleven, H., Landais, C., and Søgaard, J. E. (2019). Children and Gender Inequality: Evidence from Denmark. American Economic Journal: Applied Economics, 11(4):181–209.

Kluve, J. (2010). The effectiveness of European active labor market programs. Labour Economics, 17(6):904–918. Publisher: Elsevier B.V.

Lillard, L. A. and Tan, H. W. (1986). Private Sector Training Who Gets It and What Are Its Effects. Technical report. Publication Title: Rand Corporation.

Lundberg, S. and Rose, E. (2000). Parenthood and the earnings of married men and women. Labour Economics, 7(6):689–710.

Lynch, L. M. (1992). Private-Sector Training and the Earnings of Young Workers. The American Economic Review, 82(1):299–312. ISBN: 0002-8282.

Ma, X., Nakab, A., and Vidart, D. (2023). How do Workers Learn? Theory and Evidence on the Roots of Lifecycle Human Capital Accumulation. Working Paper.

Ma, X., Nakab, A., and Vidart, D. (2024). Human Capital Investment and Development: The Role of On-the-job Training. Journal of Political Economy Macroeconomics, 2(1):107–148.

McKenzie, D. (2017). How effective are active labor market policies in developing countries? A critical review of recent evidence. World Bank Research Observer, 32(2):127–154.

Moen, E. R. and Rosén, (2004). Does poaching distort training? Review of Economic Studies, 71(4):1143–1162.

Pischke, J.-S. (2001). Continuous Training in Germany. Journal of Population Economics, 14:523–548.

Royalty, A. B. (1996). The Effects of Job Turnover on the Training of Men and Women. Industrial and Labor Relations Review, 49(3):506–521. Publisher: Sage Publications, Inc.

Salas-Velasco, M. (2009). Beyond lectures and tutorials: Formal on-the-job training received by young European university graduates. Research in Economics, 63(3):200–211. Publisher: Elsevier Ltd.

Veum, J. R. (1995). Sources of Training and Their Impact on Wages. Industrial and Labor Relations Review, 48(4):812.

Waldfogel, J. (1998). Understanding the 'Family Gap' in Pay for Women with Children. Journal of Economic Perspectives, 12(1):137–156.

What Works - Centre for Local Economic Growth (2016). Evidence Review 1: Employment Training. Technical report, London School of Economics.

Wilde, E. T., Batchelder, L., and Ellwood, D. (2010). The Mommy Track Divides: The Impact of Childbearing on Wages of Women of Differing Skill Levels. Technical Report w16582, National Bureau of Economic Research, Cambridge, MA.

Appendix

A Literature Review on Gender Training Gap

This section provides a comprehensive review of the literature on the relationship between on-the-job training and gender. Our main focus is the evolution of the gender training gap over time, while also highlighting both similarities and differences across countries.

Table A.1 summarizes this literature. We focus on worker-level outcomes, which typically rely on worker-level data. Our primary interest is in studies that address the training gender gap in some capacity, even if it is not the main focus of the paper.[17] The table organizes the studies by country, reporting results separately for studies that examine the training gender gap across multiple countries. The literature we review covers a wide range of contexts and time periods, although fewer studies analyze the gender training gap in developing countries compared to developed ones.

Several studies from the 1970s and 1980s highlight the existence of a gender gap in training, with women receiving systematically less training than men. This disparity was documented in developed countries such as the United States (Duncan and Hoffman (1979), Lillard and Tan (1986), Gronau (1988), Lynch (1992), Bishop (1994), Veum (1995)), the United Kingdom (Booth (1991), Booth (1993)), France (Goux and Maurin (2000)), and Germany (Pischke (2001)).[18] Booth (1991) and Booth (1993) further find evidence that having children had different effects on the probability of receiving training for women and men in the 1980s. Specifically, they examine the incidence of formal on-the-job training for full-time employed individuals in the United Kingdom, and find that having children drastically reduced the probability of receiving training for women, while the effect for men was positive, though small and not statistically significant.

