The utopia of the XXI century:
Closing the gender wage gap.
A human capital approach.

Maria Petrillo

A thesis submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

Department of Economics

The University of Sheffield

April 2022

A mio nonno,

Ora e sempre nel mio cuore.

This thesis is dedicated to my grandfather

Abstract

The gender wage gap (GWG) is what undermines the utopia of the XXI century: a society that ensures gender equality of opportunities. Given the negative economic consequences experienced after the pandemic Covid-19, now more than ever the policymaker needs to unravel the puzzle behind the existence of GWG and implement effective gender-sensitive recovery policies to finally address this form of inequality.

This thesis presents three independent empirical studies that aim to uncover the major drivers of the GWG relying on a human capital approach while exploiting differences in human capital investment (vocational versus general education).

After demonstrating the existence of a differential life-cycle effect of education types on age-wage profiles, Chapter 2 uncovers a straightforward relationship between gender differences in the age-wage profile, educational background and a country's educational system.

Chapter 3 explores the event of parenthood as another important trigger of GWG and unpacks gender heterogeneities in terms of parenthood wage effects. It then takes a step further and explores any relation between the motherhood wage gap and educational background. Results provide strong evidence that vocational-background women face a higher motherhood wage gap since vocational skills are less transferable, less adaptable and depreciate quicker if compared to skills acquired via a general path.

Finally, Chapter 4 focuses on gender occupational segregation and the impact of the glass ceiling effect on women's relative wage distribution. The chapter investigates how the GWG varies over the wage distribution across education (vocational versus general) and occupation types, defined according to variation in the degree of female participation in each occupation type. Findings show that gender segregation affects the GWG over the wage distribution with women with vocational

qualifications facing a tougher glass ceiling in male-dominated and mixed occupations and women with a general background having their weakest glass ceiling effect in male-dominated occupations.

Acknowledgments

Completing this Ph.D. has been a real journey full of joy and happiness but also full of moments in which all my hopes went lost and I could not believe in myself anymore. I was able to overcome these moments only thanks to the amazing support that I have received from very special people. Hence, it is my duty to acknowledge the people who have contributed, with their tireless support, to my academic and personal growth.

First of all, I would like to express my sincere gratitude to my supervisors ***Steven McIntosh*** and ***Andy Dickerson*** for their immense patience and tenacity and for their indispensable advice and invaluable guidance. Steve and Andy, I owe you everything. You have been the first ones to believe in me, to see something in me, and this doctoral thesis would never have seen the light without you.

In addition, I would like to thank my PhD examiners, **Emma Tomney** and **Gurleen Popli**, for their invaluable, helpful and constructive feedbalck, which have significantly improved my thesis.

I would also like to thank all the academic and support staff within the Department of Economics for their help and continual support. I am particularly thankful to **Enrico Vanino** and **Jesse Matheson** for giving me the opportunity to enhance my skills as a research assistant, **Mark Brian** for his precious and meticulous comments provided in my confirmation review, and **Chiara Orsini** for giving me the chance of growing as a graduate teaching assistant.

A special thank goes to my fellow Ph.D. students **Bertha**, **Miroslava**, **Tina,** and **Anna** who have provided me with invaluable friendship. You have made this journey so much easier and have reminded me every single day that there is always a light at the end of the tunnel.

I could never have finished this job if I had not had the constant support of my best friend. **Valeria**, you have always been there for me in good and hard times providing me with the love that only a true friend can give. You have always been and always will be my safe place.

I would also like to express my gratitude to **Davide**. This journey would not have been the same without your love and support. Thank you for always being there for me, and for being such an important part of my life.

I must mention my wonderful friends: **Raya**, **Gaia** and **Andrea**. I will forever be grateful for the encouragement you gave me when I needed the most and for pushing me to work towards my dream and never give up.

Last but not least, I am grateful to my family. Starting with my dear mother, **Anna**, and my father, **Domenico**, my brother, **Francesco**, continuing with my beloved **nonna**, my adored aunt, **Cinzia,** and my precious **Gioia**. Thank you for the invaluable support that you have always provided me with and for always believing in me.

This thesis is for you all.

Table of Content

List of Figures

List of Appendix Figures

List of Tables

List of Appendix Tables

CHAPTER 1

1. Introduction

1.1. Background and motivation

Women's increased participation in the economy can be considered the most crucial revolution of the labour market during the past century. Goldin (2006) attributes the increase in women's participation in the labour force to a change in three different aspects of women's lives, that is a change in the "horizon", the "identity" and "decision making". Hence, the transition of women in the labour market reached a peak when women found individuality in their job; gained the power of deciding how to optimize their time allocation, independently from their husband's labour market choices, and switched from a short-sighted view of their involvement in the labour market to a long-time horizon view characterized by a more stable and continuous commitment to the labour force. Specifically, since 1980 the labour force participation of women increased from less than 52% to 64% across the Economic Co-Operation and Development (OECD) countries with countries such as the Netherlands, Spain and Germany registering increases of 40, 36 and 24 percentage points, respectively (OECD, 2022c).

The conviction of being an agent in the labour market for a sufficient time pushed women to invest more in human capital both in the form of on-the-job training and formal schooling (Bratti, 2001). By 1980, women, in most of the developed and many developing countries, had caught up and overtaken men in college graduation (Blau and Kahn, 2017). Nowadays, recent data from the OECD (2022a) reveal that in all the OECD countries women are more likely to have a tertiary degree compared to men. Among women and men aged 25-64, on average, 42% of women have a tertiary education against the 35% registered by men.

The substantial progress made by women in terms of labour market outcomes has been addressed in the literature (Goldin and Katz, 2002, DiPrete and Buchmann, 2006, Nicoletti et al., 2018) by exploiting different factors. An important role was played by the enforcement of anti-discrimination laws that aimed to eliminate discrimination in pay and hiring as well as differences in compensation practices between women and men working in similar occupations. An example can be the Civil Rights Act in the United States in 1964 (Bailey et al., 2012); the Equal Pay Act in the United Kingdom in 1970 (Leaker, 2008) and Sweden in 1979 (Meyersson Milgrom et al., 2001) to name but a few. Moreover, the implementation of child-oriented policies, aimed at reconciling motherhood and career aspirations by lowering the cost of childbearing, has also contributed to the reduction of the gap (Del Boca and Locatelli, 2006). Further, the introduction of contraceptive pills has been recognised as another important candidate. Widely diffused between the 1960s and 1970s, the introduction of the contraceptive pills enabled women to postpone both marriage and motherhood, resulting in an improvement in their educational achievements and stable labour force participation (Goldin and Katz, 2002, Bailey et al., 2012). Finally, women's increasing investment in human capital has also reduced- but not eliminated - the phenomenon of gender occupational segregation. While before 1970 women were more likely to secure employment in administrative support and service occupations if compared to men, mostly concentrated in managerial jobs or blue-collar occupations, they have nowadays made significant inroads into more male-dominated occupations (Blau and Kahn, 2017).

However, despite changes in policies and social norms and women's increasing investment in human capital, which has led to a more stable attachment to the labour force, data from the OECD register, on average, a gender gap of about 12.5% in terms of hourly wages across the OECD countries (Figure 1.1). That is, in 2019 across the OECD countries for every euro (or dollar) earned by men working full time, full-time employed women earn, on average, only 87.5 cents. Even though there has been a reduction of the gender wage gap over time, moving from 19% in 1996 to 12.5% in 2019, this phenomenon is still persistent and there has been only a slight variation in its magnitude over the

most recent decades as shown in the graph below, with the direct consequence that the progress toward gender equality seems to have stalled.

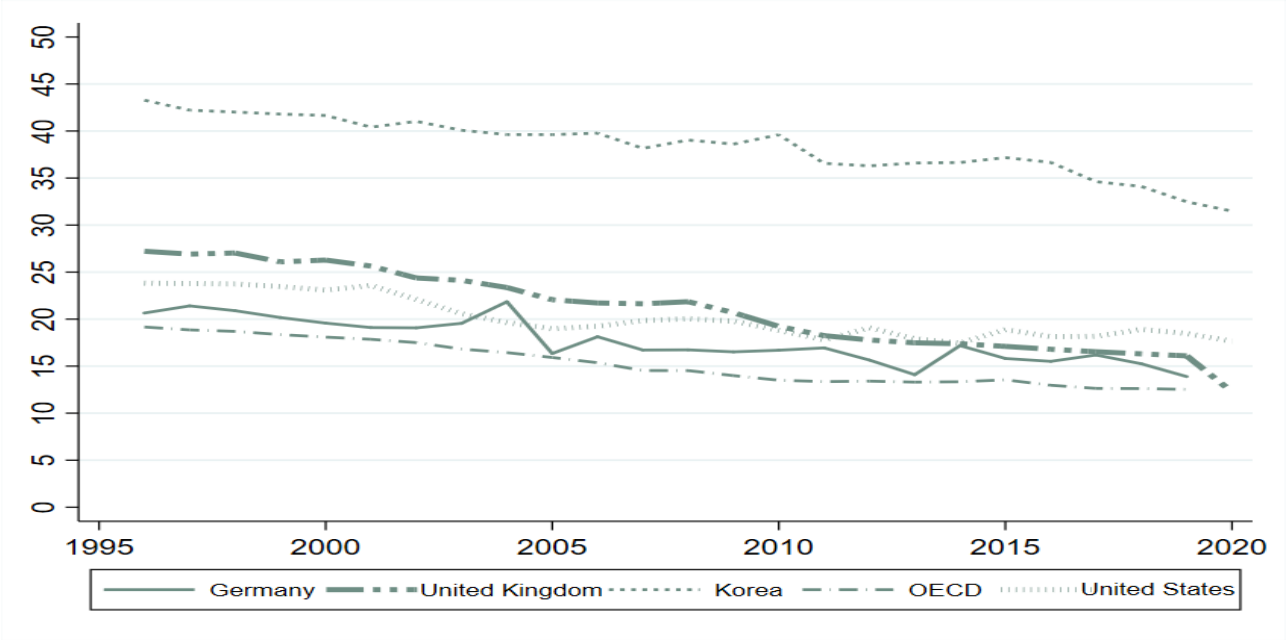

Figure 1.1 Gender wage gap across years

Note: Gender wage gap, selected countries. The gender wage gap is unadjusted, and it is computed as the difference between the median earnings of men and women relative to the median earnings of men. The sample includes full-time employees. Source: OECD (2021), Gender Wage gap 1996-2020. Data available at https://data.oecd.org/earnwage/gender-wage-gap.htm.

This slight variation in terms of the gender wage gap over the last decade has been detected also by more recent and country-specific data from the ONS (2022), which suggests that the gender pay gap for median gross hourly wages in the UK has even increased from 14.9% in 2020 to 15.4% in 2021, with part of this variation being possibly explained by the Covid-19 pandemic. The same trend is encountered in data from the Statistisches Bundesamt (Destatis) in Germany with an unadjusted gender pay gap decreasing by only 4 percentage points from 2014.

From a global perspective, according to the "The Global Gender Gap Report 2021" by the World Economic Forum (2021), the Global Gender Gap Index[1] reached 67.7% in 2021 with a remaining

[1] The Global Gender Gap Index was introduced in 2006 by the World Economic Forum and it takes into consideration many dimensions of gender disparities including economic participation, education attainment, health and political empowerment. The global Gender Gap Report Index considers countries "into eight broad geographical groupings: East Asia and the Pacific; Eastern Europe and Central Asia; Latin America and the Caribbean; Middle East and North Africa; North America; South Asia; Sub-Saharan Africa; and Western Europe".

global gap to close of 32.3%. The report points out that even though the Global Gender Gap has been declining over time, this has happened at a very slow pace with an overall improvement of only 3.6 percentage points since 2006. Consequently, according to the 2021 data, the global economy would only close the overall gender wage gap, all things being equal, in 136 years, 36 years more than what was previously estimated in 2020. This worsening trend appears to be reflecting, albeit only partially, the impact of Covid-19. Nevertheless, even though the Covid-19 pandemic has affected most people's life and work trajectories, many scholars have provided important evidence that women's jobs and livelihood have been more vulnerable to the negative impact of the pandemic (Alon et al., 2020, Madgavkar et al., 2020, Profeta, 2020, Dang and Nguyen, 2021). First, women were the ones mainly employed in sectors directly affected by the lockdown. Second, their labour force participation was the first to drop and at a higher intensity when compared to men's. Third, women were the ones who ended up bearing the weight of the increase in unpaid household work and childcare, especially after school closures. Finally, women are still the ones experiencing lower re-employment rates

As claimed by Caroline Anstey, former managing director of the World Bank "*Gender equality is a core development objective in its own right. But greater gender equality is also smart economics,*

enhancing productivity and improving other development outcomes, including prospects for the next generation and for the quality of societal policies and institutions" (World Bank, 2011, p. xiii). Indeed, closing the gap is not only important in its own right but it has also far-reaching implications on economic efficiency (Loko and Diouf, 2009, Noland et al., 2016). Existing studies suggest that closing the gender wage gap and promoting women's participation in the labour market has several benefits (Goldin, 1994, Klasen, 2000, Casarico and Profeta, 2009, Bandara, 2015, Woetzel, 2015, Cavalcanti and Tavares, 2016).

An increase in gender inequality in wages leads to a rise in gender inequality in employment. The expectation of facing gender inequality in wages and employment trajectories might induce gender inequality in terms of human capital investment by affecting both women's economic incentives

behind the human capital investment and women's choices in terms of type/level of education achieved. As a result, this might cause economic inefficiency through different channels. First, it reduces the panel of the competent workforce (Klasen, 2000), harming, consequently, the country's economic performance (Esteve-Volart, 2004, Cuberes and Teignier, 2016). The decrease in women's participation into the labour force leads to lower households' savings (also shown to be positively affected by women as human beings characterized by different saving behaviours e.g. Seguino and Floro, 2003) and to an increase in the number of individuals relying on welfare payments (Del Boca and Locatelli, 2006). The decrease in the number of workers also makes it harder for the pension system to be sustained (Casarico and Profeta, 2009). Further, gender pay gaps affect women's employment, which in turn will affect fertility rates with crucial implications from a demographic point of view (King et al., 2009, Cavalcanti and Tavares, 2016). Previous studies provide evidence that greater participation of women in the labour force leads to increasing investment in children's education, which translates into improvements in terms of the next generation's human capital level, enhancing in this way the country's economic growth (Thomas, 1997, Duflo, 2005). On one side, an increase in mothers' labour supply might yield to a reduction of parental time investment, and therefore, to negative consequences in terms of children's human capital outcomes; on the other side, it might also lead to a rise in terms of household income and, consequently, to greater financial resources to be spent on children development. However, given the existence of a good childcare support system, Nicoletti et al. (2020) provide evidence that any negative consequences of an increase in mothers' labour market participation on children outcomes are compensated by the respective increase in household income, which therefore allows investments oriented towards the improvement of school and neighbourhood quality. Finally, a branch of literature also has provided evidence of the impact of gender inequalities on governance, according to which women not only appear to be less prone to corruption (Branisa et al., 2013) and capable of providing different skills from the ones provided by men (Byrnes et al., 1999, Eckel and Grossman, 2008, Sabatier, 2015), but their presence

may also give start to some healthy competition among workers with a beneficial effect on firms' productivity.

Consequently, concerns regarding equity, economic growth and countries' prosperity have been rising hand-in-hand with the increasingly urgent need to create policies with the aim to reduce gender differences. Now more than ever, after the adverse impact of Covid-19 that has globally exacerbated gender differences, it is essential to identify the main drivers of the gender wage gap in order to better inform the policymaker and support the implementation of gender-sensitive recovery strategies.

Differences in human capital investment have been recognized as one of the key drivers that may account for part of the gender differences in terms of labour market outcomes. Even if women have made significant improvements in human capital investments, there is still a substantial gender difference with regard to the field of specialization chosen (Chevalier, 2002, Gemici and Wiswall, 2014, Bertrand, 2017, Vaarmets, 2018). According to the new report released by Education At a Glance (2021), across OECD countries, women are indeed more likely to have an upper secondary qualification compared to men. Women also show a higher probability of enrolling in tertiary education in all OECD countries with 52% of younger women (25–34-year-olds) having a tertiary degree against the 39% registered for younger men. However, those data mask important gender differences in the field of specialization: in most countries, men are found to invest more in fields linked with higher salaries, such as Science, Technology, Engineering and Mathematics (STEM) while women are more segregated in less profitable fields of specialization as humanities, art and education. Despite the increasing interest toward changing this pattern, the difference in gender enrolment in STEM has remained constant over the last decades. Men are also more likely to follow a vocational path rather than a general one. In 2019 men represented 55% and 45% of secondary graduates in vocational and general programs, respectively (OECD, 2021). Those differences could be in part explained by the fact that women may prefer to invest more into general rather than in firm-specific training given their lower expectation of being continuously employed workers - proven by

higher quit and turnover rates, on average, if compared to men- and due to the fact that specific skills are less likely to be transferrable and are more subject to obsolescence (Blau and Kahn, 2017). Further, striking gender differences in the field of specialization are tangible even when investing in vocational education qualifications with men being more likely to undertake training in the field of technologies, engineering, manufacturing and construction and women in those related to education, health and welfare, and arts and humanities (OECD, 2021).

The different trend towards human capital investment and work-life patterns exhibited by women and men has been explained by scholars through the exploitation of another important factor that is found to contribute towards gender differences in wages: gendered norms and social expectations. Hence, a natural candidate factor that could help to explain the enduring gender wage penalty lies within the meaning of women and men's social roles; where women are still perceived as rearers of their children, and men, as those who should provide reliable financial assistance for their families. Consequently, different social expectations could affect women's investment in education and work-life pattern forcing them to face career breaks, reduced hours of work and less commitment to paid employment (Anderson et al., 2003, Gangl and Ziefle, 2009). Even though it is undeniable that men and women may have some natural disposition toward these traditional roles, it is also true that they are both capable of the full range of behaviours; maternity being the only immutable gender difference. The body of research has pointed out inequality in terms of the parenthood wage effect, with women experiencing a negative impact of motherhood on wages and men receiving even higher wages after having a child (Lundberg and Rose, 2002, Gangl and Ziefle, 2009, Meurs et al., 2010, Budig and Hodges, 2014, Cukrowska-Torzewska and Matysiak, 2020).

The expectation of future career interruption and of being the primary caretakers of their children, not only leads women to invest less in human capital but also pushes them to change their labour market behaviours and select more family-friendly jobs, part-time jobs and jobs with less responsibility, at a cost of lower salaries (Waldfogel, 1997, Budig and England, 2001, Amuedo-

Dorantes and Kimmel, 2008a, Felfe, 2012). Consequently, the expectation of future career interruption combined with gender differences in human capital investment could represent the driving force behind women's and men's segregation across and within different occupations. Not only do male-dominated occupations tend to be, on average, better compensated than those classified as female-dominated (Levanon et al., 2009) but women earn less relative to men even if they secure employment in the same occupation (Goldin, 2014). Even though gender segregation has significantly decreased over time, with women entering into formerly male-dominated occupations, scholars agree on the crucial impact of gender occupational segregation on the gender wage gap (Hegewisch and Hartmann, 2014).

With the intention to advise the public debate with respect to the major source of gender inequalities in wages, this thesis delves deeper into this topic and examines the role played by education, parenthood and occupational segregation on gender differences in wages. In the following section, the aim of this thesis will be clarified by delineating the research questions addressed and discussing the main contribution to the literature.

1.2. Aims, research questions and contributions

As seen in the previous section, the gender wage gap is still considered a real concern for the whole economy. Social scientists in their attempt to untie the knot behind this phenomenon bring the understanding of the main drivers of gender wage differences in the frontline as an essential pre-condition to design effective policies.

This thesis comprises three related but independent studies providing empirical evidence from large-scale data sources of some key determinants of the gender wage gap. Hence, the main theme connecting all the chapters in this dissertation is the intention to uncover the trigger factors behind gender wage differences while relying on a human capital approach. The latter supports the idea according to which, in line with the traditional division of labour and caring responsibilities in the

family, women anticipate their intermittent attachment to the labour force by changing their labour market behaviours. Hence, women foresee that time out from the labour force will cost them not only in terms of skills depreciation and forgone human capital investment but also in terms of lost job experience. Consequently, their natural response will be to undertake different educational choices if compared to men and to select occupations that help them to minimize losses associated with the expected careers breaks (Mincer and Polachek, 1974, Polachek, 1981).

The three studies included in this thesis are going to exploit gender differences in human capital investment with particular reference to vocational versus general qualifications. Different pieces of evidence have been provided with regard to the differential impact of vocational and general skills on labour market outcomes over the life cycle (Weber, 2014, Hanushek et al., 2017, Hampf and Woessmann, 2017, Brunello and Rocco, 2017, Golsteyn and Stenberg, 2017). The general consensus is that while holding a vocational qualification may contribute to a smooth school-to-work transition at the early career stage, these advantages come at a cost of lower employment opportunities later in life followed by lower-wage levels compared with the ones reached by individuals with a general background. The main reason behind the differential effect of general and vocational skills is that vocational education paths enhance job-specific skills learning, that prepare students to work in well-delineated occupations. Consequently, those skills appear to be not transferable, less adaptable and characterized by higher depreciation rates if compared to general skills.

With the aim of contributing to the theoretical and empirical literature of Gender Economics and the Economics of Education, this dissertation will attempt to address the following research questions.

Chapter 2: study 1

1) Does the educational background (vocational versus general) impact workers' age-wage relationship?

2) Does the age-wage profile differ by gender between those with a vocational qualification and those with a general qualification as their highest qualification?

3) Does the age wage profile differ by gender between those with a vocational qualification and those with a general qualification as their highest qualification according to the orientation of the educational system of the country?

Chapter 3: study 2

1) What is the effect of parenthood on mothers' and fathers' wages?

2) Does the parenthood wage effect vary by gender?

3) Is there a relationship between educational background and parenthood wage effect?

Chapter 4: Study 3

1) How do gender differences vary over the wage distribution?

2) Does the degree of female participation in occupation affect the size of the gender wage gap over the wage distribution?

3) Is there a relationship between the type of educational background and gender differences over the wage distribution?

This thesis contributes to the understanding of the gender wage gap phenomenon in multiple ways. First, it provides a more nuanced picture of the existence of the gender wage gap and the impact of educational background, parenthood and occupational segregation on the size of this ongoing phenomenon. Secondly - after providing evidence on the existence of a strong life-cycle effect on wages of educational types - the thesis exploits, for the first time, differences in qualifications acquired through a vocational versus a general path to shed light on gender differences in wages, making, in this way, a novel contribution also in the field of Economics of Education. Thirdly, this thesis makes a quantitative contribution to the previous literature by relying on detailed datasets with

comprehensive information on individuals' educational attainments to clarify the potential role played by human capital investments in influencing the magnitude of the gender wage gap.

1.3. Structure and content of this thesis

This thesis comprises three distinct empirical works described in Chapter 2, Chapter 3, and Chapter 4. Each of the abovementioned chapters utilises individual-level data and adopts econometric approaches in order to expand our awareness of the mechanism behind the gender wage gap. Chapter 5 concludes this thesis. A brief summary of the three chapters forming the main part of this thesis is provided below.

1.3.1. A brief overview of Chapter 2

Using microdata from the Programme for the International Assessment of Adult Competencies (PIAAC), this chapter contributes to the literature over three key dimensions.

First, by analysing a comparable sample of 19 countries, the chapter demonstrates the existence of strong life-cycle effects on hourly wages of education type, that is vocational versus general education.

Based on the results achieved, the chapter exploits the observed difference between vocational and general educational qualifications to reach a better understanding of the gender wage gap phenomenon by providing evidence on whether the age-wage profile differs by gender between those with a vocational and those with a general qualification as their highest qualification. The findings uncover a straightforward relationship between gender inequality and educational background. Indeed, while the difference in age-wage profile between women and men having a vocational background is found not statistically significant, women with a general background show a less steep profile if compared with men of a similar educational background.

Further, the chapter exploits differences in terms of countries' educational systems with the sole purpose of inferring whether the latter may impact differently on gender differences in terms of age

wage profile between those with either a vocational or general background. Hence, the 19 countries are classified as either general or vocational education-oriented by relying on the information provided by the Education at a Glance (EAG) classification on the shares of vocational and general education in the educational system of each country. While the country's orientation of the educational system does not seem to concern individuals with a vocational background (with only a 0.1 percentage point difference in terms of age wage profile registered between men and women working in vocational-oriented countries), women with a general background report a steeper age-wage profile, in vocational rather than general oriented countries if compared to men with the same educational background.

1.3.2. A brief overview of Chapter 3

Chapter 3 builds on the conclusions of Chapter 2 and analyses the event of parenthood as one of the main drivers behind much of the gender wage gap. Specifically, by using German Socio-Economic Panel microdata this paper contributes new empirical evidence by examining the implications of motherhood and fatherhood for wages of women and men in the Federal Republic of Germany between 2005 and 2015.

Results uncover inequalities among women and men in terms of parenthood wage effects and recognize the difference in trends exhibited by women and by men in terms of weekly working hours after the event of giving birth as the main driver of such a distinct impact of parenthood on wage.

Moreover, the study takes a step further and investigates additional possible correlations between educational background and motherhood wage gaps by exploiting, for the first time, the difference between having a vocational or a general background, as one of the key factors to help to shed light on the motherhood wage gap. In particular, the chapter relies on the previous literature that has recognized vocational skills as those skills more subject to obsolescence over time if compared to those more concept-based skills acquired following a general path and less adaptable to change in a work environment (Weber, 2014, Hanushek et al., 2017). Following this line of thought and given

that the event of motherhood entails women to change their labour market behaviour and to face career interruption that, consequently, leads to human capital depreciation, I expect women with a vocational background to exhibit a different magnitude in terms of motherhood wage gap if compared with those women with a general qualification as highest one. Results support the main hypothesis and report a wider motherhood wage penalty for women with a vocational background if compared to those having a general background, consistent with the hypothesis that a birth-related absence from the labour market will cost more in terms of human capital loss.

1.3.3. A brief overview of Chapter 4

Chapter 4 attempts to exploit another crucial driver of the gender wage gap, that is gender occupational segregation. The chapter contributes to the literature on the gender wage gap by providing a deeper understanding of it by examining the location of women's earnings relative to their position in men's wage distributions across education and occupation types.

In particular, by drawing upon data from the British Labour Force Survey, the study uncovers gender inequality in terms of hourly wages, providing an analysis of women's wages relative to men's wages across the entire wage distribution. Findings clearly show women being overrepresented below the 20^{th} percentile of the male wage distribution and also report a lower women's relative density if compared to the ones of the male subsamples from the 80^{th} percentile upward.

The chapter builds up from these baseline results and provides new evidence of the impact of gender occupational segregation on the gender distributional wage gap. In particular, the study recognizes three broad occupation types, that is male-dominated, mixed and female-dominated occupations, and analyses the relative distribution of women's wages across the abovementioned occupation types characterized by a different extent of female participation. Results reveal that the higher the occupational extent of female participation, the higher the chance for women of being underrepresented at the top of the relative wage distribution, with a consequently higher risk of facing a significant glass ceiling effect.

Further, the chapter concludes by providing an answer to the following research question: does the educational background impact gender distributional wage differences across occupation types? Once again, the chapter exploits the different implications of having a vocational versus a general education background and the way in which the educational background may affect women's relative wage distribution. Results confirm the crucial role played by the educational background in determining women's position in men's wage distribution. While women with a vocational background are shown to be worse off in terms of relative wages in male-dominated and mixed occupations from the 80th percentile upward, women with a general background end up facing their lowest glass ceiling effect in male-dominated occupations.

The chapter concludes with the implementation of a grade of transformation approach to examine the impact of background, family and job characteristics, and educational attainments on the size of the wage gap over the pay distribution.

CHAPTER 2

2. Does the education type and the educational orientation of the country impact the gender wage gap?

2.1. Introduction

Using microdata from the Programme for the International Assessment of Adult Competencies (PIAAC), this chapter demonstrates the existence of strong life-cycle effects on hourly wages of education type (vocational vs general). The chapter contributes to the gender wage gap literature by providing evidence on the differences in age-wage profiles between women and men. These are shown to be dependent on the education types and educational orientation of the country.

Data from the OECD (2022b) reveal that men are typically paid significantly more than women and provide evidence of the significant variation of the gender wage gap phenomenon across countries (Figure A.1). The gender gap in median earnings varies from 34% in South Korea to 3% in Bulgaria. East Asian OECD countries (Japan and Korea), Israel, Latvia and the United States show the widest gender pay gaps. A variety of OECD countries, including Western European countries (Belgium and France), Southern European countries (Romania and Bulgaria), and Nordic European countries (Denmark and Norway) have the narrowest gender pay gaps if compared with the gender wage gap computed on average across all the OECD countries. In some cases (such as Italy and Greece) small gender pay gaps are likely to be due to "selection effects". Indeed, given the existence of a strong correlation between female labour force participation and the gender wage gap, the low rates of female participation in those countries artificially increase female median earnings. Consequently, if employed women tend to be only those who have a relatively higher wage, then the lower the female participation rate in the labour market, the lower the registered gender pay gap (Olivetti and

Petrongolo, 2008). In some other countries (such as Belgium, Denmark, and Norway) the narrow gap is the consequence of a compressed wage structure and low levels of earnings inequality.

Nevertheless, data from the OECD also depict that between 2008 and 2020, the gender gap in median earnings decreased in almost all the countries. Improvements were the largest in the United Kingdom, Korea, Canada and the United States.

Given the persistent existence of the gender wage gap phenomenon, this chapter aims to contribute to the literature on three different levels.

First, it builds on the previous literature by providing evidence on the differences in terms of the rate of return to education of two different types of qualifications, that is vocational versus general qualifications.

Previous studies have provided evidence of the impact of vocational education on several labour market outcomes, focusing mainly on employment (Hanushek et al., 2017, Hampf and Woessmann, 2017) and school-to-work transition (Ryan, 2001, Wolter and Ryan, 2011, Hanushek et al., 2017). The literature has agreed that while holding a vocational qualification enhances the probability of being employed at the early career stage providing ready-to-use skills, this advantage comes at the cost that the skills acquired through a vocational path can become easily obsolete. Thus, the early advantage of studying for vocational qualifications turns into a later drawback; that is, lower employment prospects later in life. The trade-off between early advantages and late disadvantages of vocational versus general education has been exploited also in terms of returns to education. For instance, by using Swedish data, Golsteyn and Stenberg (2017), have found that vocational qualifications yield an initial relative earnings advantage that changes into a disadvantage after approximately 10 years in the labour market. Similar conclusions are reached by Brunello and Rocco (2017) for the UK and by Cörvers et al. (2011) for Germany and Netherlands. Dearden et al. (2002) observed that general education yields higher returns, but also provide evidence that the premia from vocational qualifications are significantly higher for low achieving school leavers.

Following the abovementioned, this chapter provides evidence on the existence of early advantages and late disadvantages in terms of hourly wages for individuals with vocational education, by providing a direct comparison of the returns to vocational and general education by age and gender using, for the first time, a comparable sample of 19 countries.

To handle concerns related to the possibility that results are driven by unobservable characteristics this chapter applies a similar framework to the one implemented by Hanushek et al. (2017) and Hampf and Woessmann (2017) by controlling for a rich set of variables considered to be good predictors of choice of education type. Moreover, several robustenss check will be implemented.

Recognizing the importance of understanding the reason behind the ongoing phenomenon of the gender wage gap, this chapter takes a step further and exploits the demonstrated difference between vocational and general qualifications to analyse whether educational background may have an impact on the size of the gender wage gap.

Previous literature has analysed the impact of school content on gender differences in adult wages (Angle and Wissmann, 1981, Brown and Corcoran, 1997) showing that income differences between women and men are strongly related to the differences in the content of schooling. Indeed, even though women have been outperforming men in terms of years of schooling, education is still a key variable in explaining the gender wage gap due to the fact that women are likely to select different majors and areas of specialization if compared to men (Chevalier, 2002, Charles and Bradley, 2009, Vaarmets, 2018).

This chapter is unique in using the difference in terms of vocational versus general education to help shed light on the phenomenon of the gender wage gap.

Results provide clear evidence of the existence of gender differences in terms of age-wage profiles among individuals holding either a general or a vocational qualification as their highest qualification. In particular, the age-wage profile for women holding a general qualification is, on average, less steep

than the one reported by men having the same background. The difference in terms of the rate of change in wages for an additional year in age is instead not significant if the comparison is implemented among people with a vocational background.

Finally, the chapter contributes to the literature by introducing into the gender analysis another unique key variable, that is the orientation of the country's educational system, with the aim of examining the impact of the latter on the gender wage gap. In particular, using the Education at a Glance (EAG) classification (OECD, 1999, OECD, 2009, OECD, 2010, OECD, 2015), the 19 countries considered in this study are classified as either general education-oriented or vocational education-oriented countries according to the proportion of vocational and general education of their educational systems.

Once the education orientation of the countries' educational system is taken into account, the age-wage profile relationship is seen to differ between general and vocational orientated countries. While differences in terms of the age-wage relationship between men and women with a vocational background are found to be not statistically significant in general oriented countries and equal to only 0.1 percentage point in vocational-oriented countries ; women with a general qualification as the highest one show a steeper slope, in terms of age-wage profile, in vocational oriented countries if compared to men with the same educational background. A gender gap in terms of age-wage profile equal to 0.4 percentage points is instead reported if the comparison is made among individual with a vocational background working in a general-oriented country.

The chapter proceeds as follows. Section 2 gives an overview of the literature, by exploiting the gender wage gap phenomenon through a human capital approach. Section 3 gives a description of the dataset used in this analysis and some descriptive results. Section 4 provides details concerning the identification strategy adopted. Finally, Section 5 presents the results of the analysis, and Section 6 concludes.

2.2. Literature review

The gender wage gap has been a long-standing issue in political discussion as well as the subject of empirical analysis and for a good reason: it would be deeply unjust if women are systematically underpaid relative to men.

Scholars' efforts to comprehend gender differences in wages have conventionally rested on two pillars, namely, the human capital theory and the labour market discrimination theory, considered gender-specific explanations of the gender wage gap.

In this section, I do not aim to deliver a complete overview of the literature, but rather to highlight papers and concepts that are particularly pertinent to my research, focusing solely on one of the main drivers of the gender wage gap, that is gender differences in education through a human capital approach.

The human capital approach aims to explain the demand for education and on-the-job training in terms of its production and utility benefits and offers the major supply-side elucidation for gender differences in economic outcomes. The rationale behind the human capital model is simple: women's and men's earnings depend on productivity which in turn is affected by human capital; the latter can be boosted through investments in the form of education, off-the-job training, and on-the-job training. In other words, this approach sees education as a type of investment. From the individual viewpoint, the investment in education is profitable if it increases future income by more than the cost of those years of education. The costs considered in the model are usually both direct costs of education (fees) and the opportunity cost of education, thus what the individual could have earned during the time he spent in education.

Consequently, following this line of thought, the gender-specific factors which could explain the gender wage gap consist of gender differences in terms of schooling and general education, off-the-job training and on-the-job training, and work experience.

Earlier studies have shown that differences in the quantity of schooling were able to explain a sizable part of the gender wage gap in the past (Duncan and Corcoran, 1984, Card and Krueger, 1992) by considering parental economic resources (Becker, 1975a, Stromquist, 1989), women's aspirations (Goldin, 1995) and distance from school (Jacobs, 1996) as the main factors to exploit in order to explain the gap in years of schooling between women and men.

Nevertheless, over recent decades, women have made considerable gains in terms of years of schooling and now they normally outperform men on several key educational benchmarks (DiPrete and Buchmann, 2013). According to (Blau and Kahn, 2017), for instance, in the United States between 1971 and 2011, there were significant changes in women's educational attainment. In 2011 women made up 57 per cent of the total number of bachelor's degrees, against 43 per cent in 1971; 61 per cent of master's degrees against 40 per cent in 1971; and 51 per cent of PhDs against 14 per cent in 1971.

The reasons why women have not only reached but overtaken men in terms of years of education achieved are still not clear but both pecuniary and non-pecuniary factors have been exploited by the literature as potential drivers for such divergence in trend. (Blau and Kahn, 2017). First, the increasing labour force participation of women has made investments in higher education more fruitful in terms of future returns. Therefore, women were found more likely to enrol in higher education with a consequent reduction of the gender gap in terms of educational achievements. Nevertheless, the introduction of new anti-discrimination laws, aimed at securing civil rights and gender equality, has facilitated women's entry into higher-paying jobs and has led to an increase in women's attendance in higher education. The introduction of the contraceptive pill has also been recognized as one of the factors having a significant impact on women's lives by enabling them to pursue professional training after college, and delaying marriage and childbearing (Goldin and Katz, 2002, Bailey, 2006). Finally, the strength of biases due to gender stereotyping and moral and socially accepted gender roles have

been changing over time with women acquiring more credibility in terms of perceived ability (Eagly et al., 2020, Bhatia and Bhatia, 2021).

However, despite the increasing number of women participating in higher education, several studies show that the earning differences between women and men still persist. Ono (2001), for instance, shows that the wages of women graduates in the United States only match those of male high school graduates. Results could be partially explained by gender differences in educational choices, where women are found to choose strongly different patterns compared to men (Polachek, 1981).

However, differences in the qualifications achieved and more specifically in the subject area have not been fully explored due to the lack of such specific data.

According to Brown and Corcoran (1997), several factors could help explain how gender differences in terms of subject areas might affect the magnitude of the gender wage gap. First, some majors may help to build up more valuable job-related skills than do other courses. In addition, variation in terms of school content might arise from differences in students' abilities or preferences, and the latter, consequently, may have an impact on wages. Finally, the presence of labour market discrimination, which leads women to not achieve the same payoff gained by men from the same type of human capital investment, could be anticipated by women who are then more likely to select different educational patterns if compared to men.

Previous researchers indicate a quite homogenous pattern in terms of gender educational segregation across western countries (Chevalier, 2002, Charles and Bradley, 2009, Vaarmets, 2018) with women being more segregated in fields offering a less bright outlook in terms of future wages and unemployment rates. Indeed, while women focus more on Languages, Humanities and Social Sciences studies, men prefer Physics, Engineering and Mathematics. However, subjects such as Language and Humanities are associated with lower grades (McNabb et al., 2002), a higher risk of unemployment, over-education and rather lower pay than Physics, Engineering and Mathematics.

Machin and Puhani (2003), in accordance with Gerhart (1990) and Daymont and Andrisani (1984) and also highlight the importance of considering differences in the subject area in models analysing the gender wage gap. Evidence suggests that controlling for the subject area of degree helps in explaining a sizable part of wage differences. Machin and Puhani (2002), for instance, find that both in the United Kingdom and in Germany, the subject area of degree can account, ceteris paribus, from 2 to 4 percentage points of the gender wage gap. Chevalier (2002) shows that gender differences in the choice of university subject account for 6 to 17 percentage points of the pay differential.

Even if the type of education women receive has changed over time, and college majors/ degree subjects are considerably less segregated than in the past (Blau et al., 2013), gender segregation in education can still be considered an issue, with women still lagging in science, technology, engineering and mathematics (STEM) fields (Blau and Kahn, 2017).

Similar studies have been conducted on the gender pay gap among people holding a vocational qualification. Kunze (2003, 2005) for instance, has found an entry gender wage differential in the raw data of 22 percentage points, which stays constant through the first 8 years in the labour market. Taking a human capital theory approach, the author points out that the gender differences in terms of entry wages are mainly due to the larger human capital endowment of men compared to women. Even though the quantity of general education and vocational training acquired by women and men appear to be similar, Kunze finds a remarkable difference in the subject area of occupational qualification chosen: while women are found to be more qualified in services (e.g. professional clerical worker or receptionist), men are more inclined to enrol in apprenticeships in manufacturing (e.g. motor vehicle mechanic or electrician). Following the same line, Firzenberger and Kunze (2005) show that skilled women and men are trained in a quite different way, with men being trained for mechanical and technical occupations or occupations related to construction, and women being trained for administrative, sales and other service occupations. They depict a larger gender wage gap at the bottom of the income distribution and lower occupational mobility for women compared to men.

Cavaglia et al. (2018) confirm those findings by providing evidence that there is a large variability in the earning differentials by occupational categories and that this has significant consequences on the gender wage gap given the different educational choices in terms of subject area made by men and women.

Consequently, a central area of investigation should be the understanding of the existence of gender differences in subject areas. In particular, a crucial question is whether the latter might be affected by gender differences in preferences, or by inequality of access to education (e.g., pre-labour market discrimination).

Previous studies have analysed gender differences in educational attainments by focusing on the factors which could potentially influence the educational choices of women and men. Averett and Burton (1996) and Montmarquette et al. (2002) show that men care more about the future return from education compared to women, and thus they are more likely to be found studying subjects that have lower odds of graduating but that offer the prospect of higher future incomes. Women, instead, are less likely to take into consideration future income in the choice of the subject area to study since they expect work interruptions due to childrearing responsibilities. They are also found to be more risk-averse and more likely to choose subjects with the highest likelihood of graduation and for which they have the greatest affinity.

Besides, gender differences in educational attainment are strictly connected with gender differences in terms of occupational choices. Indeed, women appear to be more oriented towards more family-oriented jobs, part-time jobs and jobs with fewer responsibilities and, in general, towards jobs that allow them to achieve a work-family balance (Chevalier, 2002, Nielsen et al., 2004, Amuedo-Dorantes and Kimmel, 2008b, Amuedo-Dorantes and Kimmel, 2008a).

In conclusion, there are good reasons to believe that differences in the type of degree achieved may explain an important part of the gender wage gap. As mentioned above, while acknowledging the data limitation, the literature has made an effort to investigate gender differences in subject area

within general and vocational paths. This chapter aims to contribute to the literature showing that the nature of the highest qualification achieved can have a strong impact on the size of the gender wage gap. In particular, the present study is going to build upon the previous literature by investigating three main research questions:

HP1: How does the relationship between the age and wage of workers vary by education type (vocational vs general)?

HP2: Does the age-wage profile differ by gender between those individuals with a vocational qualification and those with a general qualification as their highest qualification?

HP3: Does the age-wage profile differ by gender between those individuals with a vocational qualification and those with a general qualification as their highest qualification according to the orientation of the educational system of the country?

2.3. Data

The primary data source used in this analysis is PIAAC, a worldwide study developed by the Organization for Economic Co-operation and Development (OECD) with the aim of assessing the skills of a representative sample of adults in each participating country and providing internationally comparable data. In a world where policymakers are becoming ever more concerned about the importance of human capital and the usefulness of the skills to sustain productivity and social cohesion, PIAAC aims to provide policymakers with policy implementation guidelines that support employment creation, sustainable long-term growth and more equally distributed income and opportunities.

The Survey is administered every 10 years and has had heretofore two cycles (Table A1). The First Cycle consists of three rounds of data collection, between 2011 and 2018. In 2018, the Second Cycle of the Survey began, with results for this cycle to be published in 2024. This chapter is going to focus

on the first round-first cycle data, collected between August 2011 and March 2012[2] which comprises a sample of approximately 5,000 individuals per country, aged 16 to 65 years old. Around 166,000 adults throughout the world participated in the survey. Participating countries developed sample design and collection plans while respecting the guidelines provided in the PIAAC Technical Standards and Guidelines.

There are two main components of the PIAAC study: the background questionnaire and the direct assessment. The direct assessment component of PIAAC evaluates the skills of adults in three fundamental domains: literacy and numeracy, which are either paper or computer-based assessments, and problem-solving in technology-rich environments (PSTRE), which is only a computer-based assessment. These skills are defined as key information-processing competencies. In other words, they are considered essential skills to understand and analyse text-based and mathematical information and as necessary skills to contribute actively to society. The tasks respondents had to answer were often framed as real-world problems, such as booking a meeting room on a particular date using a reservation system (problem-solving domain) or maintaining a driver's logbook (numeracy domain).

Literacy is defined as "understanding, evaluating, using and engaging with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential" (Desjardins et al. 2013, p.59). Thus, according to this definition, literacy includes the ability to understand, interpret and decode simple and complex texts. However, it does not refer to the capacity to produce a text (writing skills) (Kankaraš et al., 2016). This is due to the fact that it was difficult to assess writing impartially and reliably across countries.

Numeracy is described as "the ability to access, use, interpret and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life" (Desjardins et al. 2013, p.59). Numeracy and literacy skills are strictly

[2] Exceptions are Canada (November 2011–June 2012) and France (September–November 2012).

connected to each other: when mathematical expressions include written texts, having good literacy skills helps to improve arithmetical performances and numerate behaviour (Kankaraš et al., 2016).

Finally, problem-solving in technology-rich environments is interpreted as "using digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks" (Desjardins et al. 2013, p.59). Problem-solving skills are especially required in working environments where employees have to deal with information and communications technology and need to use computer-based artefacts (Kankaraš et al., 2016).

PIAAC aims to contribute towards understanding factors that can enable skills improvements, their distributions within certain subgroups by age and across countries and the relationship between skills and other social outcomes. For that reason, before the skills assessment, all participants responded to a background questionnaire. The background questionnaire gathers a rich set of information related to:

- Demographic characteristics and background of respondents (e.g. respondents' number of children, highest level of education for both mother and father of the respondents, country of origin, number of books at home, first language);
- Educational attainment and participation in learning activities (e.g. highest level of educational attainment, field of study, current qualification, uncompleted qualification, formal qualification, work experience, participation in activities such as on the job training, seminars and workshops);
- Labour force status, work history and job characteristics (e.g., industry, occupation, establishment size, employee or self-employed type of contract, gross wage or salary, earnings from the business, usual working hours);
- Social participation and health (e.g. trust in others, perception of others' behaviour towards self, the influence of political process, frequency of voluntary work and self-assessed health status);

- Use of skills (e.g., skills used during work, during everyday life, learning strategies);

With regards to the information related to the educational background of the respondents, cross-national educational attainment levels are likely to be interpreted differently by respondents in different countries depending on the features of their educational systems. Consequently, a coding system for educational attainments was very much needed. In PIAAC, a coding scheme closely related to the implementation of International Standard Classification of Education[3] (ISCED) 97 in the European Union Labor Force Survey (EU-LFS) until 2013 was used (variable name B_Q01a) (Schneider, 2018). Table A.2 explains how each level of the variable "B_Q01a", defined as "Education – Highest qualification – Level" corresponds to a level of ISCED.

To summarize, PIAAC is the most suited database for this analysis due to the rich set of information provided. As above-mentioned, PIAAC not only provides an evaluation of the skills of adults in three fundamental domains, that is literacy, numeracy and problem-solving skills for 24 countries, but it also provides, through the background questionnaire, a rich set of information related to demographic characteristics, the background of the respondents, educational attainment, labour force status, social participation, health and use of skills. Most importantly, for individuals who have undertaken secondary education, PIAAC provides a variable "Vet", which categorizes the highest qualification achieved by each respondent as a vocational qualification or a general qualification.

2.3.1. The sample

This chapter takes into consideration employed individuals, aged 16 to 65, who are not currently studying and are resident in one of the following 19 countries[4]: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland,

[3] ISCED is a statistical framework for organizing information on education implemented by the United Nations Educational, Scientific and Cultural Organization (UNESCO). The world's education systems vary widely in terms of structure and curricular content. Thus, it can be challenging to compare different national education systems across several countries. ISCED is a crucial tool for elaborating and interpreting cross-nationally comparable education statistics. The classification was initially developed in the 1970s and revised in 1997. The second main revision was made with the introduction of ISCED 2011, adopted by the UNESCO General Conference in November 2011.

4 In order to merge the different databases, I use the IEA (International Association for the Evaluation of Educational Achievement) IDB (International Database) Analyzer. The latter is a tool used to combine and analyse data from all IEA's large-scale assessments, as well as analyse data from the major large-scale assessment surveys.

Slovak Republic, Spain, Sweden, United Kingdom, United States.

Following the seminal article by Gronau (1974), it is now well-established that wage analysis suffers from a fundamental problem; namely, selection into employment. Since there are no observable market wages for unemployed individuals, any analysis will be restricted to the subsample of the population that is employed. Using the latter to make inferences on the entire population will lead to inconsistent estimation due to the problem of selection bias. By considering only employed individuals who are not currently studying, any variable that influences the status of "wage-earner" could be potentially correlated with the error term[5]. Therefore, the results achieved in this study are only applicable for people who are in employment.

As abovementioned, this paper considers only the First Cycle - First Round of PIAAC. From the 24 countries included in the First Round, I exclude from the sample the following countries:

- Australia, whose data are not available in the Public Use File;
- Russian Federation, whose data, according to OECD (2013), are only preliminary and not representative of the whole Russian population given that they do not comprise information concerning the population of the Moscow municipal area;
- Belgium, Italy and Cyprus since the information, provided by national project managers, is not enough to detect whether the highest qualification is a vocational or a general one.

Finally, the study does not include in the estimated sample individuals whose highest level of education is lower than ISCED level 3. Only in a few countries do vocational studies start before high school, hence at ISCED level 2. In the majority of the countries considered, vocational paths start at ISCED level 3 (upper secondary education) and continue in post-secondary (ISCED 4) and tertiary education (ISCED 5B) (Brunello and Rocco, 2015). Table 2.1 summarises the number of observations

[5] This chapter will not address the abovementioned problem due to data limitation that do not allow for the implementation of a valid instrument.

in the sample following the exclusion of these individuals.

Table 2.1 Sample size summary

	Sample size (obs)
Original	153,675
Drop: Individuals with ISCED 1 ISCED 2 as the highest qualification and no formal qualification, individuals who are currently studying	47,197
Drop: Belgium, Cyprus, Italy	9,040
Drop: individuals who are not employed and with missing values for the key variable	22,799
Total sample size after drops	**74,639**

Note: Australia and Russian Federation are also not considered in the analysis as data were, respectively, not available and only preliminary. The final samples is made up of individuals, aged 16 to 65, not currently studying and resident in one of the following countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, United States.

2.3.2. Variables

DEPENDENT VARIABLE

The dependent variable considered in this study is the natural logarithm of the individual's hourly wage. This variable is available in the Public Use File of each country[6]. However, in the Public Use File, earnings data for Austria, Canada, Germany, Sweden and the United States are only stated in deciles. For Germany, I obtained access to the Scientific Use File from the national data centre (GESIS) which offers continuous wage information. For the other four countries, following the methodology adopted by Hanushek et al. (2015), I used information on the median wage of each decile, in order to attribute the decile median to each survey respondent belonging to the specific decile of the country-specific wage distribution. In each country, I trim the bottom and the top one per cent of the wage distribution to limit the influence of outliners.

6 The variable is derived by the Consortium Member ROA (The Research Centre for Education and the Labour Market). In particular, the gross earnings of respondents were measured through a separate set of questions asked to each participant of the survey. Participants who were unable or not willing to state earnings had the opportunity to report earnings in broad categories. Based on assumptions on the earnings distribution, the answers to all these questions were combined into an overall measure of hourly and monthly earnings adjusted for hours worked. Gross earnings are defined as "pay before deductions for tax, national insurance (social security contributions), including any regular overtime pay, regular bonuses, tips, and commissions, excluding annual bonuses" (OECD,2011). The following questions were asked to each respondent in order to estimate the gross earnings: How much would you estimate your usual gross pay per hour/day/week/two weeks/month/year is? In addition to your usual pay, do you receive any other payments related to this job, such as annual bonuses e.g., a 13th month or holiday pay? How much would you estimate these additional payments were last year in terms of gross payment?

KEY VARIABLES

Apart from a continuous variable for age[7] and a dummy variable to account for the gender of the respondent two other dummy variables are considered essential in this study: one that indicates whether the highest qualification achieved by each respondent is a vocational or a general qualification, the other to specify if the country of residence of the respondent is vocational or general-oriented.

Vocational or general qualification

For individuals with secondary education, PIAAC provides a variable "Vet", a dummy variable that takes the value of one if the respondent's highest level of education obtained is vocational oriented, zero otherwise. For individuals with tertiary education, instead, this study follows the approach implemented by Hampf and Woessmann (2017), Hanushek et al. (2017), and Brunello and Rocco (2017) in classifying ISCED 5A programs (largely theory-based programs designed to provide qualifications for entry to advanced research programs and professions with high skill requirements) as general. On the contrary, ISCED 5B qualifications (more practical and occupational specific) are considered vocational.

Vocational and general-oriented country

In line with the approach used by Hanushek et al. (2017) and Hampf and Woessmann (2017)[8], this study classifies the 19 countries considered in this analysis into different categories using both information from the PIAAC sample and the statistics from OECD's Education at a Glance (EAG) (Table 2.2). The latter provides a good source of information with regards to each country's educational system with particular focus on the share of vocational and general programs available.

[7] Since countries like Austria, Canada and United Stated missed information related to the age of the respondent, in order to derive this variable, I use the midpoints of age groups in 5-year intervals based on LFS (Labour Force Survey) groupings. Moreover, this study uses a centred value of Age derived by subtracting the mean age from all the observations related to age in the dataset such that the new mean age is zero. The aim is to reduce multicollinearity problems due to the inclusion of a product term in the regression.

[8] Hanushek et al. (2017) use data from the EAG 1996 (OECD, 1999), and EAG 2007 (OECD, 2009), to classify countries considered in the 1994-1998 International Adult Literacy Survey (IALS) data; Hampf and Woessmann (2017) use information from the EAG 2008 (OECD, 2010) for countries included in the first round-first cycle of PIAAC.

In particular, the study is going to use the newly available information from EAG 2008 (OECD, 2010) and EAG 2013 (OECD, 2015) to fully consider the years in which the data from the first round-first cycle of PIAAC were collected. However, a robustness check, using indicators of the previous educational country-setting, hence EAG 1996 and EAG 2007, will also be provided in the results section.

In line with the approach adopted by Hanushek et al. (2017), the study defines vocational-oriented countries as those countries whose vocational educational share is at least 40% in PIAAC and at least 50% in EAG in 2008 or 2013. The countries whose shares are below those thresholds are instead considered general-oriented counties. According to this rule, I consider Canada, Denmark, Estonia, France, Ireland, Japan, Korea, Poland, Spain, Sweden United Kingdom, and the United States as "non-vocational countries". Within the remaining group of "vocational countries", I distinguish three subgroups:

- "Apprenticeship-based countries" with a share of combined school and work-based vocational programs that exceed 40% in both 2008 and 2013 EAG (Germany);
- "Non-school-based vocational countries" with a share of at least 25% in combined school and work-based programs in either 2008 or 2013 EAG (Austria, Czech Republic, Slovak Republic);
- "School-based vocational countries", which includes the remaining countries (Finland, Netherlands, Norway).

Along the above lines, I create a dummy variable that takes value one if the country is vocational-oriented, zero otherwise.

Moreover, I generate a categorical variable which takes a value of 0 if the country is general-oriented, 1 if it is a non-school based vocational country, 2 if it is a school-based vocational country and 3 if it is an apprenticeship-based country. Table 2.2 summarizes the abovementioned classification.

Table 2.2 Upper secondary education by Program Orientation

	PIAAC	OECD (EAG) 2008		OECD (EAG) 2013			
	Vocational	**Vocational**	**Combined school and work-based**	**Vocational**	**Combined school and work-based**	**VET/NO VET**	**CLASSIFICATION**
Austria	77.4	70.8	35.0	70	34	VOCATIONAL	NO-SCHOOL-BASED
Canada	38.0	5.3	-	-	-	GENERAL	GENERAL
Czech Republic	75.7	74.2	33.1	74	7	VOCATIONAL	NO-SCHOOL-BASED
Denmark	62.0	48.0	47.5	43	43	GENERAL	GENERAL
Estonia	45.5	32.0	0.4	34	0	GENERAL	GENERAL
Finland	62.6	67.9	13.4	70	11	VOCATIONAL	SCHOOL-BASED
France	59.0	44.2	12.4	43	12	GENERAL	GENERAL
Germany	72.7	57.5	42.8	48	41	VOCATIONAL	APPRENTICESHIP
Ireland	45.1	2.1	2.1	1	-	GENERAL	GENERAL
Japan	40.0	23.1	-	23	-	GENERAL	GENERAL
Korea	42.1	25.5	-	18	-	GENERAL	GENERAL
Netherlands	46.2	67.1	20.2	67	-	VOCATIONAL	SCHOOL-BASED
Norway	45.4	55.1	15.9	52	15	VOCATIONAL	SCHOOL-BASED
Poland	58.0	46.2	5.5	49	7	GENERAL	GENERAL
Slovak Republic	41.0	72.3	28.6	68	5	VOCATIONAL	NO-SCHOOL-BASED
Spain	24.1	43.8	1.8	34	-	GENERAL	GENERAL
Sweden	36.1	55.7	-	47	1	GENERAL	GENERAL
United Kingdom	22.2	31.4	-	44	25	GENERAL	GENERAL
United States	18.4	-	-	-	-	GENERAL	GENERAL

Note: Data for OECD 2008 and 2013 are from the 2010 and 2015 versions of the OECD Education at a Glance, Chapter C. The PIAAC data are calculated from all individuals who have completed an upper secondary education and are not currently enrolled in school.

CONTROL VARIABLES

The PIAAC dataset offers a rich set of information concerning individuals and their households. This information will be used to control for several exogenous factors to enable a ceteris paribus estimation of the link between hourly wage, gender, education type of the highest qualification achieved, and the orientation of each country's educational system. Table A.3 provides a full list and a detailed description of each control variable considered in this study.

First, in order to account for the possible time-varying selection of individuals with differing abilities into different education types, the study controls for the individual skills observed in PIAAC. Since PIAAC reports that many people were excluded from problem-solving in a technology-rich environment due to their lack of computer skills and given the high correlation between literacy and numeracy skills[9], this chapter will only use the information related to numeracy skills scores as a

[9] Numeracy and literacy skills correlation is found to be above 80 percent for all the countries considered in this study.

control variable. Moreover, it is important to highlight that previous studies have shown that quantitative ability is found to have a significant effect on the individual's earnings. Dearden et al. (2000), for instance, provide evidence, by using the UK National Child Development Study and International Adult Literacy Survey data sets, that once controlling for education, numeracy has a positive and significant effect on earnings. The same results were also achieved by Blackburn and Neumark (1993) and Murnane et al. (1995).