The evidence on the gender training gap has become sparser and less clear since the 1990s, with studies analyzing European countries producing mixed results. For instance, Bassanini et al. (2007) show that prime-age women in Europe had more opportunities to receive on-the-job training than men in the 1990s. Similarly, Salas-Velasco (2009) finds that among recent college graduates in Europe, women had a higher chance of receiving training than

[17] For instance, we include studies that examine the returns to training by gender and perform a training incidence regression as a first step, as long as a gender dummy is included in the analysis.

[18] It is important to note that all of these studies use some form of econometric identification that produced statistically significant coefficients. The exceptions were Duncan and Hoffman (1979), Lillard and Tan (1986), and Gronau (1988), who reported the gender gap based on descriptive averages.

men. However, Dieckhoff and Steiber (2009) finds the opposite result: in 2005, a sample of prime-age workers with partners had a lower likelihood of receiving course training if they were female.

These mixed results persist even when comparing studies with similar settings and data. For instance, Bassanini et al. (2007) and Albert et al. (2010) use the same time span and dataset to examine training across several European countries but report different findings. The former focuses on the incidence of on-the-job training, while the latter looks at vocational training. These studies find opposing effects in countries like France, Portugal, and Spain, although these effects are not statistically significant. Moreover, the results vary widely across countries. For example, both studies find that prime-age women receive less training than men in Italy, but the opposite is true in the United Kingdom.

Results from other countries, including more recent studies from the developing world, also show mixed outcomes. For instance, Gibson (2003) finds evidence that white women in New Zealand receive more training than white men, while the opposite is true for non-white women. Additionally, studies on manufacturing workers in Tanzania (Biesebroeck (2007)) and Thailand (Almeida and Faria (2014)) reveal that women receive less training than men.

Table A.1: Studies examining training incidence by gender

Study	Period	Dataset	Sample	Training Definition	Training Incidence	Estimation Method
Austria						
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: -0.017	Probit
Belgium						
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: -0.013	Probit
Denmark						
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: 0.012	Probit
Europe						
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: 0.006**	Probit
Dieckhoff (2009)	2004-2005	ESS2e03	Prime-age workers with partner	Incidence of Course Training	F: -0.20*	Logit
Salas-Velasco (2009)	1999	CHEERS	Recent European college graduates	Incidence of OJT	M: -0.2805** M: -0.1674**	Logit Probit
Finland						
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: 0.016	Probit
France						
Goux and Maurin (2000)	1988-1993	FQP	Prime-age	Incidence of employer-provided OJT	F: -0.081**	Probit
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: 0.002	Probit
Albert et al. (2010)	1995-2001	ECHP	Prime-age	Vocational Training	M: 0.194	Probit
Germany						
Pischke (2001)	1986-1989	GSOEP	Prime-age	Incidence of any training Incidence of employed sponsored training	F: -0.067*** F: -0.061***	OLS OLS
Albert et al. (2010)	1995-2001	ECHP	Prime-age	Vocational Training	M: 0.046	Probit
Burgard and Gorlit (2014)	2000, 2004, 2008	SOEP	Prime-age	Career oriented courses	M: 0.35 F: 0.32 dif=0.04**	T-test
Tamm (2018)	2007-2010	WeLL	Manufacturing or service workers	Incidence of OJT Security or health Technical training Training on computer Administrative training Communication or soft skills	M: -0.0399*** M: -0.0826*** M: 0.0903*** M: -0.0152* M: -0.0288*** M: -0.0244***	OLS
Greece						
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: -0.008**	Probit
Ireland						
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: 0.026***	Probit
Italy						
Albert et al. (2010)	1995-2001	ECHP	Prime-age	Vocational Training	M: 0.264***	Probit
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: -0.001	Probit
Kenya						
Rosholm et al. (2007)	1995	RPED	Manufacturing workers	Incidence of OJT	M: -0.053	Probit
Malaysia						
Almeida and Faria (2014)	2002	WBES	Manufacturing and service workers	OJT	F: - 0.071	Probit
Netherlands						
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: -0.006	Probit
New Zealand						
Gibson (2003)	1996	ETS	Prime-age whites Prime-age non-whites	Incidence of employer-provided OJT	M whites: -1.00 M non-whites: 1.48	Probit
Portugal						
Budria and Telhado Pereira (2007)	1998-2000	PLFS	Men and Women	Incidence of OJT	F: 0.452 M: 0.548	Averages
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: 0.006**	Probit
Albert et al. (2010)	1995-2001	ECHP	Prime-age	Vocational Training	M: 0.162	Probit