PIAAC measures each skills domain on a 500-point scale. Following Hanushek et al.'s (2015) approach, I standardize scores to have a within-country mean of zero and a within-country standard deviation of one as this overcomes issues arising from the comparison across time and within countries of skills that might be changing:

$$Numeracy\ score\ plausible\ value: \frac{NumeracyScore_i - \mu}{\sigma}$$

where μ is the mean of all the plausible values[10] included in PIAAC and σ is the standard deviation.

The study will also control for the highest-level qualification held by each respondent by categorizing it into five education variables, namely, University Qualification, Professional Qualification, Post-Secondary Qualification, Upper Secondary Qualification, Lower Secondary Qualification.

Given the critical impact of family background on shaping children's economic outcomes and, consequently, on gender inequalities, the study considers mothers' and fathers' highest educational level as conflating factors that should be included in the set of covariates considered. In particular, the educational categories considered include Primary/Lower Secondary Qualification, Upper/Post-Secondary Qualification and University Qualification. An additional category capturing missing information on parents' education is also included. It is important to mention that by including a

[10] PIAAC provides scores in three different domains: literacy, numeracy and problem solving in technology-rich environments. Those domains are described by ten plausible variables. The combined use of the plausible variables allows for unbiased estimation of individual's literacy, numeracy and problem-solving score. Plausible values are statistical means that summarize for each domain how well each respondent answered a subset of questions of the assessment related to a particular domain and how well respondents sharing a similar background answered the rest of the questions of the domain assessment.

dummy variable for each of the abovementioned qualifications it is possible to control for some of the characteristics that may depict selection into either vocational or general qualifications (Hanushek et al., 2015). Following the same line of thought, the number of books at home when the respondent was 15 years old is also included in the vector of covariates considered (Hampf and Woessmann, 2017).

Finally, in order to take into account the impact of parenthood on the wages of both mothers (Budig and England, 2001, Gangl and Ziefle, 2009, Grimshaw and Rubery, 2015) and fathers (Trappe and Rosenfeld, 2000, Meurs et al., 2010), a dummy variable for children is included in the model to control for the differential effect of having children on wages for both men and women.

2.3.3. Summary statistics

Tables A.4 and A.5 provide some descriptive statistics of the main variables in our analysis for the sample of 19 countries considered, both for women and men.

From the comparison between the sampled women and men (Table A.4 and Table A.5 - Panel 1), it is clear that men, on average, have higher hourly wages if compared with women, with the latter showing a lower mean in terms of hourly wages, independently from their educational background. The raw gender wage gap, however, is even wider when the comparison is made among people holding a general qualification.

In terms of skills analysed through the direct assessment component of PIAAC, while men and women have a very close average score for literacy skills, men do better in both numeracy and problem-solving tests, even though women show a slightly higher average in years of education.

In line with the literature, the first panel also reveals another important preliminary result, strictly connected with our first research question: people holding a general qualification as their highest qualification have, on average, a higher hourly wage if compared to people with a vocational background. Studying for a general qualification rather than a vocational one leads the individual to

be enrolled, on average, for more years in school (Panel 3) and to achieve higher scores, on average, in literacy, numeracy, and problem-solving tests (Panel 4, 5 and 6).

2.4. Methodology

The baseline model implemented in this chapter analyses the effect of education type on the hourly wage over the lifecycle within each country and can be described as follows:

$$lny_i = \alpha_0^1 + \alpha_1^1 Age_i + \alpha_2^1 Vet_i + \alpha_3^1 Female_i + \alpha_4^1 Vet_c + \beta_1^1 Vet_i * Age_i + \gamma^1 X_i + \mu_c^1 + \varepsilon_i^1 \quad 1)$$

where y_i is the hourly wage of individual i, Vet_i is an indicator for vocational (as opposed to general) education type at the individual level; Age_i is a continuous variable for age, X_i is a vector of control variables that might affect the dependent variable; μ_c are country-groups fixed effects that aim to control for the overall country differences; ε_i is a random error term. The log-linear relationship between wages and human capital is justified by the investment paradigm developed by Mincer (1974).

The model implemented in this chapter is an interaction model that explores the different layers of intersectionality in which the gender wage gap may lie at the individual level taking into consideration the different educational background of the sample of women and men considered and at the country level while considering the different educational systems adopted in the countries analyzed in the sample.

The main coefficient of interest is β_1 (Equation 1), which captures the differential effect of having a vocational relative to general education on the hourly wage, with each year of age, or equivalently the difference in the age effect (i.e. the slope of the age-earnings profile) between those with general and vocational qualifications. In order to rule out the possibility that the results are driven by unobservables, the model will control for a rich set of variables including, importantly, numeracy score, respondents' education level, parents' education level, the number of books at home when the respondent was 15 years old and a dummy variable for children. Those variables can be considered

as good predictors of choice of education type as demonstrated by Hanushek et al. (2016) and Hampf and Woessmann (2017). In particular, individuals with higher numeracy/literacy score and more books at home at the age of 15 are found to have a higher likelihood of enrolling into general education programs. Moreover, several robustness checks are implemented.

As mentioned above, the model also includes country-group fixed effects[11] By including country-group fixed effects the model is controlling for the average differences across countries-groups in any observable or unobservable predictors that remain constant over time. The inclusion of country-groups fixed effects will also deal with differences in terms of the country-groups' institutional structures for example taxes and transfers. Given the little within-country variation, the country-group fixed effects will pick up these differences and control for them.

The second model implemented considers a triple interaction term and aims to better understand

[11] In order to group countries in a way that will capture the diverse and unique institutional context of the countries included in this analysis, the latter relies on the framework adopted by Hall and Soskice (2001) and the subsequent literature. The above-mentioned framework considers the adaptation of two different approaches, also known as Varieties of Capitalism (VOC) framework and the National Business System (NBS) framework. While the first attempts to understand how economic activity is organized among capital, management, and labour within advanced economies, the second takes into consideration the nature of the educational system, the labour market, the financial market, and the role of the state of the economy (Fainshmidt et al., 2018). By combining those two approaches and while taking into account the geographical location of each country, this chapter defines seven different country groups:

- Market-based: composed of Canada and the USA
- Market-based - British Isles: which comprises the United Kingdom and Ireland
- Coordinated Market Economies - Scandinavian countries: composed of Denmark, Finland, Norway and Sweden
- Coordinated Market Economies – Asian: represented by Japan
- Coordinated Market Economies (South-West Europe) which comprises Austria, France, Netherlands, and Spain
- Collaborative agglomerations: made of Czech Republic, Estonia, Poland and Slovak Republic
- Hierarchically Coordinated: represented by Korea

Market-based economies (also known as liberal market economies) are characterized by cooperative market arrangements, a flexible labour market with a low union density, decentralised labour market organisations and competitive market forces. Firms raise capital through the private equity market and stock exchange.

In coordinated Market Economies firms forge core competencies through collaborative and strategic interactions. They show a centralised labour market organization with a high union density. The capital market relies heavily on commercial banks.

Those economies classified as Collaborative agglomerations are those relying on a high level of trust and readily available financial resources through the credit market. The labour market appears to be well organized and firms are usually very collaborative.

Hierarchically Coordinates economies show higher ownership concentration and family intervention in corporate governance and their financial market heavily relies on credit markets.

whether or not studying vocational education has a different effect if compared with general education, on the hourly wage between women and men, over the life cycle. In other words, it shows whether the effect of studying vocational education on wages over the life cycle differs between women and men.

$$lny_i = \alpha_0^2 + \alpha_1^2 Age_i + \alpha_2^2 Vet_i + \alpha_3^2 Female_i + \alpha_4^2 Vet_c + \beta_1^2 Vet_i * Age_i + \beta_2^2 Female_i * Age_i + \beta_3^2 Female_i * Vet_i + \delta_1^2 Female_i * Vet_i * Age_i + \gamma^2 X_i + \mu_c^2 + \varepsilon_i^2 \quad (2)$$

Where $Female_i$ is a dummy variable that takes a value of one if the respondent is female, zero otherwise. $Vet_i * Female * Age_i$ is the interaction term between the two dummies and the continuous variable for age which measures the effect of interest.

The final model considered utilises a quadruple interaction term between the continuous variable for age and the dummy variables for gender, vocational education at the individual level and vocational education at the country level.

$$lny_i = \alpha_0^3 + \alpha_1^3 Age_i + \alpha_2^3 Vet_i + \alpha_3^3 Female_i + \alpha_4^3 Vet_c + \beta_1^3 Vet_i * Age_i + \beta_2^3 Female_i * Age_i + \beta_3^3 Female_i * Vet_i + \beta_4^3 Vet_c * Age_i + \beta_5^3 Vet_i * Vet_c + \beta_6^3 Female_i * Vet_c + \delta_1^3 Female_i * Vet_i * Age_i + \delta_2^3 Vet_i * Vet_c * Age_i + \delta_3^3 Female_i * Vet_i * Vet_c + \delta_4^3 Female_i * Vet_c * Age_i + \varphi_1^3 Female_i * Vet_i * Vet_c * Age_i + \gamma^3 X_i + \mu_c^3 + \varepsilon_i^3 \quad (3)$$

Where Vet_c is a dummy variable that takes value one if the country is classified as a vocational-oriented country, zero otherwise. The model aims to show whether the gender effect on the changing vocational effect over the life cycle depends on the vocational orientation of the country. The goal is to understand whether women do better studying vocational education in vocational-oriented countries if compared to general-oriented countries. The coefficient φ_1 measures the effect of studying vocational rather than general education in vocational-oriented countries on the hourly wage of women relative to men compared to the effect of studying vocational rather than general education in general-oriented countries on the hourly wage of women relative to men, over age cohorts.

2.5. Results

Table 2.3 shows the results of the ordinary least squares regressions. Columns 1, 2 and 3 consider a log-linear relationship between the logarithm of the hourly wage and the main covariates.

Column 1 considers the interaction term between the dummy variable Vet_i and a continuous variable Age_i to examine the relationship between age and wage of workers of the two education types (Equation 1).

In column 2 a three-way interaction between Vet_i, Age_i and the dummy variable $Female_i$ is included. The coefficient of interest ($Female_i$*Vet_i*Age_i), which is statistically significant, provides evidence on whether the difference in the rate of change in the wage per year change in age (from now on defined as "slope of the age-wage profile") between people studying vocational and general education differs between men and women (Equation 2).

In column 3, in addition, a four-way interaction term between Vet_i, Age_i, $Female_i$ and a third dummy variable, Vet_c is finally considered. The aim is to understand whether the age-wage profile differs by gender between people holding a vocational qualification and those with a general qualification according to the orientation of the educational system of the country (Equation 3).

Columns 4, 5 and 6 exploit the same models mentioned above, this time by considering a polynomial term, age squared to account for non-linearity in the relationship between the predictor and the outcome. The non-linear equations contain the same interactions considered in the linear models, this time with both age and age squared.

Table 2.3 Baseline specifications

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age_i	0.008***	0.010***	0.011***	0.009***	0.010***	0.011***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Vet_i	0.021***	0.017**	0.012	-0.011	-0.019*	-0.018
	[0.006]	[0.008]	[0.009]	[0.008]	[0.010]	[0.012]
$Female_i$	-0.180***	-0.185***	-0.194***	-0.180***	-0.213***	-0.221***
	[0.004]	[0.006]	[0.007]	[0.004]	[0.008]	[0.010]
Vet_c	0.057***	0.057***	0.039***	0.057***	0.057***	0.023*
	[0.005]	[0.005]	[0.010]	[0.005]	[0.005]	[0.014]
Vet_i* Age_i	-0.002***	-0.004***	-0.004***	-0.002***	-0.004***	-0.004***
	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
$Female_i$* Age_i		-0.003***	-0.004***		-0.003***	-0.004***
		[0.001]	[0.001]		[0.001]	[0.001]
$Female_i$* Vet_i		0.007	0.010		0.010	0.003
		[0.008]	[0.011]		[0.011]	[0.014]
Vet_c* Age_i			-0.003***			-0.002***
			[0.001]			[0.001]
Vet_i* Vet_c			0.015			0.012
			[0.013]			[0.017]
$Female_i$* Vet_c			0.032**			0.031*
			[0.013]			[0.017]
$Female_i$* Vet_i* Age_i		0.003***	0.004***		0.003***	0.005***
		[0.001]	[0.001]		[0.001]	[0.001]
Vet_i* Vet_c* Age_i			0.002*			0.001
			[0.001]			[0.001]
$Female_i$* Vet_i* Vet_c			-0.019			0.001
			[0.017]			[0.023]
$Female_i$* Vet_c* Age_i			0.006***			0.005***
			[0.001]			[0.001]
$Female_i$*Vet_i*Vet_c*Age_i			-0.007***			-0.006***
			[0.001]			[0.001]
Age_i^2				-0.048***	-0.058***	-0.060***
				[0.000]	[0.003]	[0.004]
$Vet_i * Age_i^2$				0.019***	0.020***	0.015***
				[0.003]	[0.004]	[0.006]
$Female_i * Age_i^2$					0.020***	0.019***
					[0.004]	[0.005]
$Vet_c * Age_i^2$						0.011
						[0.007]
$Female_i * Vet_i * Age_i^2$					0.000	0.009
					[0.006]	[0.008]
$Vet_i * Vet_c * Age_i^2$						0.004
						[0.009]
$Female_i * Vet_c * Age_i^2$						0.004
						[0.009]
$Female_i * Vet_i * Vet_c * Age_i^2$						-0.020
						[0.012]
Control variables	Yes	Yes	Yes	Yes	Yes	YesYes
Dummy country-groups	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.461***	2.465***	2.470***	2.554***	2.571***	2.580***
	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.017]
Observations	59939	59939	59939	59939	59939	59939
Adjusted R^2	0.520	0.520	0.521	0.527	0.528	0.529

Note: Dependent variable: logarithm of hourly wage. Control variables: numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Age^2, $Vet*Age^2$, $Female*Age^2$, $Vetc*Age^2$, $Female * Vet * Age^2$, $Vet * Vetc * Age^2$, $Female * Vetc * Age^2$, $Female * Vet * Vetc * Age^2$ rescaled multiplying by 100. Regressions are weighted by sampling weights. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Even though age is expected to show a non-linear relationship with wages, for ease of exposition this chapter will firstly discuss the findings achieved through the implementation of linear models (Equations 1, 2, 3). The chapter will then introduce a quadratic term for age and will provide strong evidence that the results achieved are still robust when using non-linear profiles.

Looking at the results reported in column 1, the coefficient for Vet_i represents the difference in wages between an individual with vocational education as the highest qualification and one with a general qualification, holding other factors constant. The coefficient for age is 0.008, corresponding to the slope of the age-wage profile for those having a general background. The interaction term (Vet_i*Age_i) is the difference in the slope of the age-wage profile comparing respondents having a vocational qualification versus those having a general qualification. The coefficient of the interaction term of -0.002 means that the gap in the slope between individuals with a vocational versus those with a more general qualification is 0.2 percentage points. Since the model considers a centred value of age, this effect is computed on the average age of the sample[12].

Prior to discussing the main results from the ordinary least square regression of the model reported in column 2, it could be useful to visualize the adjusted means for wages as a function of the variables Vet_i, Age_i and $Female_i$. Figure 2.1 shows the adjusted means for wages by gender and education type for ages 16 to 65. The slope of the age-wage profile for men depends strongly on their educational background. Indeed, the profile for men having a general qualification as their highest qualification is steeper compared with the one for those with vocational education. At 16 years old men having a general qualification earn less than those with a vocational qualification as the highest qualification. At 65 years old the situation is exactly the opposite. The age-wage profiles for women having general and vocational background follow a similar pattern with women with a general

[12] Table A.6 considers a non-centred value of the variable Age_i . Results confirm that at "zero" age, those with a vocational qualification would earn 11.5% more. However, with each additional year, this gap would fall by 0.2 percentage points. At some point (0.115/0.002=57.5 years) the gap will turn negative and get more and more negative thereafter.

background showing a slightly steeper age-wage profile. Finally, the differences in the slope of the age-wage profile between women and men are greater for those holding a general qualification as their highest qualification than for those holding a vocational qualification.

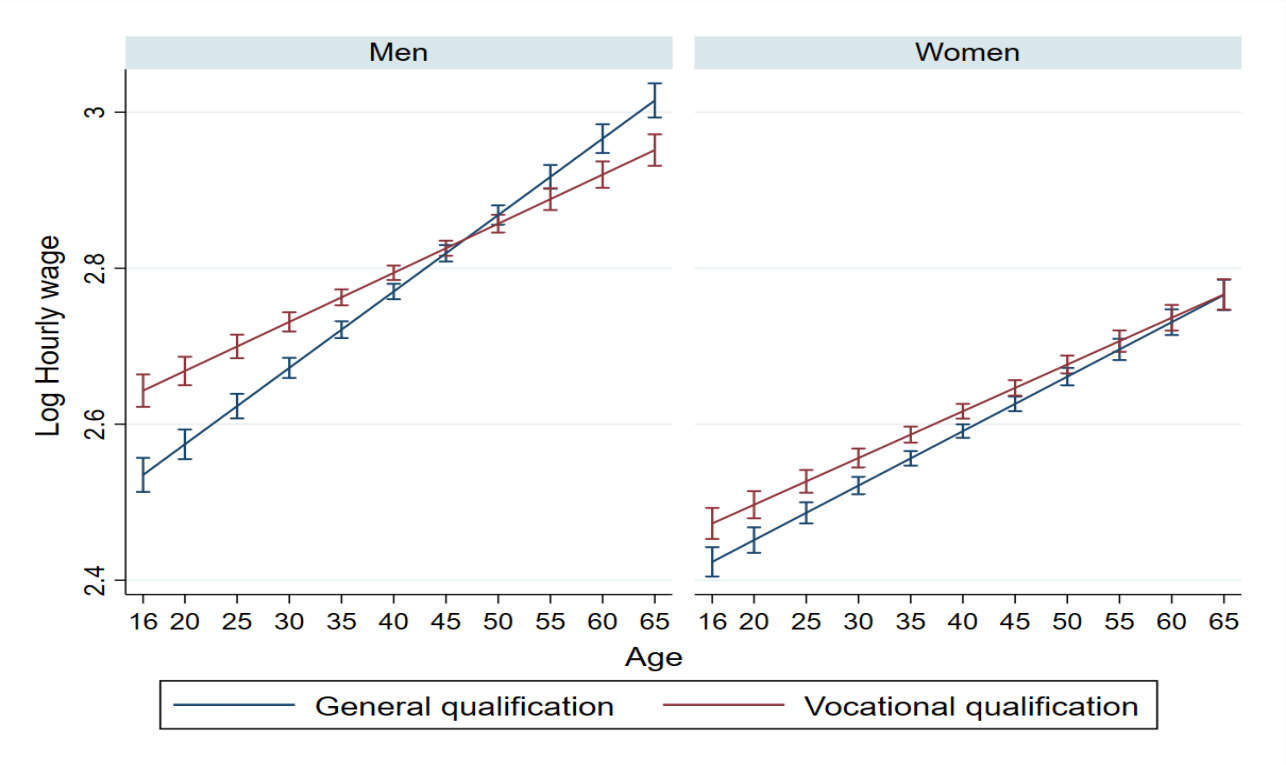

Figure 2.1 Adjusted mean of the log hourly wage by gender and education type

Note: Dependent variable: Logarithm of the hourly wage. Model 2. Control variables:, numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Country-groups fixed effect included. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. PIAAC Data.

It is important to notice how the slope of the age-wage profile varies as a function of the interaction of gender and education type. Each cell of Table A.7 shows the slope of the age-wage profile for a particular combination of gender and education type. The slope of the age-wage profile for males with a general qualification as the highest qualification (β_{0M}) is 0.010. The one for males with a vocational qualification (β_{1M}) is instead equal to 0.006. The slope of the age-wage profile for females with a general qualification (β_{0F}) is 0.007 while it is equal to 0.006 for females with a vocational qualification (β_{1F}). All coefficients are statistically significantly different from zero at 0.1%.

By comparing the coefficients of Table A.7 with the ones in Table 2.3 column 2 it is possible to notice that:

- The slope of the age-wage profile of men holding a general qualification (β_{0M}) corresponds with the coefficient of the variable Age_i
- The slope of the age-wage profile of men holding a vocational qualification (β_{1M}) is given by the sum of the coefficients on the variables Age_i and $Vet_i{*}Age_i$[13];
- The slope of the age-wage profile of women holding a general qualification (β_{0F}) is the sum of the coefficients Age_i and $Female_i{*}Age_i$
- The slope of the age-wage profile of women holding a vocational qualification (β_{1F}) is the sum of the coefficients Age_i, $Female_i{*}Age_i$, $Vet_i{*}Age_i$ and $Female_i * Vet_i * Age_i$
- $(\beta_{1F} - \beta_{0F}) - (\beta_{1M} - \beta_{0M})$ is equal to the coefficient of the triple interaction term.

The coefficient for the interaction term $Female_i{*}Age_i$ confirms that the slope of the age-wage profile for females who have a general qualification as the highest qualification is 0.3 percentage points lower than the slope of the age-wage profile for males following the same path. No significant difference is found in the age-wage profile of men and women with a vocational qualification.

The interaction term $Vet_i{*}Age_i$ compares the age-wage profile among males having as highest qualification a vocational qualification and males having as highest qualification a general qualification. The coefficient is significant and equal to -0.004 meaning that the slope of the age-wage profile significantly differs as a function of education among males. The slope of the age-wage profile for men with a vocational background is 0.4 percentage points smaller than the slope of males following a general path.

Finally, the three-way interaction term $Female_i * Vet_i * Age_i$ compares individuals having a vocational qualification with those having a general qualification and it then interacts that contrast

with gender and age. The first comparison regards the difference in the age-wage profile between women with a vocational qualification and those with a general qualification. The second comparison instead regards the difference in the age-wage profile between men with a vocational qualification and those with a general qualification. The difference in these differences is statistically significant and equal to 0.003.

In summary, the second model implemented in this study addresses the following research question: Does the age-wage profile differ by gender between those with a vocational qualification and those with a general qualification (HP2)? Results from Model 2 show that the slope of the age-wage profile depends on both education type and gender. The slope of the age-wage profile for individuals holding a general qualification is, on average, lower for women than for men. However, the difference between women and men is not significant for those holding a vocational qualification. The slope of the age-wage profile for men depends strongly on their educational background. Indeed, the profile for men having a general qualification as their highest qualification is steeper compared to the one for those with vocational education. In contrast, the age-wage profile for women studying general and vocational education is the same. In conclusion, it is possible to state that the increase in the slope of the age-wage profile comparing respondents with a vocational qualification versus those holding a general degree is greater for males than it is for females.

Column 3 of Table 2.3 shows the results related to the third model implemented in this chapter which introduces a four-way interaction term. Table A.8 shows the slope of the age-wage profile for each category of $Female_i$, Vet_i and Vet_c. By comparing the coefficients of Table A.8 with the third column of Table 2.3 it is possible to notice that:

- The slope of the age-wage profile of men holding a general qualification and working in a general-oriented country (β_{00M}) corresponds with the coefficient of the variable Age_i;

- The slope of the age-wage profile of men holding a vocational qualification in a general-oriented country (β_{10M}) is given by the sum of the coefficients on the variables Age_i and $Vet_i{*}Age_i$;
- The slope of the age wage profile of men holding a general qualification in a vocational-oriented country (β_{01M}) is the sum of the coefficients on the variables Age_i and $Vet_c{*}Age_i$
- The slope of the age-wage profile of men holding a vocational qualification in a vocational-oriented country (β_{11M}) is the sum of the coefficients on Age_i, $Vet_i{*}Age_i$, $Vet_c{*}Age_i$ and $Vet_i * Vet_c * Age_i$.
- The slope of the age-wage profile of women holding a general qualification and working in a general-oriented country (β_{00F}) is the sum of the coefficients on Age_i and $Female_i{*}Age_i$;
- The slope of the age-wage profile of women holding a vocational qualification in a general-oriented country (β_{10F}) is the sum of the coefficients Age_i, $Female_i{*}Age_i$, $Vet_i{*}Age_i$, and $Female_i * Vet_i{*}Age_i$
- The slope of the age-wage profile of women holding a general qualification in a vocational-oriented country (β_{01F}) is given by the sum of coefficients on Age_i , $Female_i{*}Age_i$, $Vet_c{*}Age_i$, and $Female_i * Vet_c{*}Age_i$
- The slope of the age-wage profile of women holding a vocational qualification in a vocational-oriented country (β_{11F}) corresponds to the sum of coefficients on Age_i , $Female_i * Age_i$, $Vet_i * Age_i$, $Female_i * Vet_i * Age_i$, $Vet_c * Age_i$, $Female_i * Vet_c * Age_i$, $Vet_i{*}Vet_c{*}Age_i$ and $Female_i * Vet_i{*}Vet_c{*}Age_i$,
- The four-way interaction is given by $[(\beta_{11F} - \beta_{10F}) - (\beta_{01F} - \beta_{00F})] - [(\beta_{11M} - \beta_{10M}) - (\beta_{01M} - \beta_{00M})]$

As it can be seen from Table A.8, the only case where the slope of the age-wage profile is higher for women is related to the comparison between males and females who achieved a general qualification in a vocational-oriented country. Also, it is possible to notice that there is no difference in the age-

wage profile between women and men among individuals holding a vocational qualification and living in general-oriented country.

Figure 2.2 allows a visual comparison of the age-wage profiles for women and men living in vocational or general-oriented countries and shows the point at which the gap between holding a vocational qualification and holding a general qualification is zero. According to the graph, the gap turns to zero at around 46 years old for men living in a general-oriented country, at around 35 years old for men living in a vocational-oriented country, and around 34 years old for women living in a vocational-oriented country. Since the age-wage profile for women living in a general-oriented country and holding a vocational qualification is parallel to the ones of women holding a general qualification, the two curves never cross.

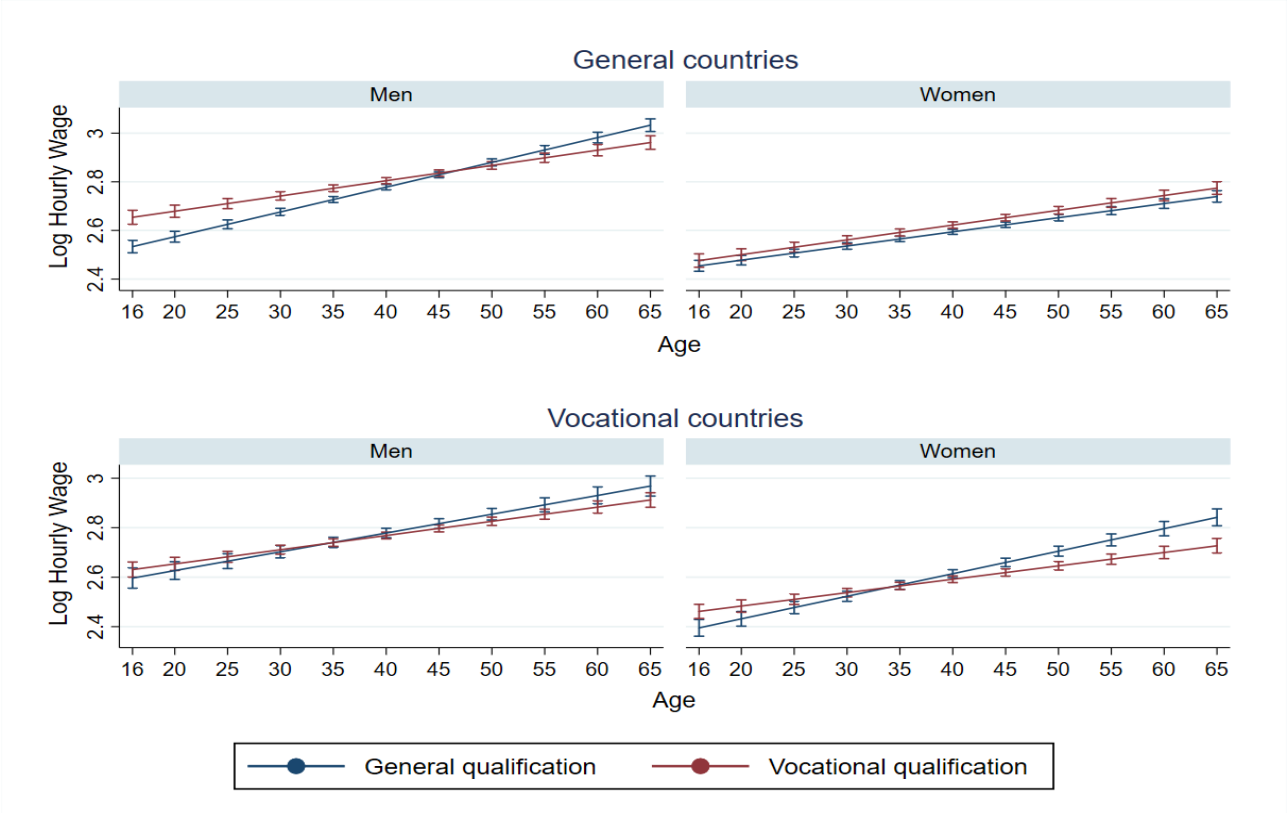

Figure 2.2 Adjusted mean of the log hourly wage by gender, education type and country orientation

Note: Dependent variable: Logarithm of the hourly wage. Control variables: Age, Vet, Female, Vetc, Veti*Age, Female*Age, Female*Vet, Female*Vet*Age, numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Country-groups fixed effect included. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. PIAAC Data.

Figure 2.3 presents the same information arranged differently, allowing us to directly see the gender wage gap in vocational and general-oriented countries for individuals with a general or a vocational qualification as their highest qualification. The figure confirms the presence of a gender wage gap in both general and vocational-oriented countries, with the gender wage gap being slightly smaller on average in vocational-oriented countries.

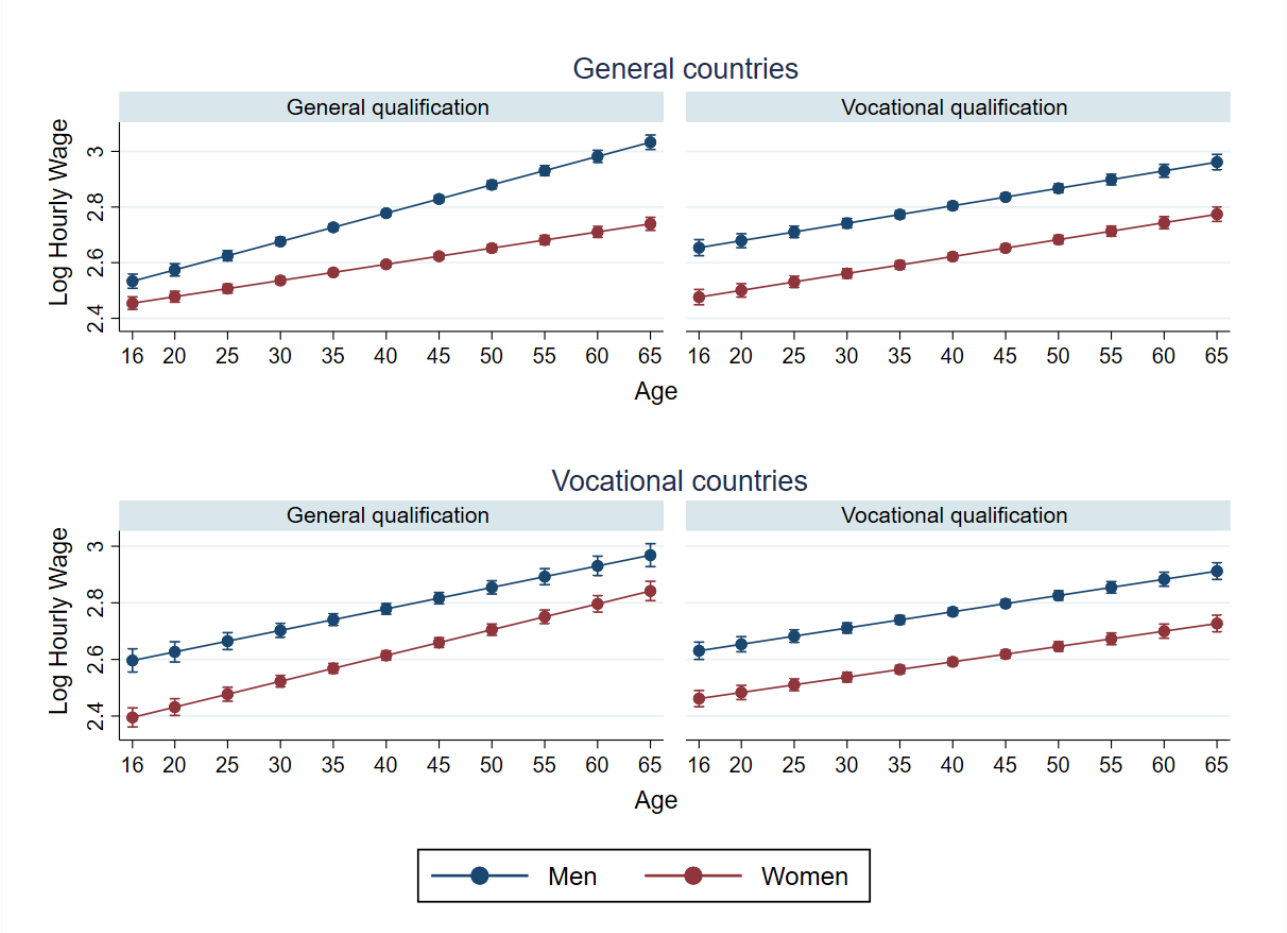

Figure 2.3 Adjusted mean of the log hourly wage by gender, education type and country orientation: the GWG between women and men.

Note: Dependent variable: Logarithm of the hourly wage. Control variables numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Country-groups fixed effect included. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. PIAAC Data.

Looking at Table 2.3 the coefficient for $Female_i$*Vet_c*Age_i is statistically significant and equal to 0.006 meaning that the increase in the slope of the age-wage profile for individuals living in

vocational-oriented countries with those living in general-oriented countries holding a general qualification is greater for women than it is for men.

The coefficient for $Female_i$*Vet_i*Age_i, is equal to 0.004 and is statistically significant, indicating that the increase in the slope of the age-wage profile for individuals having a vocational qualification with those having a general qualification, living in a general-oriented country, is bigger for females rather than for males.

Also, the coefficient Vet_i*Vet_c*Age_i tests the effect of holding a vocational or general qualification and living in a vocational or general-oriented country for males. Thus, the increase in the slope of the age-wage profile comparing men living in a vocational-oriented country with men living in a general-oriented country is greater for those having a vocational qualification.

In summary, Model 3 addresses the following research question: Does the age-wage profile differ by gender between those with a vocational qualification and those with a general qualification according to the orientation of the educational system of the country (HP3)? Results illustrate the impact of the educational orientation of the country on the slope of the age-wage profile. In line with the results achieved, it is possible to derive two different conclusions according to whether the individual is working in a vocational or a general-oriented country. In the first scenario, men with a vocational background show a 0.1 percentage point greater age-profile slope than women with a vocational background ; women with a general background show, instead, a 0.2 percentage point greater slope in terms of the age-wage profile if compared to men with the same educational background. Both men and women with a general qualification as the highest qualification show a greater slope of the age-wage profile (0.1 and 0.3 percentage points respectively) if compared to men and women with a vocational background. In the second case scenario, men and women with a vocational background show the same slope of the age-wage profile. However, among the individuals holding a general qualification as the highest qualification, men do show a 0.4 percentage point greater slope of the age-wage profile if compared with women. While women show the same age-wage profile both in

the case of general or vocational background, men with a general background show a 0.4 percentage point greater slope if compared with men with a vocational background.

In summary, the gender wage gap does exist in both vocational and general-oriented countries. However, the analysis conducted in this chapter has shown a similar age-wage profile (with only a 0.1 percentage points difference between women and men with a vocational background) for men and women holding a vocational degree. On the contrary, women with a general background show a greater slope of the age-wage profile in vocational countries but a lower slope in general-oriented countries, if compared to men with the same educational background.

In Columns 4, 5 and 6 of Table 2.3, I consider the non-linearity in the relationship between age and wage, by introducing Age squared in the baseline models.

The rationale for this is presented in Figure 2.4. The latter shows the lowess smoother[14]values of the hourly wage as a function of age, separately for men having a general qualification, men having a vocational qualification, women having a general qualification, and women having a vocational qualification. The graph shows that average wages rise with increasing age until around age 50, where average wages peak. As age increases beyond 50, average wages decline very slightly. For both men and women, the graph suggests that the degree of curvature in the relationship between age and the log of hourly wages differs based on the type of qualification. The lowess smoothed values for those with a general qualification as the highest qualification achieved show a greater degree of curvature than those with a vocational qualification.

[14] A lowess smoother is a popular tool used in regression analysis that creates a smooth line through a time-plot or scatter plot to help you to see relationships between variables and foresee trends.

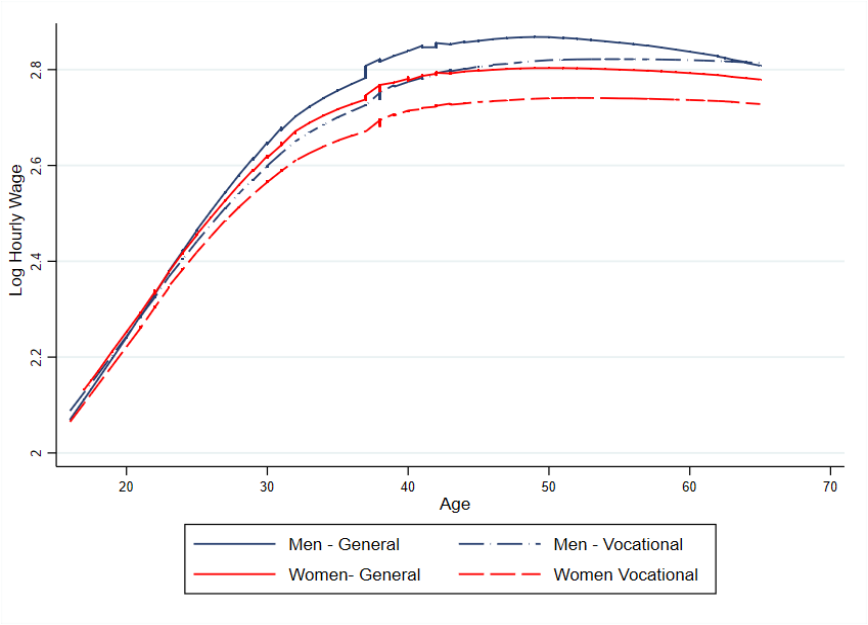

Figure 2.4 Age-log hourly wage relationship by education type and by gender

Note: Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. PIAAC data.

Based on this visual inspection of the data, a regression model predicting the hourly wage from Age_i and Vet_i as main covariates would not only need to account for the quadratic trend in age, but also the difference in the quadratic trend in age for people whose highest qualification is a vocational qualification versus people whose highest qualification is a general qualification.

Figure 2.5 allows us to visualize the impact of the differences in these quadratic coefficients by graphing the adjusted means of the logarithm of the hourly wage as a function of age and education type while adjusting for all the other covariates, based on the results in Table 2.3, column 4. The graph shows that people holding a general qualification have greater curvature in the wage-age inverted-U-shaped relationship than people with a vocational qualification. This arises because the quadratic coefficient for age is more negative for individuals with a general qualification as compared to people with a vocational qualification.

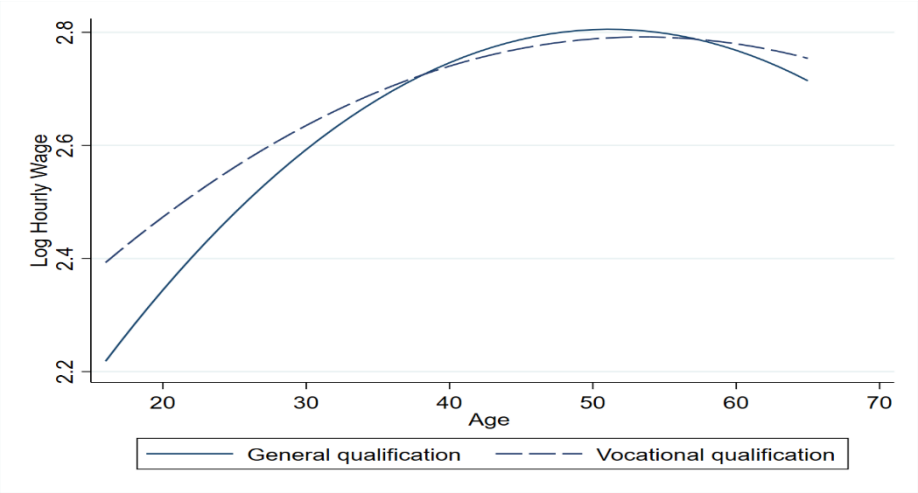

Figure 2.5 Age-log hourly wage quadratic relationship by education types

Note: Dependent variable: Logarithm of the hourly wage. Model 4. Control variables: numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Country-groups fixed effect included. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. PIAAC Data.

Figure 2.6 enables a visual inspection of the differences in the adjusted means of the hourly wage between people with vocational qualifications and people with general qualifications, highlighting them with a shaded confidence interval. Where the confidence interval excludes zero, the difference is significant at the 5% level. According to Figure 2.6, the difference is not significant for those aged 33 to 42 and those aged 51 to 61.

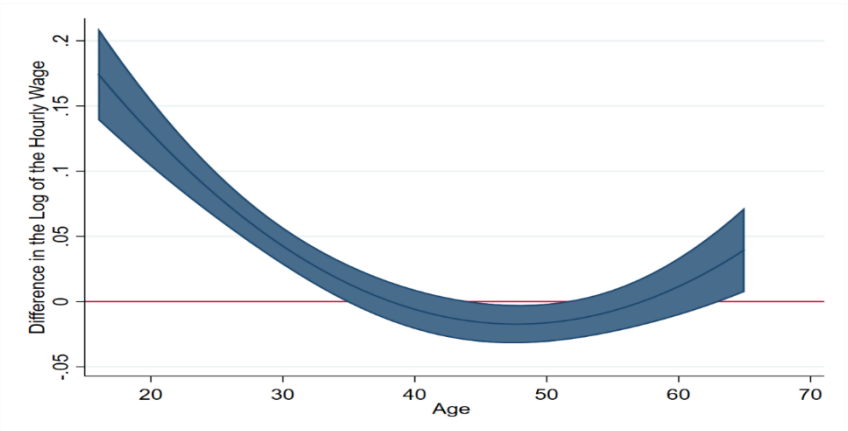

Figure 2.6 Comparison of the adjusted mean of the log of the hourly wage by education type

Note: Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. PIAAC data.

Column 5 of Table 2.3 introduces a three-way interaction between Age_i $Female_i$ and Vet_i in a non-linear model framework. Table A.9 reports the slope of the age-wage profile separately for each category of $Female_i$ and Vet_i considering specific ages of the respondents. As expected, the slope of the age-wage profile is greater at age 20 and it gradually decreases, until becoming negative, at age 60. The gender difference in the slope of the age-wage profile is greater among individuals with a general qualification rather than a vocational one. Moreover, the slope of the age-wage profile for men (women) with general qualifications is greater if compared with men (women) having vocational qualifications. The only exception can be observed at age 60.

The coefficient $Female_i{*}Age_i$ suggests that the implementation of the quadratic Model 5 leads to the same conclusions reached as with the adoption of the linear Model 2: The slope of the age-wage profile for individuals holding a general qualification as the highest qualification is, on average, lower for women than for men (0.3 percentage points smaller). No significant differences are found in the comparison made among people with vocational qualifications. Moreover, even if the slope of the age-wage profile for men depends strongly on their educational background, the age-wage profile for women studying general and vocational education is the same (Vet_i $*Age_i$). Finally, given a significant and positive coefficient on the three-way interaction term, it is possible to claim that the increase in the slope of the age-wage profile comparing individuals with vocational degrees and respondents with a general qualification is on average greater for men than it is for women.

The results of the regression related to the last model implemented are shown in Table 2.3 Column 6. Given the introduction of a four-way interaction, the slope of the age-wage profile is computed by considering each category of $Female_i$ Vet_i and Vet_c for specific ages of the respondents (Table A.10).

The coefficients for $Female_i{*}Vet_i{*}Age_i$, $Female_i{*}Vet_c{*}Age_i$ are very similar to the ones shown in Model 3, both in terms of magnitude and significance. For this reason, the conclusions reached with the linear Model 3 are validated by the implementation of the non-linear Model 6.

2.5.1. Robustness check

- **Educational orientation**

One of the main concerns in this analysis is the classification of the countries as either vocational-oriented countries or general-oriented countries. As mentioned in the data section, this paper classifies the 19 countries considered in the analysis using both information from the PIAAC sample and the statistics from the EAG 2008 and the EAG 2013. To check the robustness of the results obtained, in this section, I will adopt a different classification relying more on the educational setting faced by the countries involved in this analysis before the collection of the data started. Hence, the 19 countries involved in this study will be classified by using statistics from EAG 1996 and EAG 2007 to look at the environment when individuals were making the education decisions rather than the one in which they already entered the labour market (benchmark model). Following this line of thought, I define as vocational-oriented countries those countries whose vocational educational share is at least 40% in PIAAC and at least 50% in EAG in 1996 or 2007. The countries whose shares are below those thresholds are instead considered general-oriented countries.

According to this rule, Canada, Estonia, Ireland, Japan, Korea, Spain, the United Kingdom, and the United States are classified as general-oriented countries. Within the group of vocational-oriented countries, instead, I identify three subgroups:

- "Apprenticeship-based countries" with a share of combined school and work-based vocational programs that exceed 40% in both 1996 and 2007 EAG (Austria, Denmark and Germany);
- "Non-school based vocational countries" with a share of at least 25% in combined school and work-based programs in either 1996 or 2007 EAG (Czech Republic, Poland, Slovak Republic);
- "School-based vocational countries", which includes the remaining countries (Finland, France, Netherlands, Norway, Sweden).

The new classification and the difference from the previous one are reported in Table A.11. It must be noticed that the number of countries with general orientation has increased over time (Table 2.2 and A.11). This can be easily seen as the consequence of a post-industrialized world in which there has been a transition from an economy of goods to an economy of services. This in turn has amplified the need for innovation and increased the demand for theoretical (general) knowledge rather than practical (vocational) ones.

The results of the six Models implemented in this paper following the new classification are reported in Table A.12. The results are mostly the same, in terms of both magnitude and significance, as the ones reported in Table 2.3. The major difference regards the magnitude and the significance of the coefficients on the variables Vet_c and its interaction with Vet_i, Age_i and $Female_i$. This should be explained by the increase in the number of vocational-oriented countries using the new classification.

The intensity of the vocational component in the country's educational setting

As described in the Data section countries are characterized by widely different vocational settings. While in the main results this chapter has only considered the difference between vocational and general-oriented countries, in this section the study aims to take a step further and take into consideration the intensity of vocational education in each country's educational system. More precisely, following the classification explained in Table 2.2, this chapter is going to classify the 19 countries as either apprenticeship-based countries, non-school-based countries, school-based countries, or general-oriented countries.

In Table A.13, Model 2 is implemented separately for general, no-school based, school-based and apprenticeship countries to analyse how the difference in the slope of the age-wage profile between people studying vocational and general education differs between men and women within countries characterized by different educational systems. General countries are similar to school-based countries. In both types of countries, the slope of the age-wage profile for females is smaller both in the case of vocational background and general background compared to men. Moreover, the slope of

the age-wage profile for people with general qualifications is always higher than the slope of people with vocational qualifications.

The situation is different if one considers no-school-based and apprenticeship countries. Indeed, in those countries, the slope of the age-wage profile for females with general qualifications is higher if compared to both men having general or vocational qualifications and it also looks greater if compared to women with vocational qualifications.

In sum, the disaggregation of the PIAAC sample by the intensity of vocational education shows clear heterogeneity with regards to the amplitude of the gender wage gap and the differential impact of education and country orientation on the age-wage profile.

- **Literacy versus Numeracy skills**

In order to erase any further doubts regarding whether to control for numeracy or literacy skills, this section implements the six baseline Models considering literacy skill rather than numeracy skill as one of the control variables (Table A.14). The results are similar in terms of magnitude and significance to those shown in Table 2.3, validating in this way, what this chapter has already concluded by considering numeracy skill as one of the covariates.

- **Number of children**

The presence of children can be a potential outcome of the education variable itself (treatment variable). The risk is that by including the variable Children, "Vet" could no longer be picking up the effect of having a vocational rather than general education, but the effect conditional on the outcome of the presence of children. For instance, women with academic education may end up making different maternity-related choices than the ones made by women with a vocational background. Indeed, a general qualification lasts, on average, longer than a vocational one. Given the greater investment in terms of years of education, there is an incentive for the women who pursued this path to limit the amount of forgone returns from education by having fewer/no children. Hence, the number

of children that women end up having is the consequence of the educational choice made. For this reason, a sensitivity test had been run and the same baseline model has been implemented without the inclusion of the variable Children. The results achieved do not differ from the baseline model both in terms of magnitude and significance level (Table A.15).

- **Individuals who may have not yet finished their education**

As mentioned in Paragraph 2.3.1., the sample takes into consideration employed individuals aged 16 to 65 who are not currently studying. However, there is the possibility that the sample includes individuals who have not finished schooling. These individuals, who are not studying at the time of the interview but who have not yet finished their education may be the driving force behind the lower initial wage for those with general education, as they have not yet finished their schooling. In order to test whether this is the case, this section implements the baseline models this time by excluding all individuals aged 16-24 (resulting in loss of around 8% of the sample observation). The results reinforce the results previously achieved with regards to the coefficient on the interaction between Vet_i and Age_i. (Table A.16), which remains negative and significant, and essentially unchanged. The Vet_i coefficient itself does change a bit, though, particularly for the linear specifications in the first three columns, where it had a positive coefficient in the original results. This is not really surprising, given that this section has omitted the 16-24 age range when those with vocational qualifications typically do best.

2.6. Conclusions

This chapter aimed to answer the following research questions:

HP1: How does the relationship between the age and wage of workers vary by education type (vocational vs general)?

HP2: Does the age-wage profile differ by gender between those with a vocational qualification and those with a general qualification?

HP3: Does the age-wage profile differ by gender between those with a vocational qualification and those with a general qualification according to the orientation of the educational system of the country?

For this purpose, the chapter used the First Round of the First Cycle of PIAAC (2011-2012) by considering employed individuals who are not currently studying and resident in one of the following countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, United States.

The data reveal that the hourly wage of women is, on average, lower than for men which indicates the existence of a raw gender wage gap. However, this gap is greater among individuals holding a general qualification. In terms of skills analysed through the direct assessment component of PIAAC, while men and women have a close average score for literacy skills, men do better in both numeracy and problem-solving tests, despite women having a slightly higher average of years of schooling.

For ease of interpretation, the chapter implements three different linear interactive models in the first place; to then take a step further and validate the findings achieved through the implementation of three non-linear models to consider the non-linearity in the relationship between age and wage.

With regards to the first research question (HP1), results from the first model implemented confirm a strong early advantage and late disadvantage in terms of the hourly wage for individuals with vocational qualifications as their highest qualification. Up to age 43, individuals with vocational education earn more. However, those with general education gradually catch up and then move increasingly ahead beyond age 43.

The differential trend in terms of the age-wage profile shown by individuals with different education types may be due to the difference in the set of skills acquired through general and vocational paths. The latter are well known for providing individuals with ready-to-use skills, characterized, however, by higher depreciation rates. Consequently, while on one side vocational qualifications help in

smoothing the school-to-work transaction; on the other side, the skills acquired are more firm-specific, less transferable, and need to be updated more often. This might be a real concern, especially for women. Moreover, according to the results achieved in the robustness check section, it seems to be clear that in more general-oriented (either general or school based) countries, the slope of the age wage profile for women with general qualifications is higher if compared to both men having general or vocational qualifications. Findings also show that general-qualified women have a greater age-wage profile even when compared to vocational-qualified women. Hence, the lower the treatment intensity, the higher the chance for women to do better in terms of age wage profile. This might be due to the fact that general skills are less likely to depreciate over time and so the time spent out from the labour force (especially in case of birth-related leave) will cost less in countries with a general-oriented educational system and, in particular, for those having a general qualification as highest qualification achieved.

In light of these findings, efforts should be made to improve the vocational system and enhance the reliability of vocational programs. The latter should aim to be more inclusive and provide strong general skills to enable individuals to adapt to the current changes of the modern economy, and consequently, increase the chances for career progression and wage increases over the lifecycle.

Building on the abovementioned findings, the difference in age-wage pattern over the life cycle between the two education types considered is exploited to examine its impact on gender differences from an age-wage perspective.

In particular, Model 2 addresses the second research question (HP2) and demonstrates that the age-wage profile depends on both gender and education type. Indeed, the rate of change in wages for an additional year in age among individuals holding a general qualification is, on average, smaller for women than for men. This difference is instead not significant among people holding a vocational qualification.

Model 3, instead, addresses the third research question (HP3) and shows that once the orientation of the countries' educational system is included in the model, there are differences in the age-wage profile between women and men holding a general degree: while women show a greater slope of the age-wage profile in vocational-oriented countries, the situation is reversed in general oriented countries.

In conclusion, the chapter has provided evidence of the existence of a gender wage gap in both vocational and general-oriented countries. However, the fact that differences in age-wage patterns seem to be related to the educational background and the country's educational system confirms the need for further country-specific analysis given the important heterogeneity detected. In this study, countries are classified as vocational or general-oriented, however, given that each country differs in terms of educational systems and policies implemented, there is potential to develop further into the role of the country-specific educational systems. Understating whether there is a substantial difference in the educational systems implemented in vocational and general-oriented countries, and how this difference possibly relates to a change in the comparison of the age-wage profile between women and men could allow for a better understanding of the gender wage gap.

Appendix A.

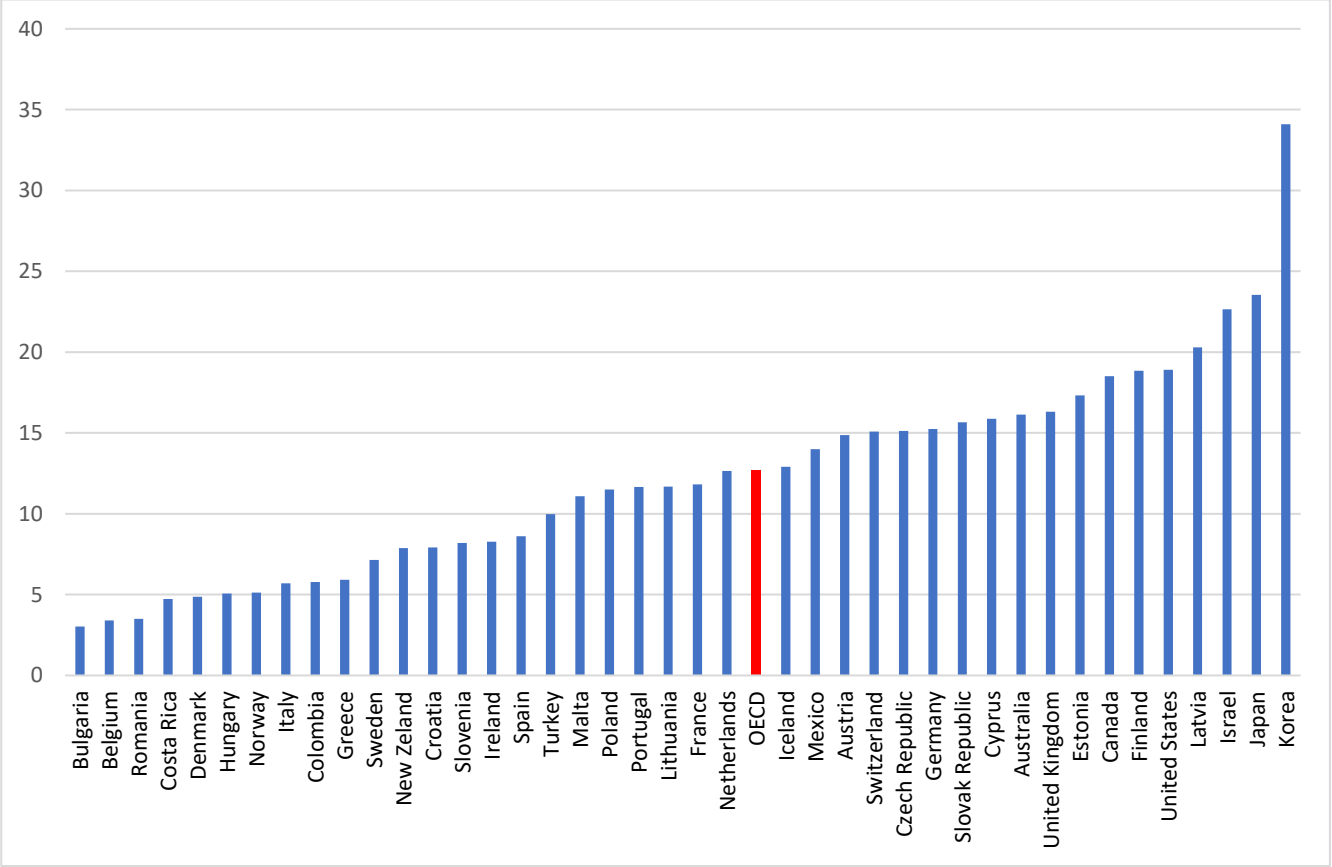

Figure A. 1 Gender gap in median earnings of full-time employees (2018)

Note: The gender wage gap shown is unadjusted and is calculated as the difference between the median earnings of men and women relative to the median earnings of men. Estimates of earnings used in the calculations refer to gross earnings of full-time wage and salary workers. Data 2018. Available at: https://data.oecd.org/earnwage/gender-wage-gap.htm

Table A. 1 PIAAC Participating countries

PIAAC First Cycle	Round 1 (2011-2012)	Australia, Austria, Belgium (Flanders), Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Russian Federation, Slovak Republic, Spain, Sweden, United Kingdom (England and Northern Ireland), United States
	Round 2 (2012-2015)	Chile, Greece, Indonesia, Israel, Lithuania, New Zealand, Singapore, Slovenia, Turkey
	Round 3 (2017)	Ecuador, Hungary, Kazakhstan, Mexico, Peru, United States
PIAAC Second Cycle	Round 1 (2022-2023)	Australia, Austria, Belgium (Flanders), Canada, Chile, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Netherlands, New Zealand, Norway, Poland, Portugal, Russian Federation, Singapore, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom (England), United States

Table A. 2 Coding scheme for educational attainment.