Study	Period	Dataset	Sample	Training Definition	Training Incidence	Estimation Method
Spain						
Albert et al. (2010)	1995-2001	ECHP	Prime-age	Vocational Training	M: 0.082	Probit
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: 0.001	Probit
Sweden						
Evertsson (2004)	1994-1998	SSLC	Prime-age	Incidence of OJT	F: -0.22***	Logit
Schøne (2004)	1989-1993	NSOE	Prime-age	Incidence of OJT	F: 0.013	IV first stage
Tanzania						
Biesebroeck (2007)	1991-1993	WBRED	Manufacturing workers	Incidence of OJT	M: 0.055**	OLS
Thailand						
Almeida and Faria (2014)	2004	WBES	Manufacturing workers	Incidence of OJT	F: - 0.072*	Probit
United Kingdom						
Booth (1991)	1987	BSAS	Full-time employed men Full-time employed women	Incidence of Formal OJT	Private Sector (M): -0.587** Children (M): 0.056 Private Sector (F): -0.204 Children (F): -0.733**	OLS
Booth (1993)	1980-1987	BHPS	College-Graduate men College-Graduate women	Incidence of Training	Children (M): 0.037 Children (F): -0.360**	Logit
Bassanini et al. (2007)	1995-2001	ECHP	Prime-age	Incidence of OJT	F: 0.030***	Probit
Albert et al. (2010)	1995-2001	ECHP	Prime-age	Vocational Training	M: - 0.139**	Probit
United States						
Duncan and Hoffman (1979)	1975	PSID	White men Black men White women Black women	Incidence of Training	WM: 0.258 BM: 0.091 WF: 0.141 BF: 0.088	Weighted averages
Lillard and Tan (1986)	1983	CPS	Men and women	Training to get currentor last job Training to improve skills	M: 0.555 F: 0.550 M: 0.38 F: 0.367	Averages
Gronau (1988)	1977-1979	PSID	Women Men	Incidence of OJT	M: 0.741 F: 0.675	Averages
Lynch (1992)	1980-1983	NLSY79	Young non-college graduates	Incidence of off-job training Incidence of OJT Incidence of Apprenticeship	M: -0.17*** M: 0.28*** M: 0.48***	Probit
Bishop (1994)	1982-1987	EOPP-NCRVE and NFIBS	New hires	Log training time	F: -0.105* F: -0.083 F: -139*** F (married): 0.109* M (married): -0.053	OLS-EOPP OLS-NFIB OLS-Augmented NFIB
Veum (1995)	1986-1990	NLSY79	Young	Incidence of company training Incidence of Apprenticeship Incidence of off-job training	M: -0.0208 M: 0.7043*** M: -0.0542	Probit
Krueger and Rouse (1998)	1991-1995	Records for manufacturing co. Records for service co.	Production workers All workers	Incidence of OJT	F: 0.122*** F: 0.057	Probit
Zambia						
Rosholm et al. (2007)	1995	RPED	Manufacturing workers	Incidence of OJT	M: -0.106	Probit

B Data sources

B.1 European Union Labor Force Survey (EU-LFS)

The European Union Labor Force Survey (EU-LFS) is a household survey conducted by the European Union to gather data on employment and labor market activities of individuals aged 15 years and above who live in the EU member states, as well as Norway, Switzerland, and Iceland. The survey is conducted on a quarterly basis and collects information on various aspects of employment, such as hours worked, type of job, employment status, occupation, and sector of activity. The EU-LFS also collects data on educational attainment, gender, age, family structure, nationality, and other demographic information to provide a comprehensive understanding of the EU labor market.