B_Q01a	**ISCED 97**
0 No formal qualification or below ISCED 1	0 No formal qualification or below ISCED 1
1 ISCED 1 (primary education)	1 ISCED 1 (primary education)
2 ISCED 2 3 ISCED 3C < 2 years	2 ISCED 2 (lower secondary)
4 ISCED 3C 2 years + 5 ISCED 3A -B 6 ISCED 3 (no distinction A-B-C)	3 ISCED 3 (upper secondary)
7 ISCED 4C 8 ISCED 4A-B 9 ISCED 4 (no distinction A-B-C)	4 ISCED 4 (post-secondary non-tertiary)
10 ISCED 5B 11 ISCED 5A, bachelor level 12 ISCED 5A, master level	5 ISCED 5 (tertiary 1)
13 ISCED 6 (tertiary 2)	6 ISCED 6 (tertiary 2)

Table A. 3 Definition of the variables used in the analysis.

Variable	Category	Description
Age	Background characteristics	Continuous-variable in years[15]
Female	Background characteristics	Dummy variable (0, 1). 1 if the individual is female; 0 otherwise
Years of Education	Educational background	Continuous and centred variable (in years)
Numeracy score	Educational background	Continuous variable with a within-country mean of zero and a within-country standard deviation of one
Literacy score	Educational background	Continuous variable with a within-country mean of zero and a within-country standard deviation of one
Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has any vocational qualification as highest qualification achieved; 0 otherwise
Vocational-oriented country	Educational background	Dummy variable (0, 1). 1 if the respondent works in a country considered vocational-oriented; 0 otherwise
General-oriented country	Educational background	Dummy variable (0, 1). 1 if the respondent works in a country considered general-oriented; 0 otherwise
No-school-based country	Educational background	Dummy variable (0, 1). 1 if the respondent works in a no-school-based country; 0 otherwise
School-based country	Educational background	Dummy variable (0, 1). 1 if the respondent works in a school-based country; 0 otherwise
Apprenticeship country	Educational background	Dummy variable (0, 1). 1 if the respondent works in a apprenticeship-based country; 0 otherwise
University Degree	Educational background	Dummy variable (0, 1). 1 if the respondent has a bachelor degree (ISCED 5A) or master/research degree (ISCED 5A/6) as the highest qualification achieved; 0 otherwise
Professional Degree	Educational background	Dummy variable (0, 1). 1 if the respondent has a professional degree (ISCED 5B) as highest qualification achieved; 0 otherwise
Post Secondary Degree	Educational background	Dummy variable (0, 1). 1 if the respondent has a post-secondary, non-tertiary (ISCED 4A-B-C) degree as highest qualification achieved; 0 otherwise
Upper Secondary Degree	Educational background	Dummy variable (0, 1). 1 if the respondent has an upper secondary (ISCED 3A-B-C long) as highest qualification achieved; 0 otherwise
Lower Secondary Degree	Educational background	Dummy variable (0, 1). 1 if the respondent has a lower secondary (ISCED 2, ISCED 3C short) degree as highest qualification achieved; 0 otherwise

[15] For ease of interpretation, the age variable is centred, and it is derived by subtracting the mean age from all the observations related to age in the dataset such that the new mean age is zero.

Primary Degree	Educational background	Dummy variable (0, 1). 1 if the respondent has a primary (ISCED 1 or less) degree as highest qualification achieved; 0 otherwise
Books 0-10	Educational background	Dummy variable (0, 1). 1 if the respondent had less than 10 books at home when he/she was 15 years old; 0 otherwise
Books 11-25	Educational background	Dummy variable (0, 1). 1 if the respondent had 11-25 books at home when he/she was 15 years old; 0 otherwise
Books 26-100	Educational background	Dummy variable (0, 1). 1 if the respondent had 26-100 books at home when he/she was 15 years old; 0 otherwise
Books 101-200	Educational background	Dummy variable (0, 1). 1 if the respondent had 101-200 books at home when he/she was 15 years old; 0 otherwise
Books 201-500	Educational background	Dummy variable (0, 1). 1 if the respondent had 201-500 books at home when he/she was 15 years old; 0 otherwise
Books 500+	Educational background	Dummy variable (0, 1). 1 if the respondent had more than 500 books at home when he/she was 15 years old; 0 otherwise
Children	Family Background	Dummy variable (0,1). 1 if the respondent has children, 0 otherwise
Father -Higher Degree	Family Background	Dummy variable (0, 1). 1 if the father of the respondent has a bachelor degree (ISCED 5A), a master/research degree (ISCED 5A/6) or a professional degree (ISCED 5B) as the highest qualification achieved; 0 otherwise
Father - Upper Post Secondary	Family Background	Dummy variable (0, 1). 1 if the father of the respondent has a post-secondary, non-tertiary (ISCED 4A-B-C) degree or an upper secondary (ISCED 3A-B-C long) degree as highest qualification achieved; 0 otherwise
Father - Primary Lower Secondary	Family Background	Dummy variable (0, 1). 1 if the father of the respondent has a lower secondary (ISCED 2, ISCED 3C short) degree or a a primary (ISCED 1 or less) degree as highest qualification achieved; 0 otherwise
Mother -Higher Degree	Family Background	Dummy variable (0, 1). 1 if the mother of the respondent has a bachelor degree (ISCED 5A), a master/research degree (ISCED 5A/6) or a professional degree (ISCED 5B) as the highest qualification achieved; 0 otherwise
Mother - Upper Post Secondary	Family Background	Dummy variable (0, 1). 1 if the mother of the respondent has a post-secondary, non-tertiary (ISCED 4A-B-C) degree or an upper secondary (ISCED 3A-B-C long) degree as highest qualification achieved; 0 otherwise

Mother - Primary Lower Secondary	Family Background	Dummy variable (0, 1). 1 if the mother of the respondent has a lower secondary (ISCED 2, ISCED 3C short) degree or a primary (ISCED 1 or less) degree as highest qualification achieved; 0 otherwise
Employed	Job characteristics	Dummy variable (0, 1). 1 if the individual is employed; 0 otherwise
Hourly wage	Job characteristics	Continuous variable, in Euros

Table A. 4 Descriptive statistics

	Men				
	Mean	Sd	Min	Max	N
Log Hourly Wage	2.8	0.6	0.3	4.6	29311
Age	42.1	12.0	16	65	37947
Vet qualification	0.48	0.5	0	1	36835
Years of schooling	13.8	2.4	7	22	37727
Numeracy score	283.9	48.8	54.1	467.0	37947
Literacy score	281.6	44.7	30.8	446.4	37947
Problem solving score	285.2	42.6	68.1	481.5	28775
Observations			37947		

	Women				
	Mean	Sd	Min	Max	N
Log Hourly Wage	2.6	0.6	-1.9	4.6	30855
Age	42.1	11.6	16	65	36691
Vet qualification	0.46	0.5	0	1	35593
Years of schooling	14.0	2.3	7	22	36491
Numeracy score	273.1	45.4	40.5	463.0	36691
Literacy score	280.9	42.1	73.2	432.0	36691
Problem solving score	280.3	40.7	73.4	440.7	28392
Observations			36691		

Note: Means, standard deviations, minimum and maximum. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States.

Table A. 5 Descriptive analysis on the main variables

PANEL 1			
Log Hourly Wage	**Women**	**Men**	***Difference***
Total	2.6	2.8	***-0.2******
Vet qualification	2.6	2.7	**-0.1*****
General qualification	2.7	2.9	**-0.2*****
Difference	**-0.1*****	**-0.2*****	

PANEL 2			
Years of schooling	**Women**	**Men**	***Difference***
Total	14.0	13.8	***0.2******
Vet qualification	13.3	13.0	**0.3*****
General qualification	14.8	14.7	**0.1*****
Difference	**-1.5*****	**-1.7*****	

PANEL 3			
Numeracy score	**Women**	**Men**	***Difference***
Total	273.1	283.9	***-10.8******
Vet qualification	266.1	276.5	**-10.4*****
General qualification	280.3	292.0	**-11.7*****
Difference	**-14.2*****	**-15.5*****	

PANEL 4			
Literacy score	**Women**	**Men**	***Difference***
Total	280.9	281.6	***-0.7*****
Vet qualification	273.4	273.2	**0.2**
General qualification	288.3	290.5	**-2.2*****
Difference	**-14.9*****	**-17.3*****	

PANEL 5			
Problem solving score	**Women**	**Men**	***Difference***
Total	280.3	285.2	***-4.9******
Vet qualification	273.6	277.9	**-4.3*****
General qualification	286.3	291.9	**-5.6*****
Difference	**-12.7*****	**-14.0*****	

Note: Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A. 6 Model 1: age variable not centred

Vet_i	0.115***
	[0.016]
Age_i	0.008***
	[0.000]
Vet_i* Age_i	-0.002***
	[0.000]
Vet_c	0.057
	[0.005]
$Female_i$	-0.179***
	[0.004]
Control Variables	YES
Dummy country-groups	YES
Constant	2.381***
	[0.014]
Observations	59939
Adjusted R^2	0.543

Note: Dependent variable: logarithm of hourly wage. Model 1 with a non-centered age variable. Control variables: numeracy score, qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, dummy variable to account for children. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A. 7 Model 2 - Slope of the age-wage profile by gender and education type

	General Qualification	**Vocational qualification**
Male	β_{0M} =0.010***	β_{1M} =0.006***
Female	β_{0F} =0.007***	β_{1F} =0.006***

Note: Dependent variable: Logarithm of the hourly wage. Model 2. Control variables: numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Country-groups fixed effect included β_{0M} β_{0F} are respectively the coefficients for men and women holding a general qualification; β_{1M} β_{1F} are respectively the coefficients for men and women holding a vocational qualification. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A. 8 Model 3- Slope of the age-wage profile by gender, education type and country orientation.

		Male	**Female**
Vocational qualification			
	Vocational-oriented country	β_{11M}= 0.006***	β_{11F}= 0.005***
	General-oriented country	β_{10M}= 0.007***	β_{10F}= 0.007***
General qualification			
	Vocational-oriented country	β_{01M}= 0.008***	β_{01F}= 0.010***
	General-oriented country	β_{00M}= 0.011***	$\beta_{00F=}$ 0.007***

Note: Dependent variable: Logarithm of the hourly wage. Model 3. Control variables: numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Country-groups fixed effect included β_{11M} $\beta_{11F}$are respectively the coefficients for men and women holding a vocational qualification and living in a vocational-oriented country; $\beta_{10M}\beta_{10F}$ are respectively the coefficients for men and women holding a vocational qualification and living in a general-oriented country; $\beta_{01M}\beta_{01F}$ are respectively the coefficients for men and women holding general qualification and living in a vocational-oriented country; $\beta_{00M}\beta_{00F}$ are respectively the coefficients for men and women holding general qualification and living in a general-oriented country. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A. 9 Model 5 - Slope of the age-wage profile by gender and by education type at age 20,30,40,50 and 60

Age= 20	**General qualification**	**Vocational Qualification**
Male	β_{0M} =0.032***	β_{1M} =0.020***
Female	β_{0F} =0.028***	β_{1F} =0.019***

a)

Age= 30	**General qualification**	**Vocational Qualification**
Male	β_{0M} =0.022***	β_{1M} =0.013***
Female	β_{0F} =0.019***	β_{1F} =0.013***

b)

Age= 40	**General qualification**	**Vocational Qualification**
Male	β_{0M} =0.012***	β_{1M} =0.008***
Female	β_{0F} =0.009***	β_{1F} =0.008***

Age= 50	**General qualification**	**Vocational Qualification**
Male	β_{0M} =0.005***	β_{1M} =0.002***
Female	β_{0F} = −0.001	β_{1F} =0.002***

c)

Age= 60	**General qualification**	**Vocational Qualification**
Male	β_{0M} = −0.007***	β_{1M} =0.003***
Female	β_{0F} = −0.010***	β_{1F} =-0.004***

d)

Note: Dependent variable: Logarithm of the hourly wage. Model 5 for specific age values. Control variables: numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Country-groups fixed effect included. β_{0M} $\beta_{0F}$are respectively the coefficients for men and women holding a general qualification; β_{1M} β_{1F} are respectively the coefficients for men and women holding a vocational qualification Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A. 10 Model 6 - Slope of the age-wage profile by gender by education type and by country orientation at age 20,30,40,50 and 60

AGE=20		**Male**	**Female**
Vocational qualification			
	Vocational-oriented country	β_{11M}=0.018***	β_{11F}=0.019***
	General-oriented country	β_{10M}=0.021***	β_{10F}=0.017***
General qualification			
	Vocational-oriented country	β_{01M}=0.031***	β_{01F}=0.030***
	General-oriented country	β_{00M}=0.032***	β_{00F}=0.027***

a)

AGE=30		**Male**	**Female**
Vocational qualification			
	Vocational-oriented country	β_{11M}=0.013***	β_{11F}=0.013***
	General-oriented country	β_{10M}=0.015***	β_{10F}=0.012***
General qualification			
	Vocational-oriented country	β_{01M}=0.021***	β_{01F}=0.020***
	General-oriented country	β_{00M}=0.023***	β_{00F}=0.017***

b)

AGE=40		**Male**	**Female**
Vocational qualification			
	Vocational-oriented country	β_{11M}=0.007***	β_{11F}=0.008***
	General-oriented country	β_{10M}=0.009***	β_{10F}=0.006***
General qualification			
	Vocational-oriented country	β_{01M}=0.011***	β_{01F}=0.010***
	General-oriented country	β_{00M}=0.013***	β_{00F}=0.007***

c)

AGE=50		**Male**	**Female**
Vocational qualification			
	Vocational-oriented country	β_{11M}=0.002***	β_{11F}=0.002***
	General-oriented country	β_{10M}= 0.004***	β_{10F}=0.001
General qualification			
	Vocational-oriented country	β_{01M}= 0.002**	β_{01F}=0.001*
	General-oriented country	β_{00M}= 0.004***	β_{00F}= -0.002***

d)

AGE=60		**Male**	**Female**
Vocational qualification			
	Vocational-oriented country	β_{11M}= -0.004***	β_{11F}= 0.003***
	General-oriented country	β_{10M}= -0.002	β_{10F}= -0.005***
General qualification			
	Vocational-oriented country	β_{01M}= -0.008***	β_{01F}= -0.008***
	General-oriented country	β_{00M}= -0.006***	β_{00F}= -0.012***

e)

Note: Dependent variable: Logarithm of the hourly wage. Control variables: numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Country-groups fixed effect included. β_{11M} $\beta_{11F}$are respectively the coefficients for men and women holding a vocational qualification and living in a vocational-oriented country; $\beta_{10M}\beta_{10F}$ are respectively the coefficients for men and women holding a vocational qualification and living in a general-oriented country; $\beta_{01M}\beta_{01F}$ are respectively the coefficients for men and women holding general qualification and living in a vocational-oriented country; $\beta_{00M}\beta_{00F}$ are respectively the coefficients for men and women holding general qualification and living in a general-oriented country. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A. 11 New classification

		OECD (EAG) 1996		OECD (EAG) 2007		
	VET/NO VET	Vocational	Combined school and work-based	Vocational	Combined school and work-based	VET/NO VET (Hanushek)
Austria	VOCATIONAL	76	34	70.7	34.3	VOCATIONAL
Canada	GENERAL	-	-	5.5	-	GENERAL
Czech Republic	VOCATIONAL	84	47	75.2	34	VOCATIONAL
Denmark	GENERAL	53	48	47.7	47.2	VOCATIONAL
Estonia	GENERAL	-	-	31.3	31.3	GENERAL
Finland	VOCATIONAL	52	5	66.7	11.5	VOCATIONAL
France	GENERAL	54	11	43.8	12.1	VOCATIONAL
Germany	VOCATIONAL	76	52	57.4	42.2	VOCATIONAL
Ireland	GENERAL	20	5	2.2	2.2	GENERAL
Japan	GENERAL	28	-	23.4	-	GENERAL
Korea	GENERAL	42	-	26.8	-	GENERAL
Netherlands	VOCATIONAL	70	23	67.6	18.5	VOCATIONAL
Norway	VOCATIONAL	58	-	57.5	14.9	VOCATIONAL
Poland	GENERAL	69	69	44.3	6.4	VOCATIONAL
Slovak Republic	VOCATIONAL			73.2	29.8	VOCATIONAL
Spain	GENERAL	39	2	43.4	1.9	GENERAL
Sweden	GENERAL	51	-	56.2	-	VOCATIONAL
United Kingdom	GENERAL	57	-	41.4	-	GENERAL
United States	GENERAL	-	-	-	-	GENERAL

Note: Data for OECD 2007and 1996 are from the 2009 and 1998 versions of the OECD Education at a Glance, Chapter C. The PIAAC data are calculated from all individuals who have completed an upper secondary education and are not currently enrolled in school.

Table A. 12 Baseline specifications - New classification

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age_i	0.008***	0.010***	0.011***	0.009***	0.010***	0.011***
	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.001]
Vet_i	0.018***	0.012	-0.003	-0.016**	-0.024**	-0.022
	[0.006]	[0.008]	[0.012]	[0.008]	[0.010]	[0.016]
$Female_i$	-0.180***	-0.186***	-0.224***	-0.180***	-0.214***	-0.255***
	[0.004]	[0.006]	[0.009]	[0.004]	[0.008]	[0.012]
Vet_c	0.089***	0.088***	0.029**	0.087***	0.087***	0.000
	[0.009]	[0.009]	[0.012]	[0.009]	[0.009]	[0.014]
$Vet_i * Age_i$	-0.002***	-0.004***	-0.003***	-0.002***	-0.004***	-0.003***
	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
$Female_i * Age_i$		-0.003***	-0.005***		-0.003***	-0.005***
		[0.001]	[0.001]		[0.001]	[0.001]
$Female_i * Vet_i$		0.008	-0.017		0.012	-0.034*
		[0.008]	[0.015]		[0.011]	[0.020]
$Vet_c * Age_i$			-0.002***			-0.002**
			[0.001]			[0.001]
$Vet_i * Vet_c$			0.040***			0.027
			[0.014]			[0.018]
$Female_i * Vet_c$			0.081***			0.088***
			[0.012]			[0.016]
$Female_i * Vet_i * Age_i$		0.003***	0.003**		0.003***	0.003**
		[0.001]	[0.001]		[0.001]	[0.001]
$Vet_i * Vet_c * Age_i$			0.000			-0.000
			[0.001]			[0.001]
$Female_i * Vet_i * Vet_c$			0.006			0.031
			[0.018]			[0.024]
$Female_i * Vet_c * Age_i$			0.006***			0.005***
			[0.001]			[0.001]
$Female_i * Vet_i * Vet_c * Age_i$			-0.002			-0.002
			[0.002]			[0.002]
Age_i^2				-0.048***	-0.058***	-0.069***
				[0.002]	[0.000]	[0.005]
$Vet_i * Age_i^2$				0.020***	0.020***	0.009
				[0.003]	[0.004]	[0.008]
$Female_i * Age_i^2$					0.021***	0.026***
					[0.004]	[0.006]
$Vet_c * Age_i^2$						0.023***
						[0.000]
$Female_i * Vet_i * Age_i^2$					-0.000	0.014
					[0.001]	[0.010]
$Vet_i * Vet_c * Age_i^2$						0.007
						[0.009]
$Female_i * Vet_c * Age_i^2$						-0.005
						[0.008]
$Female_i * Vet_i * Vet_c * Age_i^2$						-0.017
						[0.013]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Dummy country-groups	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.461***	2.465***	2.488***	2.553***	2.571***	2.605***
	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.017]
Observations	60166	60166	60166	60166	60166	60166
Adjusted R^2	0.520	0.520	0.522	0.527	0.528	0.530

Note: Dependent variable: logarithm of hourly wage. Control variables: numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Age^2, $Vet*Age^2$, $Female*Age^2$, $Vetc*Age^2$, $Female * Vet * Age^2$, $Vet * Vetc * Age^2$, $Female * Vetc * Age^2$, $Female * Vet * Vetc * Age^2$ rescaled multiplying by 100. Regressions are weighted by sampling weights. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A. 13 The intensity of vocational component

Variables	General	No-school based	School-based	Apprenticeship
Age_i	0.010***	0.004***	0.010***	0.005**
	[0.000]	[0.001]	[0.001]	[0.002]
Vet_i	-0.013	-0.052**	0.013	0.390***
	[0.009]	[0.023]	[0.015]	[0.092]
$Female_i$	-0.185***	-0.179***	-0.132***	-0.167***
	[0.007]	[0.021]	[0.011]	[0.035]
$Vet_i * Age_i$	-0.004***	0.002	-0.003***	0.002
	[0.001]	[0.002]	[0.001]	[0.003]
$Female_i * Age_i$	-0.003***	0.004**	-0.001	0.005
	[0.001]	[0.002]	[0.001]	[0.004]
$Female_i * Vet_i$	0.007	-0.022	-0.018	0.030
	[0.010]	[0.025]	[0.014]	[0.039]
$Female_i * Vet_i * Age_i$	0.002**	-0.003	-0.001	-0.006
	[0.001]	[0.002]	[0.001]	[0.004]
Constant	2.632***	2.006***	3.004***	2.419***
	[0.011]	[0.034]	[0.019]	[0.095]
Observations	60166	6892	7268	2752
Adjusted R^2	0.375	0.548	0.419	0.281

Note: Dependent variable: logarithm of hourly wage. Control variables: numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Country fixed effect included. Regressions are weighted by sampling weights. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.14 Baseline specifications - Literacy skill

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age_i	0.009***	0.010***	0.011***	0.009***	0.010***	0.011***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Vet_i	0.019***	0.016**	0.011	-0.012	-0.019*	-0.018
	[0.006]	[0.008]	[0.009]	[0.008]	[0.010]	[0.012]
$Female_i$	-0.198***	-0.203***	-0.212***	-0.197***	-0.230***	-0.238***
	[0.004]	[0.006]	[0.007]	[0.004]	[0.008]	[0.010]
Vet_c	0.057***	0.057***	0.038***	0.057***	0.057***	0.024*
	[0.005]	[0.005]	[0.010]	[0.005]	[0.005]	[0.014]
$Vet_i * Age_i$	-0.002***	-0.004***	-0.004***	-0.002***	-0.004***	-0.004***
	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
$Female_i * Age_i$		-0.003***	-0.004***		-0.003***	-0.004***
		[0.001]	[0.001]		[0.001]	[0.001]
$Female_i * Vet_i$		0.005	0.008		0.008	0.001
		[0.008]	[0.011]		[0.011]	[0.014]
$Vet_c * Age_i$			-0.003***			-0.002**
			[0.001]			[0.001]
$Vet_i * Vet_c$			0.015			0.012
			[0.013]			[0.017]
$Female_i * Vet_c$			0.032**			0.029*
			[0.013]			[0.017]
$Female_i * Vet_i * Age_i$		0.002***	0.004***		0.003***	0.005***
		[0.001]	[0.001]		[0.001]	[0.001]
$Vet_i * Vet_c * Age_i$			0.002			0.001
			[0.001]			[0.001]
$Female_i * Vet_i * Vet_c$			-0.019			0.002
			[0.017]			[0.023]
$Female_i * Vet_c * Age_i$			0.006***			0.005***
			[0.001]			[0.001]
$Female_i * Vet_i * Vet_c * Age_i$			-0.006***			-0.006***
			[0.001]			[0.001]
Age_i^2				-0.048***	-0.058***	-0.060***
				[0.002]	[0.003]	[0.004]
$Vet_i * Age_i^2$				0.019***	0.019***	0.014**
				[0.003]	[0.004]	[0.006]
$Female_i * Age_i^2$					0.019***	0.018***
					[0.004]	[0.005]
$Vet_c * Age_i^2$						0.010
						[0.007]
$Female_i * Vet_i * Age_i^2$					0.000	0.010
					[0.000]	[0.008]
$Vet_i * Vet_c * Age_i^2$						0.004
						[0.009]
$Female_i * Vet_c * Age_i^2$						0.006
						[0.009]
$Female_i * Vet_i * Vet_c * Age_i^2$						-0.020
						[0.013]
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Dummy country-groups	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.461***	2.465***	2.488***	2.553***	2.571***	2.605***
	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.017]
Observations	60166	60166	60166	60166	60166	60166
Adjusted R^2	0.539	0.54	0.54	0.547	0.549	0.549

Note: Dependent variable: logarithm of hourly wage. Control variables: literacy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Age^2, $Vet*Age^2$, $Female*Age^2$, $Vetc*Age^2$, $Female * Vet * Age^2$, $Vet * Vetc * Age^2$, $Female * Vetc * Age^2$, $Female * Vet * Vetc * Age^2$ rescaled multiplying by 100. Regressions are weighted by sampling weights. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Table A. 15 Sensitivity test: number of children

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age_i	0.010***	0.011***	0.012***	0.009***	0.011***	0.011***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Vet_i	0.022***	0.017**	0.013	-0.011	-0.020**	-0.018
	[0.006]	[0.008]	[0.009]	[0.008]	[0.010]	[0.012]
$Female_i$	-0.176***	-0.182***	-0.192***	-0.178***	-0.211***	-0.220***
	[0.004]	[0.006]	[0.007]	[0.004]	[0.008]	[0.010]
Vet_c	0.057***	0.056***	0.038***	0.057***	0.056***	0.024*
	[0.005]	[0.005]	[0.010]	[0.005]	[0.005]	[0.014]
$Vet_i * Age_i$	-0.002***	-0.004***	-0.004***	-0.002***	-0.004***	-0.004***
	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
$Female_i * Age_i$		-0.003***	-0.005***		-0.003***	-0.005***
		[0.001]	[0.001]		[0.001]	[0.001]
$Female_i * Vet_i$		0.009	0.012		0.011	0.004
		[0.008]	[0.011]		[0.011]	[0.014]
$Vet_c * Age_i$			-0.003***			-0.002**
			[0.001]			[0.001]
$Vet_i * Vet_c$			0.015			0.011
			[0.013]			[0.017]
$Female_i * Vet_c$			0.033***			0.031*
			[0.013]			[0.017]
$Female_i * Vet_i * Age_i$		0.002***	0.004***		0.003***	0.005***
		[0.001]	[0.001]		[0.001]	[0.001]
$Vet_i * Vet_c * Age_i$			0.002			0.001
			[0.001]			[0.001]
$Female_i * Vet_i * Vet_c$			-0.020			0.001
			[0.017]			[0.023]
$Female_i * Vet_c * Age_i$			0.006***			0.005***
			[0.001]			[0.001]
$Female_i * Vet_i * Vet_c * Age_i$			-0.007***			-0.006***
			[0.001]			[0.001]
Age_i^2				-0.051***	-0.060***	-0.063***
				[0.002]	[0.003]	[0.004]
$Vet_i * Age_i^2$				0.019***	0.020***	0.015***
				[0.003]	[0.004]	[0.006]
$Female_i * Age_i^2$					0.019***	0.018***
					[0.004]	[0.005]
$Vet_c * Age_i^2$						0.010
						[0.007]
$Female_i * Vet_i * Age_i^2$					0.000	0.009
					[0.000]	[0.008]
$Vet_i * Vet_c * Age_i^2$						0.005
						[0.009]
$Female_i * Vet_c * Age_i^2$						0.004
						[0.010]
$Female_i * Vet_i * Vet_c * Age_i^2$						-0.020
						[0.012]
Constant	2.512***	2.516***	2.522***	2.582***	2.600***	2.608***
	[0.015]	[0.015]	[0.016]	[0.015]	[0.016]	[0.016]
Control Variables	YES	YES	YES	YES	YES	YES
Dummy countries	YES	YES	YES	YES	YES	YES
Observations	59939	59939	59939	59939	59939	59939
Adjusted R^2	0.517	0.518	0.518	0.527	0.528	0.528

Note: Dependent variable: logarithm of hourly wage. Control variables: numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old. Age^2, $Vet*Age^2$, $Female*Age^2$, $Vetc*Age^2$, $Female * Vet * Age^2$, $Vet * Vetc * Age^2$, $Female * Vetc * Age^2$, $Female * Vet * Vetc * Age^2$ rescaled multiplying by 100. Regressions are weighted by sampling weights. Sample includes employed individuals aged 16-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A. 16 Baseline specifications - individuals aged 16-24 excluded

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age_i	0.007*** [0.000]	0.008*** [0.000]	0.009*** [0.001]	0.009*** [0.000]	0.011*** [0.000]	0.012*** [0.001]
Vet_i	-0.013* [0.007]	-0.013 [0.008]	-0.030*** [0.009]	-0.046*** [0.008]	-0.052*** [0.010]	-0.062*** [0.012]
$Female_i$	-0.182*** [0.004]	-0.181*** [0.006]	-0.192*** [0.007]	-0.182*** [0.004]	-0.217*** [0.008]	-0.229*** [0.010]
Vet_c	-0.018 [0.011]	-0.018 [0.011]	-0.059*** [0.014]	-0.020* [0.011]	-0.020* [0.011]	-0.079*** [0.017]
$Vet_i * Age_i$	-0.002*** [0.000]	-0.003*** [0.001]	-0.004*** [0.001]	-0.003*** [0.000]	-0.005*** [0.001]	-0.005*** [0.001]
$Female_i * Age_i$		-0.003*** [0.001]	-0.004*** [0.001]		-0.004*** [0.001]	-0.006*** [0.001]
$Female_i * Vet_i$		-0.003 [0.008]	-0.001 [0.011]		0.005 [0.011]	-0.009 [0.015]
$Vet_c * Age_i$			-0.003*** [0.001]			-0.003*** [0.001]
$Vet_i * Vet_c$			0.051*** [0.013]			0.042** [0.018]
$Female_i * Vet_c$			0.040*** [0.013]			0.039** [0.018]
$Female_i * Vet_i * Age_i$		0.003*** [0.001]	0.005*** [0.001]		0.004*** [0.001]	0.005*** [0.001]
$Vet_i * Vet_c * Age_i$			0.002 [0.001]			0.002 [0.001]
$Female_i * Vet_i * Vet_c$			-0.020 [0.017]			0.014 [0.024]
$Female_i * Vet_c * Age_i$			0.006*** [0.001]			0.006*** [0.001]
$Female_i * Vet_i * Vet_c * Age_i$			-0.006*** [0.002]			-0.005*** [0.002]
Age_i^2				-0.051*** [0.003]	-0.067*** [0.004]	-0.072*** [0.005]
$Vet_i * Age_i^2$				0.029*** [0.004]	0.032*** [0.006]	0.024*** [0.007]
$Female_i * Age_i^2$					0.032*** [0.005]	0.031*** [0.006]
$Vet_c * Age_i^2$						0.014 [0.009]
$Female_i * Vet_i * Age_i^2$					-0.004 [0.008]	0.011 [0.009]
$Vet_i * Vet_c * Age_i^2$						0.012 [0.012]
$Female_i * Vet_c * Age_i^2$						0.005 [0.012]
$Female_i * Vet_i * Vet_c * Age_i^2$						-0.034** [0.015]
Constant	2.748*** [0.011]	2.748*** [0.011]	2.757*** [0.012]	2.827*** [0.012]	2.847*** [0.012]	2.861*** [0.013]
Control Variables	YES	YES	YES	YES	YES	YES
Dummy countries	YES	YES	YES	YES	YES	YES
Observations	54957	54957	54957	54957	54957	54957
Adjusted R^2	0.546	0.546	0.546	0.551	0.552	0.553

Note: Dependent variable: logarithm of hourly wage. Control variables: numeracy score, the qualification held by the respondent, mother's qualification, father's qualification, number of books at home when the respondent was 15 years old, children. Age^2, $Vet*Age^2$, $Female*Age^2$, $Vetc*Age^2$, $Female * Vet * Age^2$, $Vet * Vetc * Age^2$, $Female * Vetc * Age^2$, $Female * Vet * Vetc * Age^2$ rescaled multiplying by 100. Regressions are weighted by sampling weights. Sample includes employed individuals aged 25-65 who are not currently studying and resident in one of the following 19 countries: Austria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom, and the United States. Standard errors in brackets. Significance level: $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

CHAPTER 3

3. Variation in Parenthood Wage Effect: A human capital approach

3.1. Introduction

The fact that women earn less than men is a well-established phenomenon, known as the gender wage gap. Earlier studies have tried to provide an explanation for this ongoing trend, mainly relying on two pillars, namely the human capital theory and labour market discrimination theory. However, even after controlling for individual observable and unobservable characteristics, taking into account possible differences in educational attainment (DiPrete and Buchmann, 2006), school content (Brown and Corcoran, 1997), occupational segregation (Bayard et al., 2003, Kunze, 2005), career and life expectation (Chevalier, 2002, Chevalier, 2007) and personality traits (Strain and Webber, 2017), a large gender wage gap remains unexplained.

What is common among the abovementioned studies is that differences in the educational path, school content, career and life expectation, and personality traits could in part be explained by different expectations in terms of women and men's social roles; where women are still perceived as caregivers and as rearers of their children, and men, as those who should provide reliable financial assistance for their families.

It is, indeed, undeniable that the different social expectations, in terms of men's and women's behaviours and traditional social roles of the sexes, have been shaped by the biological event of motherhood, which continues to be the only immutable gender difference (Schwartz, 1989). Given that, motherhood certainly is a critical event behind much of the gender wage gap (Bertrand, 2020).

In view of this evidence, the differential impact of motherhood and fatherhood on wages, that is, respectively, the pay gap between mothers/fathers and childless individuals with similar

characteristics, has been recognized as a key factor in explaining gender inequality in the labour market. Indeed, while the literature (Budig and England, 2001, Gangl and Ziefle, 2009, Meurs et al., 2010) agrees on the negative consequences of motherhood in terms of career opportunities and wage rates, a positive impact of fatherhood on wages has been found, confirming the existence of a fatherhood wage premium (Trappe and Rosenfeld, 2000, Meurs et al., 2010).

The aim of this chapter is to make a novel contribution to the literature by investigating the impact of parenthood on wages in Germany using the German Socio-Economic Panel (GSOEP). Previous studies have analysed the impact of parenthood on wages by using different econometric techniques: Ordinary Least Squares estimators (OLS) (Kumlin, 2007, Budig et al., 2012); Fixed effects models (Budig and England, 2001, Lundberg and Rose, 2000, Gangl and Ziefle, 2009, Wilde et al., 2010), Heckman regression model (Kellokumpu, 2007, Zhang et al., 2008); Quantile regression (Nestić, 2007); Instrumental variables (Simonsen and Skipper, 2012); Inverse probability of treatment weight (Pal and Waldfogel, 2014) ; quasi-experimental event study approach (Kleven et al., 2019). This study contributes to the literature by uncovering inequalities among women and men in terms of parenthood wage effects within a two-way fixed effect framework. The latter will involve comparing treated individuals, that is mothers/fathers who had a child in 2010, with childless women/men, with similar background characteristics, in order to estimate the effect of interest, hence the existence of a motherhood wage penalty/ fatherhood wage premium. Hence, to justify the results achieved, additional robustness checks for concerns regarding the time window and the threshold chosen will be performed. Furthermore, results are reinforced through the implementation of a generalised fixed effect estimation.

In addition, the present chapter throws further light on the factors that may exacerbate the motherhood wage gap, by investigating the human capital theory as one of the possible explanations for the different magnitude of the family-career trade-off faced by women during the childbearing age. In brief, the human capital theory identifies career interruptions, which lead to human capital depreciation and lost job experience, as one of the main factors impacting wage growth rates.

Consequently, the rate of depreciation of skills acquired over the educational path plays a fundamental role in defining the wage penalties faced by women over birth-related leave.

Following this line of thought, this chapter is unique in that is the first study to exploit the difference in terms of skills acquired through a vocational or a general educational path to evaluate the impact of skills and, in particular, of skills depreciation, on the motherhood wage gap. The results are consistent with the main hypothesis of this study which supports the idea according to which women with a vocational background suffer from a larger motherhood wage penalty if compared to those women having a general background. The main hypothesis and, consequently, the significance of the results achieved, relies on three main theoretical pillars. First, the existence of a strong trade-off between early advantages and late disadvantages in labour market outcomes for individuals with vocational education compared with those having a general background (Ryan, 2001, Zimmerman, 2013, Hanushek et al., 2017). Second, the difference in terms of skills developed following a general and a vocational path, where the latter is known to provide skills that are less adaptable to occupational changes, less transferable, and more easily atrophied over time (Weber, 2014, Hanushek et al., 2017). Third, the different allocation over occupational domains shown by individuals with a vocational or a general background, which might be a natural consequence of the different competencies acquired through different educational paths (Heijke et al., 2003).

Germany looks to be a good setting for this analysis for two main reasons. First, it is one of the European countries with the highest shares of vocational programs in the country's educational system (Hanushek et al., 2017). This means that individuals in Germany have a wide range of choices in terms of educational qualifications when it is time to embark on an educational path. Moreover, German legislation offers a legislative framework with extensive potential parental leave aiming at guaranteeing the return of individuals to their former workplace[16].

[16] Mothers are legally entitled to fourteen weeks of maternity leave (six weeks before and eight weeks after the birth of a child). In addition, both parents can take advantage of parental leave. The parental leave can be up to three years, and it is unpaid. However, parents can apply for the "*Elterngeld"*, a parental allowance that grants between 300 to 1800 euro per months accordingly to the income parents had before having a child.

The remainder of this paper is organised as follows. The next section provides a review of the motherhood wage gap and the fatherhood wage premium and a comparison of vocational versus general education. Section 3 describes the data and section 4 explains our identification strategy. Section 5 presents the main findings. Finally, Section 6 concludes.

3.2. Literature review

3.2.1. The impact of parenthood on wage

The motherhood wage gap consists of the difference in pay between mothers and childless women with similar characteristics, with non-mothers defined as those employed women who do not fulfil the dual requirements of having children and being female.

Several different mechanisms are identified by social science research investigations, to provide a plausible explanation for the existence of the motherhood wage gap (Grimshaw and Rubery, 2015, Cukrowska-Torzewska and Matysiak, 2020). According to the rational economics approach, mothers experience more career interruptions; consequently, the time spent out of the labour force might have an impact on the level and the growth rate of earnings. It is indeed well documented that there is a wage gap between an intermittent worker relative to a continuously employed worker (Cox, 1984, Jacobsen and Levin, 1995) due to the forgone human capital investment, lost job experience, and skill depreciation (Mincer and Polachek, 1974); thus, a difference in wage between mothers and non-mothers is anticipated.

Jacobsen and Levin (1995) summarize the main reasons to motivate the decrease in wages faced by women after career interruption as follows. First, women who experience career breaks do not build up seniority, which, by itself, leads to a higher wage. Second, women who return to the labour force are less likely to invest in on-the-job training to enhance their skills and productivity and, consequently, their wages. Third, job skills and knowledge deteriorate during periods of non-employment.

Several studies (Budig and England, 2001, Gangl and Ziefle, 2009, Cukrowska-Torzewska and Matysiak, 2020) have shown that part of the above-mentioned wage gap could be explained by the fact that those birth-related career breaks lead to a loss and non-accumulation of human capital. Using the French Families and Employers survey, Meurs et al. (2010) provide information related to the impact of career interruptions and time out of the labour market. Their results support the human capital theory, according to which the motherhood wage gap can be explained by differences in human capital acquisition and human capital depreciation.

Furthermore, the expectations of future career interruption, by themselves, may impact current earnings growth. De facto, women could predict to be in the labour force for a shorter period of time; therefore, they will be less incentivized to enhance their skills, given that they will benefit from the human capital investment for a shorter time period (Polachek, 1981, Blakemore and Low, 1984, Anderson et al., 2003, Kalist, 2008, Simonsen and Skipper, 2012). This attitude could suggest that women can exhibit a weaker attachment to their job (Munasinghe et al., 2008).

Finally, the existence of work interruptions could also lead women to change their labour market behaviour. Indeed, women might be more likely to select family-friendly jobs, part-time jobs, or jobs with less responsibility, usually characterized by lower salaries (Waldfogel, 1997, Budig and England, 2001, Amuedo-Dorantes and Kimmel, 2008). Nielsen et al. (2004) point out a severe penalty after care-related leave in sectors with non-family-friendly policies. This justifies the self-selection of mothers into female-dominated occupations, which allows them to meet family responsibility by sacrificing the wage received. Lundberg and Rose (2000) find that while mothers return to their jobs working fewer hours and suffer from a decrease in wages, men, after becoming fathers, work more and earn more. Using the German Socio-Economic Panel data and by implementing a first difference analysis, Felfe (2012) investigates women's work conditions after they became mothers. Given that for women who work full-time and have children the pressure on their time may be extreme, the study reports a decrease in terms of working hours, and a stronger preference for jobs with a lower level of stress.

Kleven et al, (2019) implement a quasi-experimental event study approach on Denmark administrative data and show that women's child-related penalty is almost equal to 20% in the long run, and it affects several labour market outcomes: employment, working hours, wage, sector and firm chosen. They estimate that the child-related penalty may explain about 80% of the unexplained gender wage gap.

While the negative consequences of motherhood, both in terms of career opportunities and wages, have been exhaustively addressed in the literature, there are relatively few studies that focus on the effect of parenthood on men.

The general findings agree that fathers experience a wage premium if compared to childless men (Trappe and Rosenfeld, 2000, Meurs et al., 2010). By estimating a fixed effect model on two cohorts of men using the Panel Study of Income Dynamics, Lundberg and Rose (2002) find a significant increase in the hourly wage rate, with bonuses of 4 to 7 per cent, and a positive impact on labour supply.

Those results are confirmed by Koslowski (2010), who analyses, using the European Community Household Panel data, whether fathers work longer hours compared to childless men and if the time spent with the children has an impact on the wage. The study concludes that parental status does not seem to impact the weekly working hours and that fathers who report spending more time with their children earn 1 per cent more than childless men.

The literature tries to explain the existence of the fathers' wage premium by exploiting different factors. The most accepted theory is that the fatherhood wage premium depends strictly on women's uptake of employment after giving birth to a child and whether the child's mother works part or full time. An early study from Presser (1994), shows how employment schedules might impact family life. The author analyses the factors that can impact men's choice to share household labour, pointing out that men share household work only when the employment schedules of the couple do not overlap. Other studies support those early findings, showing the wage premium results to be bigger, indeed,

when the child's mother works part-time or does not work at all (Hodges and Budig, 2010). Those findings strictly connect with the traditional division of labour concerning the socially prescribed gender roles, which see the women fulfilling family responsibilities and the men as the "breadwinner".

However, "a move towards a universal caregiver or dual-earner/dual carer society is a necessary one if true gender equality is to be achieved" (Fraser,1994 pp 116). If men do not participate in household labour the only way to lift the barrier and achieve gender equality is the outsourcing of childcare. Thus, another factor that might impact the father wage premium is the implementation of childcare related policy interventions such as parental leave which might impact mothers' and fathers' work decisions. Using Norwegian registry data, Rege and Solli (2013) investigate the effect of paternity leave on fathers' wages. Through the use of a difference-in-differences model, the authors disentangle the effect of the introduction of a paternity leave quota by the Norwegian Government in 1993 on wages, finding that fathers taking paternity leave are subject to earnings decreases five years later.

Other studies, instead, focus the attention on factors such as race and level of education to provide an explanation of the size of the fathers' premium. Glauber (2008) shows that the wage premium depends, indeed, on the race of the father, with black fathers having a significantly lower premium than white fathers. Hodges and Budig (2010), instead, indicate that graduate fathers have a larger premium if compared with non-graduate fathers.

3.2.2. Vocational versus general education

As previously stated, this study aims to contribute to the literature by analysing the impact of motherhood and fatherhood on wages, according to the type of educational background.

Earlier studies (Ryan, 2001, Zimmerman, 2013, Hanushek et al., 2017) have provided extensive evidence that while holding a vocational qualification enhances the probability of being employed at the early career stage, providing ready to use skills and an initial relative earnings premium, these advantages turn into later disadvantages in terms of lower employment opportunities in later life and

lower wages when compared to individuals with a general background (Cörvers et al., 2011, Golsteyn and Stenberg, 2017, Brunello and Rocco, 2017).

Moreover, previous studies have confirmed that the skills acquired through studying vocational qualifications become more easily obsolete and may require updating more often compared to skills and knowledge acquired through a general path (Hanushek et al., 2015, Hampf and Woessmann, 2017). Weber (2014) uses data from the Swiss Labour Force Survey over the period 1998-2008, to examine the human capital depreciation rate across different education types and by different occupations, skills levels, and technology intensity. The study identifies that "concept-based" qualifications (e.g., general qualifications), provide greater worker protection against skills obsolescence when compared to "skills-specific" qualifications (e.g., vocational qualifications). While technical obsolescence, the depreciation of skills due to under-utilization of skills, may impact both educational types, the economic obsolescence, the depreciation due to the workers' environment and technological changes, may impact more heavily on those workers with a vocational background. The latter will be less able to adapt effectively to new situations in the labour market.

Following this line of thought, where human capital depreciation varies according to the educational qualifications and associated skills held by the individual, with vocational skills being more easily obsolete; and given the existence of a strong trade-off between early advantages and late disadvantages in labour market outcomes for individuals with vocational education when compared with those having a general qualification, this chapter aims to contribute to the literature by investigating whether, in the long term, women with a vocational background are likely to face a wider motherhood wage gap.

3.3. Data

The primary data source used in this study is the GSOEP. In particular, the chapter is going to use the SOEP-Core which is the centrepiece of the GSOEP. The GSOEP is an interdisciplinary longitudinal survey of private households for the representative analysis of social and economic

behaviour in the Federal Republic of Germany. The data collection of the GSOEP started in 1984, by the German Institute for Economic Research, DIW (Deutsches Institut für Wirtschaftsforschung) Berlin, and shortly after German reunification, it was enlarged by including a representative sample from East Germany. The GSOEP surveys about 30,000 individuals annually in about 15,000 households. German citizens living in Germany, overseas citizens residing in Germany, and from 2016 a representative proportion of refugees, are included in the GSOEP sample. Every year each participating household member, aged 18 years and older, is requested to fill out a questionnaire which comprises a wide range of questions providing information about demographic, epidemiological, geographic, health science, political science, socio-psychological and even sport-science issues.

GSOEP is the most suited database for this analysis due to the rich set of information provided. It does not only provide useful data related to the demographic characteristics, the background of respondents, educational attainment, labour force, and health status but it also offers valuable information on women's fertility history and the mother-child relationship. Most importantly, using the Comparative Analysis of Social Mobility in Industrial Nations (CASMIN) classification, the highest qualification achieved by each respondent can be easily classified as either vocational or general orientated.

3.3.1. The Sample

The data used for this chapter comes from wave "v", in 2005, to wave "bf", in 2015[17], of the GSOEP. Thus, the study relies on an unbalanced panel of eleven years of data. The final analytical sample used in this chapter comprises 25,088 women and 30,890 men. This study considers only women of fertile age, defined as age 18 to 47[18]. The same restrictions, in terms of age, are applied to men[19].

[17] This study focuses on 2005-2015 data as those are identified by the author to be the most recent years reporting the highest numbers in terms of women giving birth to the first, second, or third child among all the years available in the GSOEP database.
[18] Individuals who turn 47 are then dropped from the sample.
[19] After 45 years old there is a decrease in the number of biological children for both women and men.

Given that this chapter aims to investigate the impact of having a child on wages, men and women not currently employed are also excluded from the sample.

To allow a comparison of the impact of parenthood on women and men with different educational backgrounds, individuals with no qualifications or training are excluded from the sample. Finally, to make the sample of mothers and fathers as homogenous as possible, this study will focus on those parents whose first child is born during or after 2005. People working for the army and students are also excluded. Table 3.1 summarises the number of observations in the sample following the above-mentioned exclusions.

Table 3.1 Sample size summary

	Women	**Men**
Total number of observations (2005-2015)	235,947	222,719
If the individual is younger than 18 and older than 47	(-139,484) 96,463	(-137,211) 85,508
If the individual is not employed	(-44,770) 51,693	(-33,083) 52,425
If the individual is currently studying or has no qualifications/training	(-312) 51,381	(-271) 52,154
Mothers/Fathers who gave birth to their first child before 2005	(-26,266) 25,115	(-20,915) 31,239
Other exclusion (army)	(-27) 25,088	(-349) 30,890
Total number of usable observations	**25,088**	**30,890**

3.3.2. Variables

Dependent variable

The dependent variable is the natural logarithm of the individual's current labour monthly wage[20]. While overtime payments are included in the monthly wage, no irregular one-time payments such as holidays or bonuses are considered. Income details are consistently provided in euros for all waves.

[20] The current labour monthly wage is an imputed variable generated for all SOEP respondents who are employed in a main job in each wave. The DIW applies different techniques in order to reduce the number of missing values. The non-response is imputed in a "two-stage" procedure. First, they rely on the "Row and Column" method as described by Little and Su (1989) using individual longitudinal/cross-section data available for the entire panel duration. If data are lacking, they base the imputation on a regression using different Mincerian covariates (Frick and Grabka, 2007). Hence, the use of labour monthly wage allows this analysis to overcome the problem of missing values that this analysis would have faced if using any other dependent variable for wages (e.g.: hourly wage computed by dividing the imputed variable -monthly wage- by the monthly working hours).

To limit the influence of outliners, this analysis trims the bottom and the top one per cent of the wage distribution. The variable is then adjusted for inflation using the consumer price index provided by the GSOEP (base year 2015- survey year 2016).

Key variables

Mothers / Fathers

This study defines "Childless women" as those women who never had a child and as those women who became mothers, in the years before they gave birth. Mothers are identified as those women who gave birth to a child (biological child), in the years after they give birth. The same classification is adopted for "Fathers" and "Childless men". Consequently, our key independent variables, that identify the wage penalty/premium of mothers/fathers, are two dummy variables: "mother" and "father", both taking value one when the individual has a child.

Figure 3.1 shows the lowess smoothed values of the logarithm of the monthly wage across ages, separating mothers/fathers from childless individuals for employed individuals aged between 18 to 47. The graph confirms that the degree of curvature in the relationship between age and the logarithm of monthly wage differs based on whether an individual has a child. The wage gap is wider among women, with mothers having a lower wage, on average, compared with non-mothers. In particular, the figure highlights that there is a fatherhood wage premium and a motherhood wage penalty at all ages, not just on average.

Figure 3.2 shows the distribution of the logarithm of the monthly wages. On the horizontal axis there is the logarithm of the monthly wage and on the vertical axis the corresponding percentages. Both distributions are skewed to the left or negatively skewed. While for the distributions of fathers and childless men, fathers show a greater frequency for the highest values of the logarithm of the monthly wage; the distributions of mothers and non-mothers lead to a different conclusion, with non-mothers showing a higher frequency for the highest wage values.

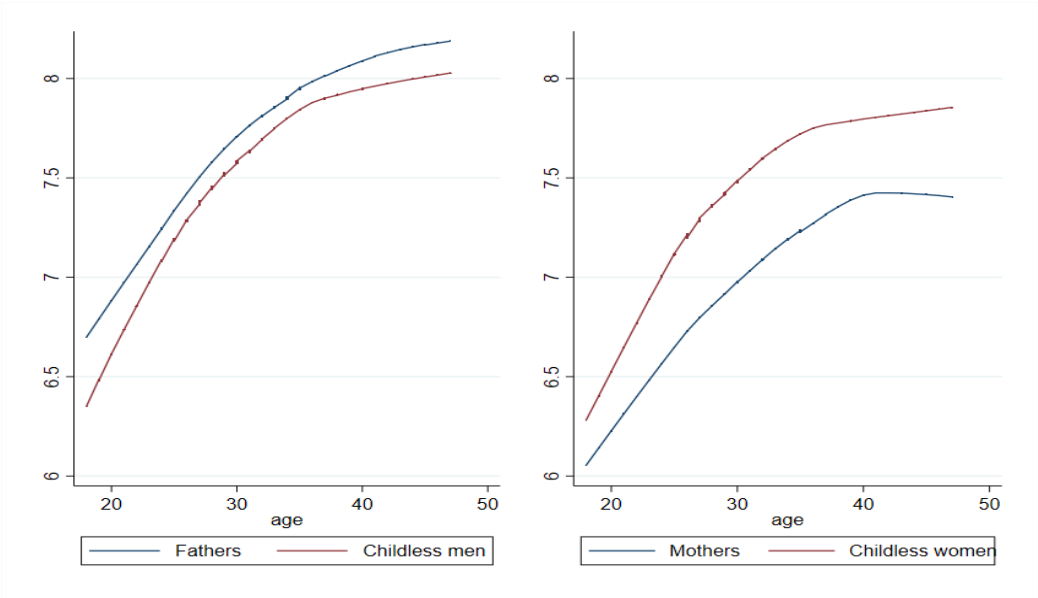

Figure 3.1 Age-log monthly wage relationship for mothers/fathers and childless individual

Note: Lowess smoothed values of the logarithm of the monthly wage across ages. The sample includes employed individuals aged 18-47 and who are not currently studying (2005-2015). Individuals with no qualification or training are excluded from the sample. Only mother and fathers whose first child is born during or after 2005 are considered. GSOEP data.

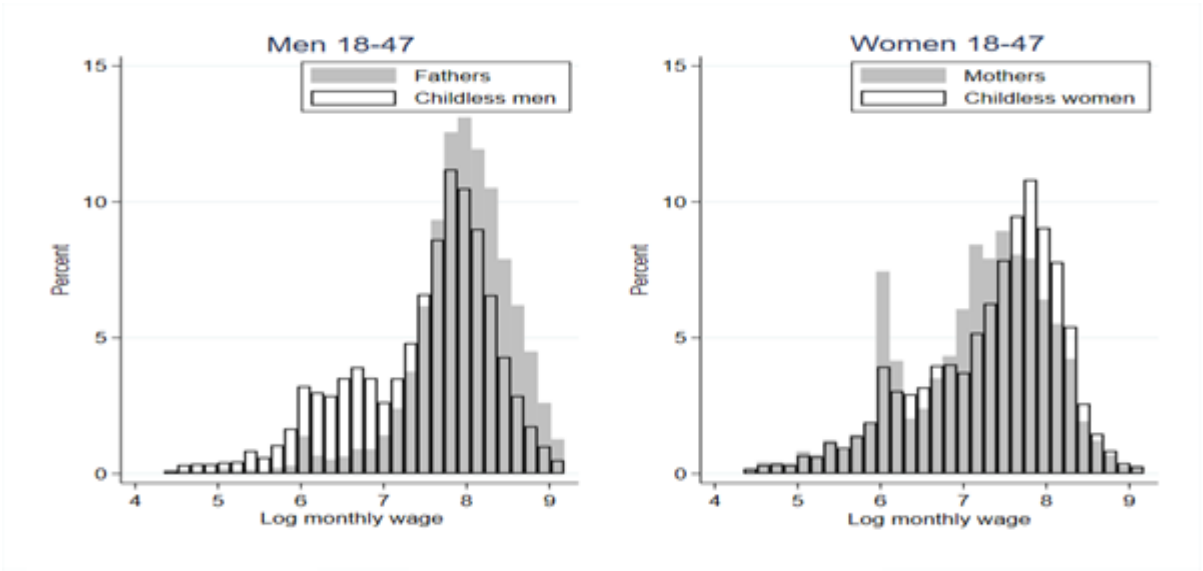

Figure 3.2 Logarithm of the monthly wage distribution by gender (Parents vs childless individuals)

Note: Distribution of the logarithm of the monthly wage. The sample includes employed individuals aged 18-47 and who are not currently studying (2005-2015). Individuals with no qualification or training are excluded from the sample. Only mother and fathers whose first child is born during or after 2005 are considered. GSOEP data.

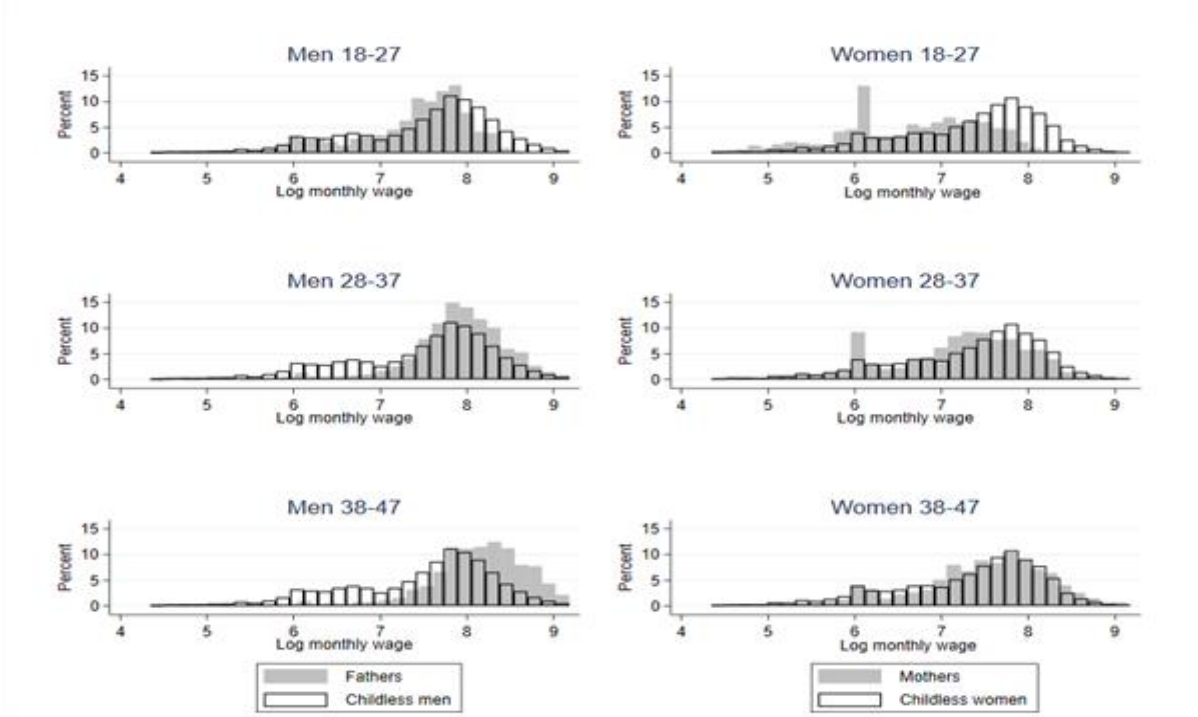

Figure 3.3 Logarithm of the monthly wage distribution by gender (Parents vs childless individuals) and by age range

Note: Distribution of the logarithm of the monthly wage by gender (men and women) and age-range (18-27, 28-37, 38-47). The sample includes employed individuals aged 18-47 and who are not currently studying (2005-2015). Individuals with no qualification or training are excluded from the sample. Only mother and fathers whose first child is born during or after 2005 are considered. GSOEP data.