The survey is conducted using a common methodology across all participating countries, allowing for cross-country comparisons and analysis of trends in the labor market over time. While data collection began in 1983 or 1992 for most countries, our analysis uses data from 2006 to 2021 due to data constraints. In particular, information on the age of respondents' children, which is needed to construct event times for parents, only started being collected in 2006.

B.1.1 Training definition

- On-the-job training: Participation in non-formal education and training in the last 4 weeks. This variable covers learning activities organized with the intention to improve workers' knowledge, skills and competences, and encompasses participation in courses (classroom instruction, lecture, distance learning), seminars, workshops, or private lessons.

B.1.2 Matching variables

The set of variables used in the matching procedure comprises gender, education, marital status, occupation, urban/rural status, and country. We describe the education, marital status, occupation, and urban/rural status variables variables below.

- Education: Less than primary, primary, lower-secondary, upper-secondary, post-secondary.
- Marital status categories: married and not married.[19]

[19]Since we do not have a proper "marital status" variable available, we identified married individuals as those adults over 25 years old who live together in the same household and whose age difference is the smallest among all the people in that household.

- Occupation categories: managers; professionals; technicians and associate professionals; clerical support workers; service and sales workers; skilled agricultural workers; craft and related trades workers; plant and machine operators; and assemblers, elementary occupations.

Table B.1: Summary statistics in EU-LFS

	Men			Women		
	Child	No Child	**Difference**	Child	No Child	**Difference**
Mean age	34.40	38.72	-4.31	33.92	40.56	-6.64
Fraction married	0.59	0.38	0.21	0.55	0.43	0.12
Fraction urban	0.65	0.66	-0.02	0.66	0.68	-0.02
Fraction w/ less than primary education	0.00	0.00	0.00	0.01	0.00	0.00
Fraction w/ primary education	0.08	0.03	0.04	0.07	0.03	0.04
Fraction w/ lower-secondary education	0.33	0.20	0.14	0.31	0.18	0.13
Fraction w/ upper-secondary education	0.45	0.58	-0.13	0.45	0.56	-0.11
Fraction w/ post-secondary education	0.13	0.18	-0.05	0.16	0.23	-0.07
Fraction on parental leave	0.00	0.00	0.00	0.01	0.00	0.00
Fraction employed	0.70	0.75	-0.05	0.55	0.68	-0.13
Fraction engaging in on-the-job training	0.07	0.08	-0.01	0.08	0.11	-0.03
Fraction managers	0.05	0.05	0.01	0.02	0.03	-0.01
Fraction professionals	0.07	0.10	-0.03	0.08	0.12	-0.04
Fraction technicians and associate professionals	0.09	0.10	-0.02	0.08	0.11	-0.03
Fraction clerical support workers	0.04	0.05	-0.01	0.08	0.10	-0.02
Fraction service and sales workers	0.07	0.09	-0.01	0.15	0.18	-0.03
Fraction skilled agricultural, forestry and fishery workers	0.03	0.04	-0.00	0.02	0.02	0.00
Fraction craft and related trades workers	0.16	0.17	-0.00	0.02	0.02	-0.00
Fraction plant and machine operators and assemblers	0.10	0.10	-0.00	0.02	0.03	-0.01
Fraction elementary occupations	0.07	0.06	0.00	0.07	0.07	0.00
Number of Observations	9,879,261	12,662,648		10,748,353	11,574,763	