Figure 3.3 shows the distribution of the log monthly wage this time taking age into account. It shows that even after taking age into account by plotting the distribution according to the age range considered, the conclusions that one could derive are still the same. During the child-bearing age, non-mothers show a higher frequency for the highest wage if compared with mothers. The two distributions become closer only when the age range 38-47 is examined. Non-fathers show higher frequency for the highest wage values only for the age range 18-27.

Highest qualification achieved

The highest qualification achieved by the individual is identified according to the CASMIN classification which is an internationally comparable measurement instrument for educational attainment (Brauns et al, 2003). The CASMIN classification was developed in the 1970s to take into consideration the effects of different educational systems on inter and intra-generational mobility.

Müller (2000) describes the German qualifications falling in each CASMIN level (Table 3.2).

Table 3.2 Casmin Classification- German qualifications

	Qualifications	VET/NO VET
1a	**Inadequately completed general education**	-
	ohne Abschluß, berufliches Praktikum	
1b	**General elementary education**	GEN
	Haupt-/Volksschulabschluß	
1c	**Basic vocational qualification/general elementary education and vocational qualification**	VET
	Haupt-/Volksschulabschluß mit Abschluß einer Lehr-/Anlernausbildung oder Meister-/Technikerausbildung	
2a	**Intermediate vocational qualification/ Intermediate general qualification**	VET
	Realschulabschluß (Mittlere Reife) mit Abschluß einer Lehr-/Anlernausbildung oder Meister-/Technikerausbildung	
2b	**Intermediate general qualification**	GEN
	Realschulabschluß (Mittlere Reife)	
2c_gen	**General Maturity certificate**	GEN
	Fachhochschulreife, Hochschulreife (Abitur)	
2c_voc	**Vocational maturity/ General maturity and vocational qualification**	VET
	Fachhochschulreife, Hochschulreife (Abitur) mit Abschluß einer Lehr-/Anlernausbildung oder Meister-/Technikerausbildung	
3a	**Lower tertiary education**	VET
	Fachhochschule, Ingenieurschule	
3b	**Higher tertiary education**	GEN
	Hochschule	

According to Table 3.2, one can distinguish 9 different CASMIN levels:

- *Level 1a, inadequately completed general education*: which includes individuals without a completion certificate or internship.
- *Level 1b, general elementary education*: that considers the certifications that an individual can achieve with the completion of the *Hauptschule*.
- *Level 1c, basic vocational qualification/general elementary education and vocational*: that includes the certifications achieved with the completion of the *Hauptschule* with a completed apprenticeship.
- *Level 2a, intermediate vocational qualification/ intermediate general qualification and vocational qualification*: that comprises the *Realschule* leaving certificate with a completed apprenticeship or vocational training.

- *Level 2b, intermediate general qualification*: that includes the *Realschule* leaving certificate without a completed apprenticeship or vocational training.
- *Level 2c_gen, general maturity certificate*: that considers the *Fachhochschulreife*, school leaving certificate after *Realschule* and/or the *Hochschulreife*, also called *Abitur*, a maturity certificate usually achieved after 13 years of *Gymnasium* and that allows access to universities.
- *Level 2c_voc, vocational maturity certificate/ general maturity certificate and vocational qualification*: school leaving certificate after *Realschule* and/or the *Hochschulreife*, also called *Abitur*, a maturity certificate usually achieved after 13 years of *Gymnasium* and that allows access to universities, plus a completed apprenticeship or vocational training.
- *Level 3a, lower tertiary education*: that considers degrees from *Fachhochschule, Ingenieurschule*, polytechnic or engineering college.
- *Level 3b, higher tertiary education*: that includes degrees from the *Hochschule*, that is University.

Accordingly, this chapter considers as general level 1 and 2 those qualifications that fall in CASMIN level 1b and 2b, as general level 3 those included in CASMIN level 2c_gen, and finally as general level 4 those contained in CASMIN level 3b. For how it concerns, instead, vocational qualifications, those qualifications included in level 1c and 2a CASMIN are considered as level 1 and level 2 vocational, while those in level 2c_voc and 3a define, respectively, level 3 vocational and level 4 vocational.

Consequently, eight dummy variables have been generated "level 1 general", "level 2 general", "level 3 general", "level 4 general", binary variables taking value one when the highest qualification achieved by the respondent is level 1 general, 2 general, 3 general or 4 general respectively, and "level 1 vocational", "level 2 vocational" "level 3 vocational" and "level 4 vocational" (with level 4 vocational being the base category), that assume value one when the individual has as highest qualification achieved a level 1 vocational, 2 vocational, 3 vocational or 4 vocational respectively.

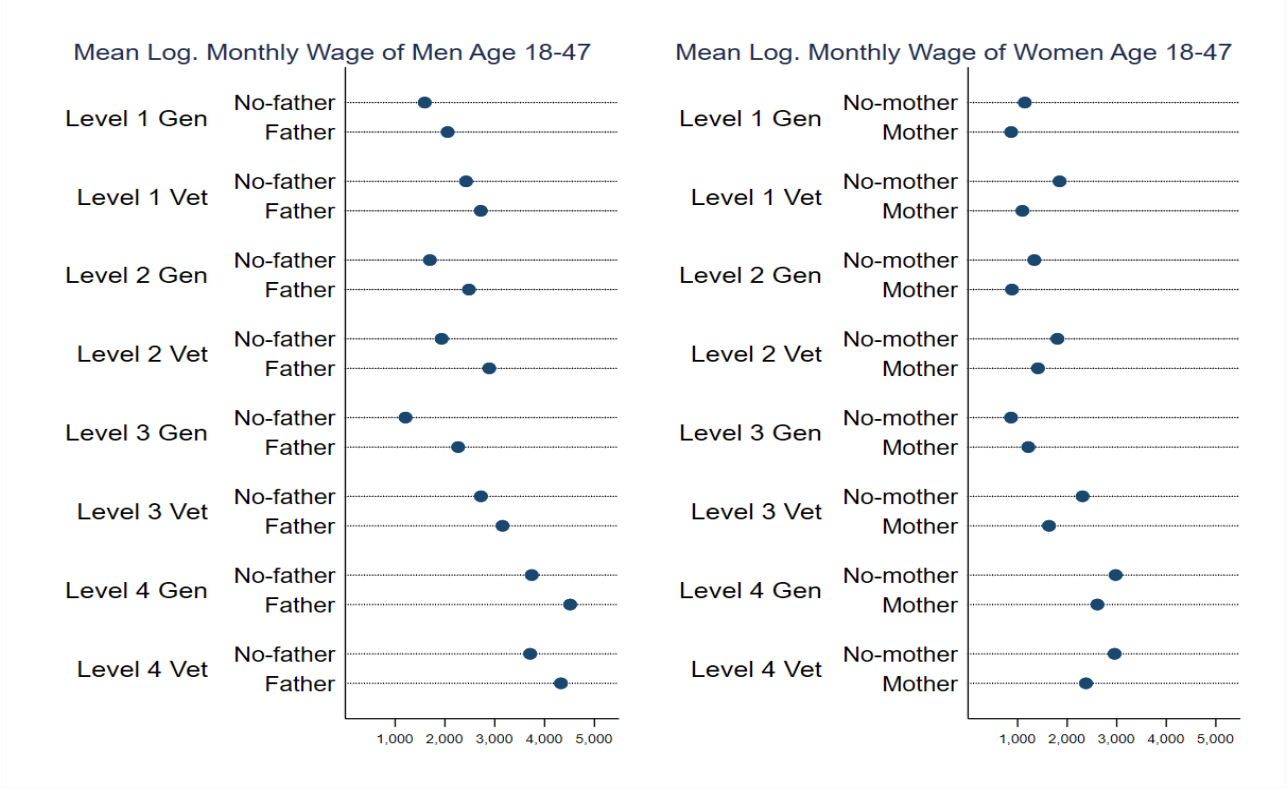

Figure 3.4 Mean of the log of the monthly wage of mothers/fathers and childless individuals by education type

Note: Average monthly wage. The sample includes employed individuals aged 18-47 and who are not currently studying (2005-2015). Individuals with no qualification or training are excluded from the sample. Only mother and fathers whose first child is born during or after 2005 are considered. GSOEP data.

Figure 3.4 shows the average monthly wage for both men and women by education type separating mothers and fathers from childless individuals, for employed individuals aged 18-47. While mothers are shown to have a lower monthly wage, on average, if compared with childless women for all the qualification types (the only exception being level 3 General), fathers show, instead, a slightly higher monthly wage if compared with childless men.

Control variables

The GSOEP dataset provides very rich information concerning the background characteristics of the individuals. To control for other conflating factors that may impact an individual's monthly wage and the motherhood wage gap/ father wage premium, the model will consider background characteristics, relationship status, educational background, and job characteristics.

A summary of both key variables and other control variables is provided in Table B.1.

The choice of explanatory variables is based on the existing literature. For instance, a set of two dummy variables "Single" (reference category) and "Married", is used to control for the relationship status of the respondent given the impact that the latter could have on wages for both men and women (Becker, 1981, Barg and Beblo, 2009, Pollmann-Schult, 2011).

An important part of the literature has focused on the positive returns to experience and seniority (Altonji and Williams, 1997, Dustmann and Meghir, 2005). It is also well known that women who decide to become mothers need to consider that birth-related leave will lead to foregone human capital investment, lost job experience, and skill depreciation (Mincer and Polachek, 1974) which consequently will impact their wage rate; the same effect is not observed for men. Relying on the importance given to experience from the previous literature, the model implemented in this study will consider both part-time and full-time years of experience. Those variables reflect the total length of full-time and part-time employment in the respondent's career. Also, binary variables for current "Full-time", "Public sector" and "Self-employed" status are included in the model. The variables will assume value one if the respondent works full time, in the public sector, and is self-employed, respectively.

The model will also include dummy variables to classify the occupation of the respondent. The categorization of the different occupations is made according to the third version of the International Standard Classification of Occupation (ISCO-88) for European Union purposes. "Elementary occupation" (the base category) indicates whether the individual has an elementary occupation; "Agricultural/fishery workers", "Craft and trade workers" and "Machine operators" if the respondent is, respectively, a skilled agricultural and fishery worker, a craft worker or a plant and machine operator; "Clerks" "Service workers" "Technicians" if the respondent is a clerk, a service worker/market sale worker or a technician and associate professional; "Managers" and "Professionals" if the individual is a legislator, senior officials and manager or a professional.

Finally, in agreement with the literature which sees unstable employment and low income as significantly related to precarious workers' perceived health (Lim et al., 2015) the model will include

a dummy variable "Good health" which takes the value of one when the respondents define their health status as rather good, zero otherwise.

3.3.3. Descriptive statistics

The descriptive statistics of the analytical sample are provided in Appendix B. The data show the existence of a raw motherhood wage penalty (Table B.2) and a fatherhood wage premium (Table B.3)[21] both if the comparison is made among people with a vocational qualification or with a general qualification as the highest qualification achieved (Table B.4, B.5). The difference in means of the monthly wage remains negative and statistically significant across the selected age ranges for women with general or vocational qualifications; in contrast, the difference in means of the monthly wage for men remains positive across age and education type.

Lining up with the literature, while the gap, within gender groups, between the monthly wage of individuals having a vocational qualification and those having a general background is positive if we consider individuals aged 18-27 (for both mothers and non-mothers), this gap turns instead negative if we consider individuals aged 28-37 or 38-47. This can be explained by the fact that vocational educational paths help to develop specific job-related skills that prepare students to work in particular occupations while general education provides students with broad knowledge and basic skills as a foundation for further learning and/or on-the-job training. This leads to a strong early advantage and a late disadvantage in terms of labour market outcomes (wage, employment, school-to-work transition) for individuals with a vocational qualification as their highest qualification.

The latter could also help to understand why the motherhood wage gap is, on average, bigger for women with a vocational background compared to women with a general background (the only exception being women aged 18-27). Indeed, previous studies have confirmed that while holding a

[21] Table B.2 and B.3 also include the p-values for the test that the means are equal. As can be noticed there are differences between the treatment and control groups. Mothers and non-mothers and fathers and non-fathers are at different points of their respective life cycles. However, differences are overall qualitatively small. We take this difference into account in our analysis by controlling for life cycle differences in our estimations with an extensive set of covariates.

vocational qualification enhances the probability of being employed and having a higher wage at the early career stage by providing ready-to-use skills, this advantage comes at the cost that the skills acquired through studying vocational qualifications become more easily obsolete. Thus, the early advantage of studying vocational qualifications turns into a later disadvantage. In this respect, women with a vocational background, who give birth to a child and who then take some time off from their job, would be exposed to a depreciation of their skills which will cost more in terms of future income as compared to women with a general background. The path is not clear, instead, if the comparison is made between men with a vocational versus those with a general background. Indeed, the educational background does not seem to affect the fatherhood wage premium.

The monthly wage appears to be higher, on average, for childless women if compared to mothers, even though mothers are, on average, older than no-mothers. Not surprisingly, childless women have a higher probability to work full-time (77%) while only 31% of mothers work full-time. On the contrary, fathers are more likely to work full time than non-fathers (93% vs 88%). Further striking differences, which can be partly explained by the age differences, can be observed with respect to work experience: mothers show more years of both part-time (2.7) and full-time (6.7) job experience when compared with non-mothers (with respectively 1.5 and 6.1 years of experience). The difference in years of full-time job experience is even greater if the comparison is made between fathers (11.7) and childless men (6.9). It is interesting to highlight that, in agreement with the literature, while men show, on average, more years of full-time job experience, women show, on average, more years of part-time experience when compared with men.

Figures 3.5 and 3.6 provide a clear framework of differences in terms of occupational distribution with a clear comparison between individuals with (before and after they give birth to a child) and without children and across education types (vocational versus general).

Women with a vocational background appear to secure employment more as “Technicians and associate professionals”, “Service and Sales workers” and “Clerical support workers” while those with a general background are more likely to segregate into “Professionals” occupations. Men with a

vocational background seem instead to be more segregated into occupations such as “Craft and trade” and “Technicians and associate professionals”; those with a general background are more into “Professionals” occupations. The occupational distribution between mothers before and after giving birth is quite alike. The only perceptible difference is a reduction of women into “Professional” occupations and an increase of women working in “Elementary occupations”, regardless of their educational background. The same is detected when we compare fathers before and after the birth of a child.

As expected, 70% of the mothers and 78% of the fathers in the sample have a partner while less than 15% of childless men and women have one.

Childless women and mothers show the same average of years of schooling (12 years), and the same can be said for fathers and non-fathers. More than 57% of the women and men considered in this study have as their highest qualification a vocational qualification.

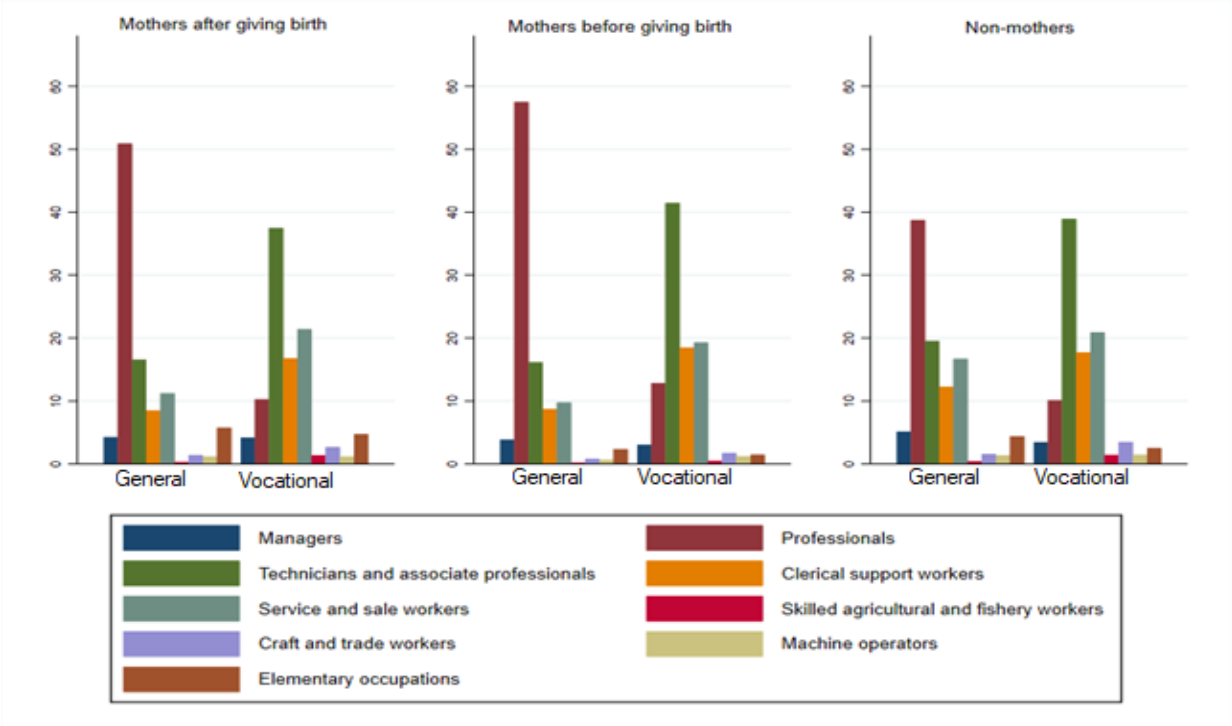

Figure 3.5 Occupational distribution -Women

Note: Distribution of occupations for mothers before and after giving birth and non-mothers by education type of the highest qualification achieved (vocational and general). The sample includes employed women aged 18-47 and who are not currently studying between 2005-2015. Individuals with no qualification or training are excluded from the sample. Only mothers whose first child is born during or after 2005 are considered. GSOEP data.

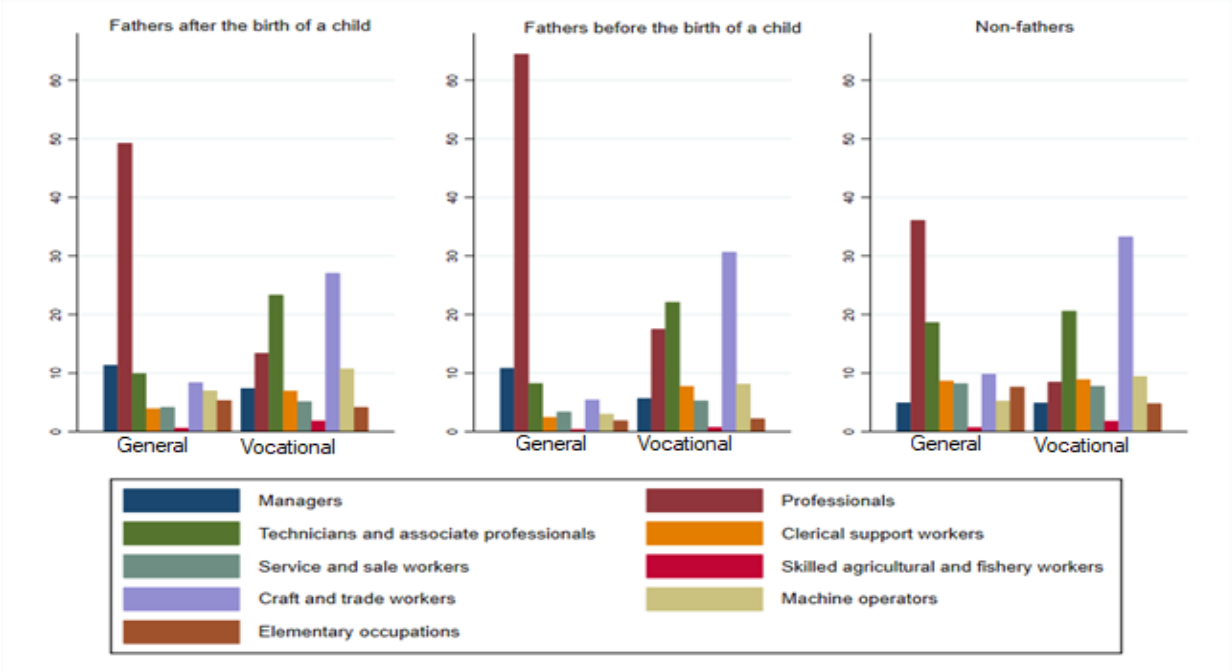

Figure 3.6 Occupational distribution – Men

Note: Distribution of occupations for fathers before and after giving birth and non-fathers by education type of the highest qualification achieved (vocational and general). The sample includes employed men aged 18-47 and who are not currently studying between 2005-2015. Individuals with no qualification or training are excluded from the sample. Only fathers whose first child is born during or after 2005 are considered. GSOEP data.

3.4. Methodology

The model seeks to compare the difference in monthly earnings between two groups of women/men: the ones who had a child at a given time t and the ones who are childless throughout the sample period. The model implemented in this study can be represented as a two-way fixed effect estimator regression also known as unit and time fixed effect approach:

$$lny_{it} = \alpha_0 + \beta Treatment_i * Time_t + \gamma X_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad 1)$$

In particular, our baseline model considers a threshold t= 2010 and investigates the event of giving birth to a child in 2010 looking at five years before and five years after the event and considering a sample of employed women and men between 2005 and 2015. Hence:

y_{it}denotes the outcome of interest, thus the monthly earnings of individual i at time t.

$Time_t$ is the indicator of the post-birth period, and it switches on to 1 from 2010 onwards.

$Treatment_i$is the treatment dummy variable and it takes a value of one if the individual is treated, zero otherwise. In particular, the treatment considered in this analysis is whether the individual gives birth to a child in 2010.

β is the main coefficient of interest, on the interaction term between the two dummies mentioned above, and thus measures the difference in terms of the logarithm of the monthly wage between individuals who had a child in 2010 and those who are childless throughout the sample period, after the birth of a child.

The parameter γ is a vector of coefficients on the characteristics of individual i at time t that might affect the dependent variable including, importantly, background characteristics, highest qualification achieved, relationship status, and job characteristics.

The model includes individual fixed effects (μi) to account for time-invariant heterogeneity at the individual level and eliminate any confounding factors that might be caused by effects that are constant over time at the individual level; and time fixed effects (δt) to adjust for time-specific unobserved confounders.

Finally, εit is an error term.

The log-linear relationship between wages and human capital is justified by the investment paradigm developed by Mincer (1974).

To justify the results achieved, additional robustness checks to ensure that the results are not sensitive to choices regarding the time window and the threshold chosen will be performed.

3.5. Results

Prior to discussing the results achieved in this section, it is worth mentioning that this chapter aims to investigate the impact of having a child on wages. Therefore, men and women not currently employed are excluded from the sample. The key problem is that we only observe wages among the employed, a group that self-selects into the labour force (Heckman 1979). With a self-selected sample,

there is the possibility that the estimation could over or underestimate the true dimension of the wage gap due to non-random selection into employment. In particular, this study acknowledges that the employment rates are very different for women by motherhood status, with 53% of mothers being employed compared to 75% of non-mothers; the employment rate is instead higher for fathers if compared with childless men (90% compared with 75%). Therefore, half of the mothers are dropped from the estimation as they earn no wage. Hence, the following results are conditional on being in employment[22].

The baseline model implemented in this analysis considers a threshold t= 2010 and investigates the event of giving birth to a child[23] in 2010 looking at five years before and five years after the event and considering a sample of employed women and men aged 18-47 between 2005 and 2015. Individuals with no qualifications and who are currently studying are excluded from the sample. Consequently, the results reported in this section consider mothers/fathers who had a child in the year t=2010 as the treatment group. Women/men who are childless throughout the all-sample period, constitute the control group[24].

The results for the sample of women and men are reported, respectively[25], in Table 3.3 and Table 3.4, taking into consideration three different specifications: Columns 1 and 2 consider all women/men of any educational background; columns 3 and 4 include women/men whose highest qualification achieved is a vocational qualification; columns 5 and 6 comprise women/men with a general

[22] In order to consider these mothers and fathers- who have been excluded from the sample in the analysis - as classified as no-wage earners- this study estimates the parent penalty on employment. Results are shown in Table B.6 (for women) and B.7 (for men) through the implementation of a linear probability model with individual and time-fixed effects. Results clearly show a negative effect of motherhood on the probability of being employed (almost 32% for all women, 31% for women with a vocational background, and 30% for women with a general background). The effect of fatherhood is instead negative but not statistically significant for men (for every specification considered).

[23] Due to concerns related to the sample size, this analysis considers the event of giving birth to any child in year t=2010. This means that women and men in the treatment group may already have other children, and consequently they could already have been subject to the parenthood wage effect. However, results of the same model run, this time, by considering the event of giving birth to the first child in 2010 confirm the reliability of the results achieved with our baseline model, albeit with fewer observations. Moreover, the same model has been implemented including the number of children in the vector of covariates. Despite the decrease in the number of observations, the results achieved from the baseline regression are still confirmed.

[24] Women and men who had a child either between 2005 and 2009 or between 2011 and 2015 are excluded from the sample.

[25] The full results from the model, showing the controls for the background characteristics, education, relationship status and job characteristics, are provided in the Appendix (Table B.8, Table B.9).

background. For each specification two models are implemented: the model in columns 1, 3 and 5 accounts for individual-level fixed effects, the one reported in columns 2, 4, and 6 for individual and time-level fixed effects.

The main coefficient of interest, Treatment*Time, is the interaction term between the variable Treatment, which takes a value of one if woman_i /man_i has a child in 2010, and Time, which switches on to one from 2010 onwards[26]. With regards to the framework of this analysis, the coefficient of interest captures the monthly change in the wages between women/men in the treatment and control group after the birth of a child.

Table 3.3 shows a negative and statistically significant coefficient for the variable of interest, Treatment*Time, in the first and second specification, hence when all women and when those with a vocational background are considered. The effect of having a child is similar across both models with a slight increase in magnitude with the progressive inclusion in the model of control variables. Consequently, looking at the complete model, giving birth in 2010 results in a further decrease in monthly earnings by 28% for all women and by 38% for women with a vocational background, relative to the control group of non-mothers. The coefficient is instead negative and not statistically significant for women with a general background. [27]

These results are consistent with the main hypothesis of this chapter which supports the idea that women with a vocational background suffer from a larger motherhood wage penalty compared to those women having a general background. This could suggest that a birth-related leave will have a higher cost in terms of human capital loss for those with vocational qualifications due to the fact that

[26] One of the possible concerns might be that it is not the birth of the child itself that should be considered as the cut-off point. The cut-off point could instead be the year before when the plan for the child is made. However, results are still consistent both in terms of magnitude and significance even when the study considers a dummy time that switches on to 1 from 2009 onward (Treatment= giving birth to a child in 2010, time period studied=2005-2015)

[27] Given the East-West Germany differences in attitude towards gender division of labour (Kolinsky, 1992; Adler & Brayfield,1996) shaped also by the different provision of public care for children (Leitner et al., 2007) the baseline model was also implemented by estimating separate equations for East and West Germany. Results are confirmed in both subgroups.

skills acquired through vocational studies depreciate quicker, may require to be updated more often and may lead individuals to secure employment in different occupation types.

Table 3.3 Baseline model - Women

	All women	All women	Vocational Education	Vocational Education	General Education	General Education
Treatment* time	**-0.278*** **	**-0.278*** **	**-0.374*** **	**-0.377*** **	**-0.025**	**-0.025**
	[0.058]	[0.058]	[0.069]	[0.069]	[0.087]	[0.087]
Background characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	14839	14839	10041	10041	4716	4716

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women aged 18-47 and who are not currently studying (2005-2015). Women with no qualification or training are excluded from the sample. Treatment: giving birth in 2010. Time: dummy variable that switches on 1 from 2010 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.4 shows the results for the two-way fixed effect model implemented for men, once again, by education type. The coefficients are small and positive but not statistically significant for all the specifications and models considered, confirming, in accordance with the previous literature, that men's wages are unaffected from the birth of a child.

Table 3.4 Baseline model - Men

	All men	All men	Vocational Education	Vocational Education	General Education	General Education
Treatment* time	**0.010**	**0.009**	**0.014**	**0.013**	**0.005**	**0.002**
	[0.035]	[0.035]	[0.041]	[0.041]	[0.068]	[0.069]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	18296	18296	12959	12959	5143	5143

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed men aged 18-47 and who are not currently studying (2005-2015). Men with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

One of the main factors explaining the heterogeneous effect of parenthood on women's and men's wages is the change in the average number of weekly working hours experienced after the birth of a child. Figure 3.7 shows the average weekly worked hours by gender distinguishing between

mothers/fathers and childless individuals. The difference between fathers' and non-fathers' average weekly hours worked after the event is similar to the gap before the event, with the two lines moving in parallel after 2010 and with fathers working, on average, more hours on a weekly basis than non-fathers. Fathers seem to diverge from childless men in the year before the event where the average of the weekly worked hours slightly increases when compared to childless men.