Table B.2: Data availability and number of observations in EU-LFS by country

Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Austria	87576	88840	85060	80433	78036	76366	75758	75033	99316	96938	99325	100495	97329	96611	96799	77557
Belgium	44876	43632	40726	39452	38325	35227	34477	33942	57842	54753	55051	81060	79281	82144	79198	69681
Bulgaria	58925	56119	56733	57341	54541	50877	49339	51063	65154	63609	65688	63357	65320	63475	55203	57209
Switzerland	0	0	0	0	51051	54020	53793	50344	86253	87347	83974	84150	83466	80422	82265	89501
Cyprus	13728	13927	14740	15085	15775	15327	15013	14618	22228	22004	22358	22421	21680	20810	20628	18230
Czechia	136243	133639	125185	118917	115630	111082	106458	101222	120642	117191	115417	113247	109502	106889	101193	99807
Germany	202850	195243	191455	190300	188092	174670	170929	167431	236616	237444	254884	260120	255418	253928	54242	151692
Denmark	20298	40821	35888	37339	42510	46430	46881	45866	66903	66005	54524	54604	56475	55084	54242	45067
Estonia	9398	10942	10126	8784	8694	9151	9890	9561	13961	13491	13482	15527	15329	15278	16423	14483
Greece	112499	107429	104397	105947	107056	94464	82229	81938	107612	104262	111604	107563	100576	92298	79994	68714
Spain	242079	251166	251248	253041	251166	242697	241183	237809	354440	342441	330806	327380	330640	333897	306041	243456
Finland	72529	70294	70300	67549	65036	62104	59845	57493	88300	86057	84150	81327	78050	73929	70113	46706
France	136431	140276	136957	159966	188998	193597	189056	169900	265984	264250	266425	258609	254468	247450	190164	174014
Iceland	5118	6753	6600	6485	6521	6514	6501	6255	8964	8735	8213	7444	8993	8332	9046	8452
Italy	304198	295019	290164	281424	280103	274235	252471	252185	294519	288870	279198	276763	273541	267035	248813	236354
Lithuania	16987	22738	20885	22611	22493	21445	21044	20501	30769	29374	28484	29229	29247	27380	24374	23399
Netherlands	208197	188740	184935	180503	167968	177131	176313	182416	255847	245774	240071	229922	254227	244454	237021	96011
Norway	45109	44220	40974	40329	38438	37896	35295	33931	58620	57162	58115	60605	62232	61490	61465	49658
Poland	110290	103332	101157	100715	190976	189667	183079	165690	197385	171679	158180	145657	131993	117363	128851	127221
Slovenia	36864	35006	32927	32709	31551	29215	26680	27394	36198	34686	35105	35459	35544	33316	33129	36897
Slovakia	62569	59925	59083	54719	53279	52506	49964	48482	56597	53868	52320	49473	47816	45886	45186	42483
United Kingdom	179537	175938	171789	161875	151753	141547	137691	131198	209683	200776	192315	189017	187123	181706	112304	0

B.2 European Union Adult Education Survey (EU-AES)

The European Union Adult Education Survey (EU-AES) collects data on participation in education and learning activities, with the specific objective of understanding adult education patterns. The survey includes information on the type and characteristics of learning activities pursued, along with information on workers skills and demographic information. This survey utilizes harmonized definitions and concepts, and provides a set of methodological documents and guidelines to help countries properly collect data. EU-AES covers individuals aged 25–64, and was conducted during 2007, 2011, and 2016.[20] We focus on the 2011 and 2016 waves for our analysis, since the 2007 wave was a pilot containing very different training definitions.

Table B.3: Summary statistics in EU-AES

	Men			Women		
	Child	No Child	**Difference**	Child	No Child	**Difference**
Mean age	39.40	40.59	-1.19	38.88	42.18	-3.30
Fraction married	0.78	0.52	0.25	0.72	0.57	0.16
Fraction urban	0.63	0.67	-0.04	0.65	0.68	-0.04
Fraction w/ less than primary education	0.01	0.01	-0.00	0.01	0.00	0.00
Fraction w/ primary education	0.02	0.02	0.00	0.02	0.01	0.01
Fraction w/ lower-secondary education	0.15	0.13	0.02	0.14	0.11	0.04
Fraction w/ upper-secondary education	0.47	0.44	0.02	0.42	0.40	0.02
Fraction w/ post-secondary education	0.29	0.34	-0.05	0.36	0.43	-0.07
Fraction employed	0.79	0.73	0.06	0.63	0.69	-0.05
Fraction managers	0.07	0.05	0.02	0.03	0.03	-0.01
Fraction professionals	0.12	0.13	-0.01	0.15	0.18	-0.03
Fraction technicians and associate professionals	0.11	0.10	0.00	0.10	0.12	-0.02
Fraction clerical support workers	0.04	0.04	-0.00	0.08	0.09	-0.01
Fraction service and sales workers	0.08	0.08	-0.00	0.13	0.13	-0.00
Fraction skilled agricultural, forestry and fishery workers	0.04	0.03	0.01	0.02	0.02	0.01
Fraction craft and related trades workers	0.16	0.14	0.03	0.03	0.02	0.00
Fraction plant and machine operators and assemblers	0.10	0.08	0.01	0.02	0.02	-0.00
Fraction elementary occupations	0.05	0.05	-0.00	0.06	0.06	-0.00
Fraction engaging in on-the-job training	0.40	0.39	0.01	0.39	0.43	-0.04
Fraction participated in training - not wanted	0.31	0.29	0.02	0.27	0.30	-0.02
Fraction participated in training- wanted	0.16	0.15	0.01	0.19	0.19	0.00
Fraction not participated in training - not wanted	0.40	0.44	-0.04	0.37	0.39	-0.01
Fraction not participated in training - wanted	0.12	0.12	0.00	0.16	0.13	0.04
Number of Observations	91,047	78,681		111,469	75,332	

[20] In particular, this survey was deployed as a voluntary survey in 26 EU countries in 2007, and then as a mandatory survey in 27 and 28 countries, respectively, during 2011 and 2016. Information about these countries and sample sizes are available in Table B.4.

Table B.4: Data availability and number of observations in EU-AES by country

Country	2011	2016
Austria	4,915	4,672
Belgium	4,250	4,148
Bosnia and Herzegovina	0	4,660
Bulgaria	5,045	4,478
Croatia	0	2,417
Cyprus	2,040	2,424
Czech Republic	7,428	8,465
Denmark	3,166	2,912
Estonia	2,873	3,227
Finland	2,952	2,517
France	10,884	12,173
Germany	5,339	5,782
Greece	4,800	4,092
Hungary	6,287	5,856
Ireland	10,377	3,910
Italy	8,026	9,323
Latvia	4,276	4,797
Lithuania	4,311	2,878
Luxembourg	2,743	3,337
Malta	2,218	1,486
Netherlands	2,419	2,283
North Macedonia	0	5,915
Norway	2,773	2,308
Poland	21,093	12,630
Portugal	9,205	9,112
Romania	9,968	10,547
Serbia	3,349	2,988
Slovak Republic	4,387	2,563
Slovenia	3,930	4,321
Spain	14,808	18,112
Sweden	2,627	2,492
Switzerland	8,233	6,922
United Kingdom	2,736	5,324

B.2.1 Training and other relevant variables

- On-the-job training: Participation in any activity (courses, workshops and seminars, guided on-the-job training, or private lessons) with the intention to improve knowledge/skills in any area (including hobbies) during the last 12 months.
- Training desirability:
  - Participated in training - not wanted: Participated in formal or non-formal education and training during the last 12 months, but did not want to participate in more of these activities then.
  - Participated in training - wanted: Participated in formal or non-formal education

and training during the last 12 months but wanted to participate in more of these activities then.

  - Not participated in training - not wanted: Did not participate in formal or non-formal education and training during the last 12 months and did not want to participate.

  - Not participated in training - wanted: Did not participate in formal or non-formal education and training during the last 12 months but wanted to participate.

- Training financing for training during the last 12 months:

  - By employer: Training is fully or partially paid for by the employer.

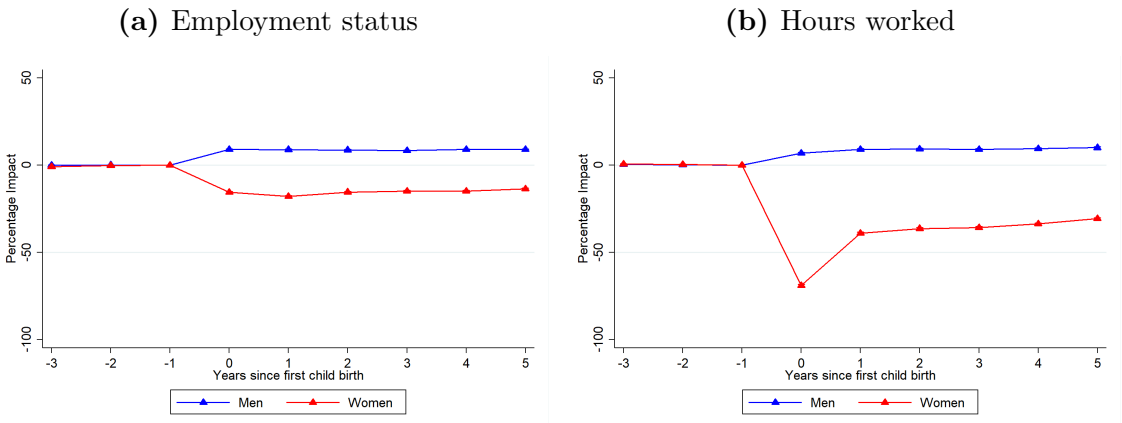
  - By public institutions: Public institutions or the government programs finance the training.

  - By themselves: The individual worker self-financed the training.

  - Mixed: When both the employer and the worker share the costs of the training.

C Additional results from EU-LFS

Figure C.1: Impact of first child birth on the employment and hours worked of men and women (EU-LFS)



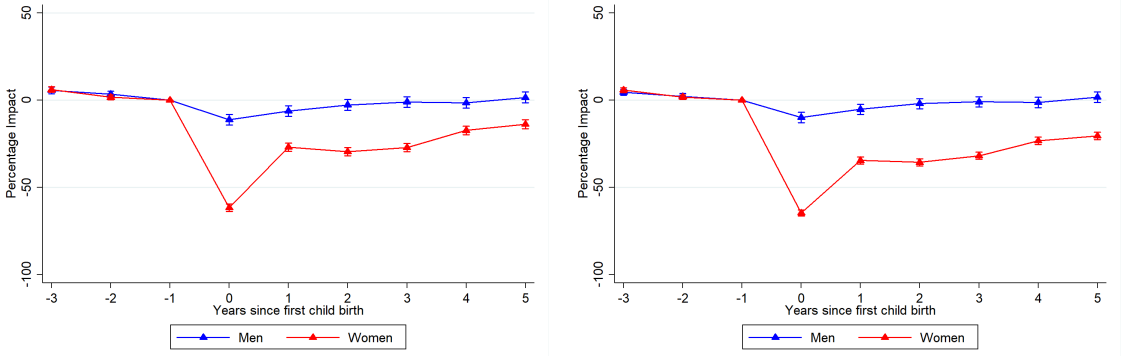
Notes: This figure presents pseudo-event studies of the impact of first child birth on the employment status and hours worked of men and women using pooled data from all countries in the EU-LFS following the matching method of Kleven et al. (2024) exactly.[21] We limit the sample of parents to individuals whose age at first birth is between 25 and 45, and follow the specification in Equation (1). The series depict the percentage impact of child birth (P_t^m and P_t^w in Equation (2)) at each event time t relative to the base event time corresponding to the year before child birth, $t = -1$. The error bars depict 95% confidence intervals based on robust standard errors.

[21] This means the matching variables encompass education, marital status, urban/rural status, and country.

Figure C.2: Impact of first child birth on the participation of men and women on on-the-job training activities, without restricting to full-time workers (EU-LFS)

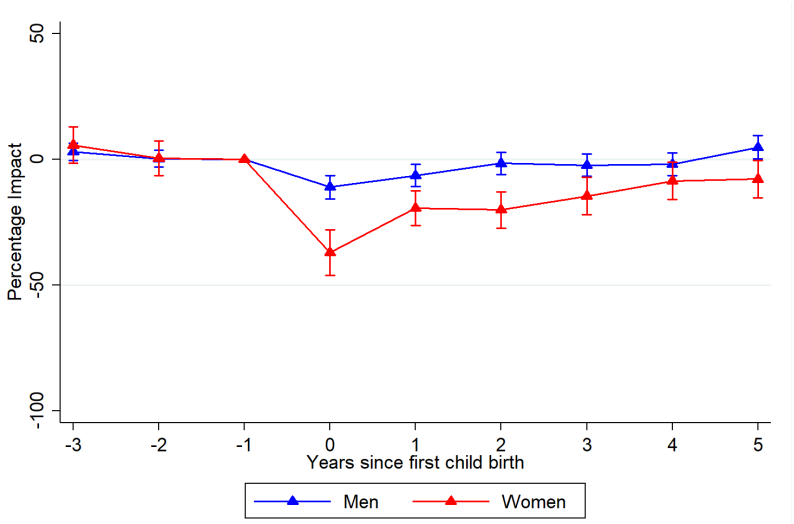
(a) Employed individuals, regardless of hours worked

(b) All individuals



Notes: These figures present pseudo-event studies of the impact of first child birth on the participation of men and women on on-the-job training activities using pooled data from all countries in the EU-LFS when considering all individuals, and all employed individuals regardless of hours worked, respectively. We limit the sample of parents to individuals whose age at first birth is between 25 and 45, and follow the specification in Equation (1). The series depict the percentage impact of child birth (P_t^m and P_t^w in Equation (2)) at each event time t relative to the base event time corresponding to the year before child birth, $t = -1$. The error bars depict 95% confidence intervals based on robust standard errors.

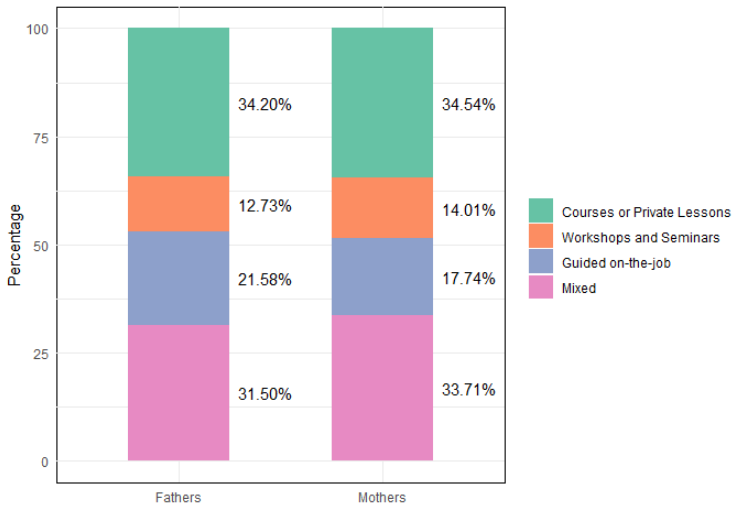
Figure C.3: Impact of first child birth on the participation of men and women on on-the-job training activities (EU-LFS), with occupation fixed effects



Notes: This figure presents pseudo-event studies of the impact of first child birth on the participation of men and women on on-the-job training activities using pooled data from all countries in the EU-LFS following the sample refinements described in Section 2.3, and the specification in Equation (1), with the addition of occupation fixed effects. The series depict the percentage impact of child birth (P_t^m and P_t^w in Equation (2)) at each event time t relative to the base event time corresponding to the year before child birth, $t = -1$. The error bars depict 95% confidence intervals based on robust standard errors.

D Additional results from EU-AES

Figure D.1: Training types for mothers and fathers (EU-AES)



Notes: This figure presents the share of mothers and fathers engaging in different types of on-the-job training among those who participated in training in the past 12 months. Data comes from the EU-AES 2011 and 2016, and focuses on employed individuals.