On the contrary, women show a large decrease in the actual work time per week immediately after they give birth. Indeed, while before the event, mothers work, on average, more hours than non-mothers, the event of giving birth in 2010 drastically reduces the average hours worked, leading to the existence of a "motherhood hours penalty" which does not seem to close in the following years. The decrease starts from the pregnancy period and persists for several more years after the event. The drastic drop in terms of weekly working hours after 2010 is registered by all women, independently from their educational route (Figure B.1). Consequently, the difference in motherhood wage penalties between women with a vocational background and those with a general background cannot be simply attributed to a differential hours response.

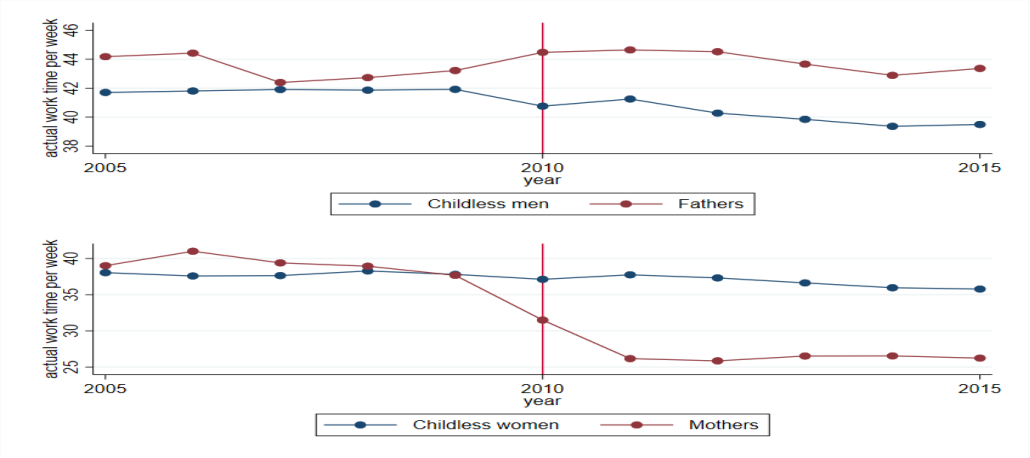

Figure 3.7 Change in weekly working hours by gender across time, before and after the event.

Note: Average weekly working hours. Sample includes employed individuals aged 18-47 and who are not currently studying (2005-2015). Individuals with no qualification or training are excluded from the sample. Treatment: having a child in 2010. GSOEP data.

3.5.1. Robustness checks

In this section, the study will introduce several robustness checks to support the results of the baseline model presented in the previous section.

Different time windows

First, the same model is implemented, this time taking into consideration different time windows to the one analysed in the baseline model (2005-2015) while using the same threshold year (t=2010). In particular, the time before and after the "event" is reduced first from 5 to 4 years, and then to 3 years. The results for the sample of women considered by education type are shown in Tables 3.5 and 3.6[28]. Table 3.5 refers to a period of time which goes from 2006 to 2014 (4 years before and 4 years after the "event"), while Table 3.6 considers the years 2007-2013 (3 years before and 3 years after the "event"). Despite reducing the number of observations, the results are consistent and qualitatively similar to the main results. Specifically, giving birth in 2010 leads to a decrease in monthly earnings of 24% (2006-2014) and 21% (2007-2013) more for mothers than for non-mothers amongst all women and by 33% (2006-2014) and 27% (2007-2013) more for mothers than for non-mothers amongst those women with a vocational qualification as their highest qualification.

Table 3.5 Baseline model - different time windows (2006-2014) – Women

	All women 2006-2014	**All women 2006-2014**	**Vocational Education 2006-2014**	**Vocational Education 2006-2014**	**General Education 2006-2014**	**General Education 2006-2014**
Treatment* time	**-0.243*** **	**-0.244*** **	**-0.323*** **	**-0.326*** **	**-0.053**	**-0.051**
	[0.054]	[0.054]	[0.065]	[0.065]	[0.093]	[0.094]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	11873	11873	8140	8140	3673	3673

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women aged 18-47 and who are not currently studying (2006-2014). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[28] The results from the full model, including controls on the background characteristics, education, relationship status and job characteristics, are provided in the appendix Tables B.10 and B.11

Table 3.6 Baseline model - different time windows (2007-2013) – Women

	All women 2007-2013	All women 2007-2013	Vocational Education 2007-2013	Vocational Education 2007-2013	General Education 2007-2013	General Education 2007-2013
Treatment* time	**-0.206*** **	**-0.206*** **	**-0.271*** **	**-0.274*** **	**-0.074**	**-0.073**
	[0.063]	[0.052]	[0.093]	[0.063]	[0.095]	[0.095]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	9161	9161	6330	6330	2786	2786

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women aged 18-47 and who are not currently studying (2007-2013). Men with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Again, having a child does not have a statistically significant impact on men's monthly earnings (Table 3.7 and 3.8[29]). Consistently with the baseline specification and despite the fact that the time window considered for the analysis is reduced, the results achieved are still persistent.

Table 3.7 Baseline model - different time windows (2006-2014) – Men

	All Men 2006-2014	All Men 2006-2014	Vocational Education 2006-2014	Vocational Education 2006-2014	General Education 2006-2014	General Education 2006-2014
Treatment* time	**0.002**	**0.001**	**0.002**	**0.002**	**0.018**	**0.016**
	[0.034]	[0.034]	[0.034]	[0.039]	[0.039]	[0.068]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristic	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	14781	14781	10589	10589	4037	4037

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed men aged 18-47 and who are not currently studying (2006-2014). Men with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[29] The results from the full model, including controls on the background characteristics, education, relationship status and job characteristics, are provided in the appendix Table B.12 and Table B.13.

Table 3.8 Baseline model - different time windows (2007-2013) – Men

	All Men 2007-2013	All Men 2007-2013	Vocational Education 2007-2013	Vocational Education 2007-2013	General Education 2007-2013	General Education 2007-2013
Treatment* time	**-0.004**	**-0.004**	**-0.012**	**-0.011**	**0.010**	**0.010**
	[0.030]	[0.030]	[0.034]	[0.034]	[0.071]	[0.071]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristic	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	11557	11557	8342	8342	3092	3092

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed men aged 18-47 and who are not currently studying (2007-2013). Men with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Comparison of the time-trend of the treatment and control group

One possible concern of this analysis is that wage differences between mothers and no-mothers (and fathers and no-fathers) may be driven by differences in pre-event trends between treatment and control groups or by confounding factors. For this reason, a graphical inspection for the comparison of the treatment and the control group at different points in time is provided in this section. The aim is to compare changes in outcomes for the treatment and control groups before the event to understand whether those groups are systematically different over time. Figure 3.8 shows the trend of the logarithm of monthly earnings by gender for both treatment and control groups across the years. The lines move in parallel before the event, for both genders confirming that the trend in their wages is not systematically different in the period before the event[30]. The only exception is in 2009 when a small divergence in trends is noticed, particularly for men. This is quite expected given that the event (giving birth to a child) manifests its effects already 9 months before, during the pregnancy period.[31]

[30] A visual inspection of the trend in terms of real monthly earnings can be found in Appendix B (Figure B.2). Figure B.3 provides instead a visual inspection on the trend for the sub-sample of women classified accordingly to their educational background.

[31] In the regression framework it is quite difficult to disentangle whether there is an issue of endogeneity in the fatherhood wage premium. Men who anticipate the birth of a child might be more likely to increase their working hours. On the other hand, men may become more willing to have a child if they achieve more financial stability. Hence, there might be a potential endogeneity problem operating both on fertility decisions and labour market behaviours.

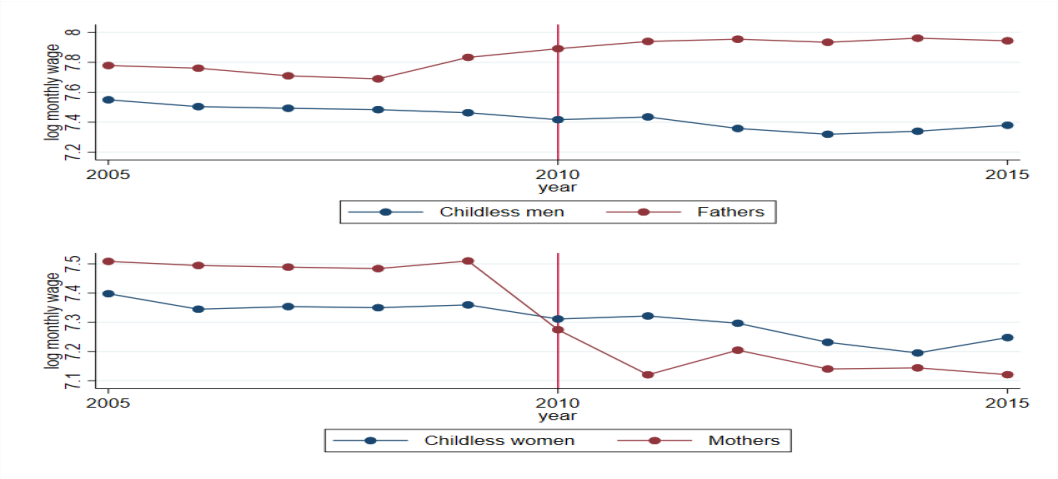

Figure 3.8 Time trend: Logarithm of the monthly wage by gender

Note: Trend of the logarithm of monthly wage over time. Sample includes employed individuals aged 18-47 and who are not currently studying (2005-2015). Individuals with no qualification or training are excluded from the sample. Treatment: having a child in 2010. GSOEP data.

Moreover, given that the treatment analyzed manifests some "pre-treatment" effect, due to the nine months of pregnancy period preceding the event of giving birth, for the sake of robustness the baseline model has also been implemented by excluding 2009 from the pre-treatment sample. The results achieved are still in line both in terms of coefficient and significance level with those achieved with the baseline model, giving in this way a certain level of confidence that the results are not driven by pre-event effects.

Placebo test

Third, the visual inspection is complemented with placebo regressions. The purpose is to test if there is an observed effect even where not expected, in the absence of treatment. This study implements placebo tests using previous periods, by shortening the sample period up to the year before the event, and by generating a fake Time dummy variable. In particular, in Tables 3.9 and 3.10[32] a fake dummy Time2006, which switches to one from 2006 onwards, is included in the analysis which considers a period of time 2005-2008[33]. The results related to the main coefficient show that there are no

[32] The full results, including controls on the background characteristics, education, relationship status and job characteristics, are provided in the appendix Table B.14 and B.15.

[33] Year 2009 is omitted from the regression due to the possible contamination with the birth effect. This could be happening given that women giving birth in 2010 might be pregnant already in 2009.

statistically significant coefficients in any specifications, suggesting that there are no significant variations in monthly earnings trends between treatment and control groups before treatment occurs.

Table 3.9 Placebo test with a fake dummy time 2006 - Women

	All women 2005-2008	All women 2005-2008	Vocational Education 2005-2008	Vocational Education 2005-2008	General Education 2005-2008	General Education 2005-2008
Treatment*Time2006	**-0.040**	**-0.040**	**-0.040**	**-0.040**	**-0.121**	**-0.121**
	[0.051]	[0.051]	[0.059]	[0.059]	[0.096]	[0.095]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship status	Yes	Yes	Yes	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	4365	4365	3186	3186	1167	1167

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women aged 18-47 and who are not currently studying (2005-2008). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2006 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.10 Placebo test with a fake dummy time 2006 - Men

	All Men 2005-2008	All Men 2005-2008	Vocational Education 2005-2008	Vocational Education 2005-2008	General Education 2005-2008	General Education 2005-2008
Treatment*Time2006	**-0.074**	**-0.074**	**-0.143**	**-0.143***	**0.263**	**0.263**
	[0.076]	[0.076]	[0.079]	[0.079]	[0.230]	[0.230]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship status	Yes	Yes	Yes	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	5497	5497	4123	4123	1341	1341

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed men aged 18-47 and who are not currently studying (2005-2008). Men with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2006 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Different time-period

To demonstrate that the results obtained are not particular to the choice of the year, 2010, this section performs the same baseline model using different combinations of time windows associated with different thresholds. In Tables 3.11 and 3.12 the model considers a time-window 2005-2013 and the event analysed is "giving birth in 2009". In Tables 3.13 and 3.14, the time window analysed is 2007-2015 and the event is "giving birth in 2011". In Tables 3.15 and 3.16 the time window is 2005-2011 while the event is "giving birth in 2008"; and finally, Tables 3.17 and 3.18[34] look at the years 2009-

[34] Full results reported in Tables B.16, B.17, B.18, B.19, B.20, B.21, B.22, B.23 in the Appendix

2015 considering "giving birth in 2012" as the event. While the effect of fatherhood on men is, again, not statistically significant, the results derived for women are, once again, confirmed: women with a vocational background show a wider motherhood wage gap if compared to women with a general background, who instead show a non-statistically significant coefficient.

Table 3.11 Treatment: giving birth in 2009 (2005-2013) - Women

	All Women	All Women	Vocational Education	Vocational Education	General Education	General Education
Treatment* time	**-0.248*** **	**-0.250*** **	**-0.325*** **	**-0.325*** **	**-0.051**	**-0.066**
	[0.059]	[0.059]	[0.062]	[0.062]	[0.138]	[0.140]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	11901	11901	8303	8303	3541	3541

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women aged 18-47 and who are not currently studying (2005-2013). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2009. Time: dummy variable that switches on 1 from 2009 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.12 Treatment: giving birth in 2009 (2005-2013) - Men

	All Men	All Men	Vocational Education	Vocational Education	General Education	General Education
Treatment* time	**0.017**	**0.016**	**0.024**	**0.023**	**0.030**	**0.028**
	[0.037]	[0.037]	[0.045]	[0.045]	[0.059]	[0.059]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	14755	14755	10749	10749	3872	3872

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed men aged 18-47 and who are not currently studying (2005-2013). Men with no qualification or training are excluded from the sample. Treatment: having a child in 2009. Time: dummy variable that switches on 1 from 2009 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.13 Treatment: giving birth in 2011 (2007-2015) - Women

	All Women	All Women	Vocational Education	Vocational Education	General Education	General Education
Treatment* time	**-0.197*** **	**-0.203*** **	**-0.272*** **	**-0.277*** **	**-0.075**	**-0.084**
	[0.050]	[0.050]	[0.059]	[0.059]	[0.084]	[0.084]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	11904	11904	7943	7943	3895	3895

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women aged 18-47 and who are not currently studying (2007-2015). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2011. Time: dummy variable that switches on 1 from 2011 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.14 Treatment: giving birth in 2011 (2007-2015) - Men

	All Men	All Men	Vocational Education	Vocational Education	General Education	General Education
Treatment* time	**-0.019**	**-0.025**	**-0.029**	**-0.035**	**0.069**	**0.064**
	[0.030]	[0.030]	[0.034]	[0.034]	[0.056]	[0.057]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	14556	14556	10199	10199	4219	4219

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed men aged 18-47 and who are not currently studying (2007-2015). Men with no qualification or training are excluded from the sample. Treatment: having a child in 2011. Time: dummy variable that switches on 1 from 2011 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.15 Treatment: giving birth in 2008 (2005-2011) - Women

	All Women	All Women	Vocational Education	Vocational Education	General Education	General Education
Treatment* time	**-0.218*** **	**-0.216*** **	**-0.303*** **	**-0.303*** **	**-0.035**	**-0.035**
	[0.061]	[0.061]	[0.073]	[0.073]	[0.091]	[0.091]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	8934	8934	6362	6362	2545	2545

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women aged 18-47 and who are not currently studying (2005-2011). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2008. Time: dummy variable that switches on 1 from 2008 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.16 Treatment: giving birth in 2008 (2005-2011) - Men

	All Men	All Men	Vocational Education	Vocational Education	General Education	General Education
Treatment* time	**-0.003**	**-0.003**	**-0.022**	**-0.022**	**0.084**	**0.086**
	[0.032]	[0.032]	[0.032]	[0.032]	[0.091]	[0.091]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	10938	10938	8038	8038	2811	2811

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed men aged 18-47 and who are not currently studying (2005-2011). Men with no qualification or training are excluded from the sample. Treatment: having a child in 2008. Time: dummy variable that switches on 1 from 2008 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.17 Treatment: giving birth in 2012 (2009-2015) - Women

	All Women	All Women	Vocational Education	Vocational Education	General Education	General Education
Treatment* time	-0.127**	-0.132***	-0.173**	-0.177**	-0.094	-0.104
	[0.050]	[0.050]	[0.071]	[0.071]	[0.065]	[0.065]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	9511	9511	6185	6185	3266	3266

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women aged 18-47 and who are not currently studying (2009-2015). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2012. Time: dummy variable that switches on 1 from 2012 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.18 Treatment: giving birth in 2012 (2009-2015) - Men

	All Men	All Men	Vocational Education	Vocational Education	General Education	General Education
Treatment* time	-0.027	-0.030	-0.034	-0.037	0.016	0.015
	[0.030]	[0.030]	[0.030]	[0.030]	[0.070]	[0.070]
Background	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	11438	11438	7868	7868	3451	3451

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed men aged 18-47 and who are not currently studying (2009-2015). Men with no qualification or training are excluded from the sample. Treatment: having a child in 2012. Time: dummy variable that switches on 1 from 2012 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Selection into education

The baseline model implemented in this analysis has focused on the selection into motherhood and has investigated the differences between a treated group of mothers compared to a control group of childless women while controlling for observable and unobservable characteristics, between the two groups, that remain fixed over time and that are not correlated with the treatment itself. However, when comparing the analysis implemented for the vocational sample with the one for the general sample, two different regressions are being compared. Consequently, if there are differences between individuals with a vocational background and those having a general background, these differences could account for part of the difference in the results obtained.

In order to provide some robustness to the results achieved, this section implements a two-way fixed effect model with a triple interaction term as an additional specification to take into account differences in terms of time-invariant characteristics between individuals with a vocational or a general background (Table 3.19[35]).

Table 3.19 Triple Interaction Model - Education

	All women	**All women**
Treatment*Time	**-0.105**	**-0.105**
	[0.094]	[0.093]
Vet	0.204***	0.204***
	[0.050]	[0.050]
Treatment*Vet	0.138	0.146
	[0.227]	[0.227]
Time*Vet	-0.123***	-0.125***
	[0.030]	[0.030]
Treatment*Time*Vet	**-0.282****	**-0.281****
	[0.118]	[0.118]
Background characteristics	Yes	Yes
Education	Yes	Yes
Relationship Status	Yes	Yes
Job Characteristics	Yes	Yes
Individual FE	Yes	Yes
Time FE	No	Yes
Observations	14757	14757

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women aged 18-47 and who are not currently studying (2005-2015). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. Vet takes value of one if the highest qualification achieved is a vocational qualification. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[35] Full results reported in Table B.24

The coefficient on the triple interaction term, given by Treatment*Time*Vet, is negative and strongly significant, showing that the results achieved are significantly different for people with a vocational qualification compared to people with a general one while controlling for time-invariant differences between people with the two types of qualification. The coefficient for the interaction Treatment*Vet is clearly insignificant and suggests that fixed differences between vocational and general educated women remain the same amongst mothers as amongst childless women, before the treatment. This might be useful in suggesting that there is no interaction between motherhood and vocational status before treatment has taken place. Hence, there is no additional effect from the two together, over and above the individual effects of each, which might have been affecting the vocational versus general results. It is important to acknowledge that this section does not take into account differences in terms of time-variant characteristics between the two groups.

Change in occupation versus human capital depreciation

A possible concern that this analysis may raise is whether one can consider skills depreciation rather than occupational differences, between women with vocational versus a general background, as the main driver behind the differential amplitude of the motherhood wage effect on women with different educational backgrounds. In light of this concern, this section implements a triple interaction model (Table 3.20[36]) taking into consideration whether women in both the treatment and the control group change their occupation[37] after the event of giving birth.

[36] Full results are reported in Table B.25

[37] Once again, the categorization of the different occupations is made according to the third version of the International Standard Classification of Occupation (ISCO-88) for European Union purposes. The analysis considers the following major groups: 1) Legislators, senior officials and managers, 2) Professionals, 3) Technicians and associate professionals, 4) Clerks, 5) Service workers and shop market sales workers, 6) Skilled agricultural and fishery workers, 7) Craft and related trades workers, 8) Plant and machine operators and assemblers, 9) Elementary occupations. Movers are defined as those individuals changing up or down their occupation after the event occurs. The total number of individuals classified as a mover is 2986, of those 201 individuals fall into the treatment group.

Table 3.20 Triple Interaction model – Change in occupation

	All women	All women	Vocational Education	Vocational Education	General Education	General Education
Treatment*Time	**-0.102***	**-0.104***	**0.001**	**-0.000**	**0.001**	**-0.006**
	[0.060]	[0.060]	[0.050]	[0.050]	[0.083]	[0.084]
Mover*Time	-0.089**	-0.090**	-0.042	-0.043	-0.024	-0.021
	[0.041]	[0.041]	[0.033]	[0.033]	[0.070]	[0.070]
Treatment*Mover*Time	**-0.176**	**-0.175**	**0.091**	**0.095**	**-0.076**	**-0.064**
	[0.170]	[0.172]	[0.090]	[0.091]	[0.204]	[0.207]
Background characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes	Yes	Yes
Relationship status	Yes	Yes	Yes	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Observations	6192	6192	6536	6536	2143	2143

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women aged 18-47 and who are not currently studying (2005-2015). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. Mover takes value of one if the individual has changed occupation after the Treatment. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The coefficient on the interaction term, given by Treatment*Time, explicates the treatment effect for non-movers. This is found to be negative and statistically significant only in the first specification. The triple interaction term, Treatment*Time*Mover, provides evidence on the extent to which the treatment effect is any different for movers compared to individuals who did not change job after 2010. The coefficient is not statistically significant in all the specifications considered, suggesting that the coefficients of interest are not statistically different between those who moved occupation and those who did not. Consequently, this test seems to provide a signal that moving occupation is not an important cause of the fall in wages; that is, the different amplitude of the motherhood wage gap between women with a general or a vocational background may be mainly driven by declining human capital rather than occupational differences. However, one must consider that it could also be the case that the high standard error, in turn due maybe to small numbers of movers, is driving the insignificant triple interaction term coefficient, not that the true effect of interest is really zero.

Life cycle and the endogeneity in the timing of birth

The study does not distinguish the age that individuals are in the treatment and control group, and treats the timing of birth as exogenous. However, the time of birth is linked to the life cycle profile of income. In order to consider the endogeneity in the timing of birth, this section implements the

baseline model by considering subgroups of different age-ranges (18-27, 28-37, and 38-47). The age subgroups have been identified by dividing the birth-cycle into three different phases: early, middle and late. Within in a particular age range, the exact timing of a birth can be considered as more random than when considering across age ranges in the main results. Results are confirmed in all subgroups for all women (Table 3.21), women with vocational education (Table 3.22), and those with a general background (Table 3.23), the only exception being women aged 38-47 (Table 3.21). However, this is quite expected given that those women are in the flatter part of the age-wage curve.

Table 3.21 Women - age groups

	18-27	**28-37**	**38-47**
Treatment* time	-0.166*	-0.155**	-0.279
	[0.100]	[0.071]	[0.192]
Background characteristics	Yes	Yes	Yes
Education	Yes	Yes	Yes
Relationship status	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	6360	4996	3483

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women who are not currently studying (2005-2015). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.22 Women with a vocational background - age groups

	18-27	**28-37**	**38-47**
Treatment* time	-0.215*	-0.233***	-0.561***
	[0.114]	[0.085]	[0.086]
Background characteristics	Yes	Yes	Yes
Education	Yes	Yes	Yes
Relationship status	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	4356	3199	2486

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women with a vocational background who are not currently studying (2005-2015). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.23 Women with a general background - age groups

	18-27	28-37	38-47
Treatment* time	-0.043	-0.040	0.070
	[0.175]	[0.127]	[0.122]
Background characteristics	Yes	Yes	Yes
Education	Yes	Yes	Yes
Relationship status	Yes	Yes	Yes
Job characteristics	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	1977	1773	966

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women with a general background who are not currently studying (2005-2015). Women with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. GSOEP data. Standard errors in brackets. Significance level: $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Generalised fixed effects model

To support the robustness of the previous findings, the wage penalty for motherhood was therefore also estimated using a generalised fixed effects panel data regression model. While the baseline models implemented previously looked at the effect of giving birth to a child in a particular year t, the generalised fixed effects model performed now analyses the effect on the monthly wage for births in all years.

In other words, the generalised fixed effects model allows the consideration of the birth of a child at any time within the sample period, in a single model.

More specifically:

$$lny_{it} = \alpha_0 + \alpha_1 Age_{it} + \alpha_2 Age_{it}^2 + \beta Mother_{it} + \gamma X_{it} + v_i + \varepsilon_{it} \qquad 2)$$

Equation 2 relates the logarithm of the monthly wage observed for respondent i at time t to a set of covariates. The key interest is the estimation of parameter β that provides the wage penalty/premium for motherhood/fatherhood keeping constant a set of covariates through the vector, X_{it}. Mother/Father is a dummy variable that will switch to one when the individual becomes a parent, at any point within the sample period. Finally, v_i represents an individual-specific error term. By including v_i one can ensure that the model will be able to control for any possible unobserved but time-constant factors

that might impact the individual's wage. Hence, it eliminates the need to include in X_{it} explanatory time-invariant characteristics, and it allows for efficient estimation of the effect of giving birth to a child on women's and men's wages over time.

Tables 3.24 and 3.25[38] report the main results for both women and men by education type. The coefficient of interest is mother/father, a binary variable that takes the value one if the individual has a child, zero otherwise. As shown, motherhood is consistently associated with a significant wage penalty for the overall sample and women with a vocational background. Consistent with the main hypothesis of this study, the motherhood wage penalty is found again to be highest among women with a vocational background, with a 20% decrease in monthly earnings. The overall sample reports, instead, a decrease in earnings of 14%. For women with general education, there is an absence of any significant effects of motherhood on wages. Again, no significant effects are found for fathers.

Table 3.24 Generalised Fixed Effect (2005-2015) - Women

	All women	**Vocational Education**	**General Education**
Mother	**-0.141*****	**-0.197*****	**-0.030**
	[0.017]	[0.019]	[0.033]
Background characteristics	Yes	Yes	Yes
Education	Yes	Yes	Yes
Relationship-status	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes
Observations	22439	15254	7067

Note: Generalised fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed women who are not currently studying (2005-2015). Women with no qualification or training are excluded from the sample. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.25 Generalised Fixed Effect (2005-2015) - Men

	All men	**Vocational Education**	**General Education**
Father	0.002	-0.009	0.039
	[0.013]	[0.015]	[0.026]
Background characteristics	Yes	Yes	Yes
Education	Yes	Yes	Yes
Relationship Status	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes
Observations	27409	19193	7868

Note: Generalised fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes employed men who are not currently studying (2005-2015). Men with no qualification or training are excluded from the sample. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[38] Full results reported in Tables B.26 and B.27 in the Appendix

3.6. Conclusion

Using German GSOEP data for 2005-2015, this study examines the impact of the birth of a child on mothers' and fathers' monthly earnings, documenting a significant wage penalty for mothers, while registering no impact on men's earnings. This study applies an interactive two-way fixed effect approach that aims at comparing two groups, that is the control group, made of childless women/men, and a treatment group, consisting of those mothers/ fathers who had a child in year t.

In particular, the baseline analysis setting uses t=2010 as the threshold-year. Results show that giving birth in 2010 leads to a 28% decrease in mothers' monthly earnings compared to childless women. The coefficient of interest is, instead, positive but not statistically significant for men. All of these results are still coherent and robust if different time frames and different thresholds are adopted to perform the same analysis. All results are also robust to using an alternative, generalised fixed effects, estimation methodology.

The study takes this analysis a step further by investigating a possible correlation between human capital skills depreciation and the motherhood wage gap. The main assumption relies on the human capital theory according to which women suffer from a motherhood wage gap because birth-related leave and, in general, career interruptions, lead to human capital depreciation and lost work experience. In this context, in order to analyse the impact of human capital depreciation on earnings, the study exploits, for the first time, the difference between skills acquired through a vocational educational path versus those developed following a general one, as one of the keys factors to help to shed light on the motherhood wage gap. Given that skills acquired through vocational studies depreciate quicker and may require to be updated more often, and that changes in labour market behaviours, that is occupational changes driven by the birth of a child (Waldfogel, 1997, Budig and England, 2001, Amuedo-Dorantes and Kimmel, 2008), may be more easily handled by women with a general background whose skills are well known to be more adaptable to changes in work environments, this study supports the hypothesis that a birth-related leave will have a higher cost in

terms of human capital loss/loss of job experience for those women with a vocational qualification when compared to those having a general one. The hypothesis is confirmed by the results which uncover a 37% larger decrease in monthly earnings for women with a vocational qualification as their highest qualification. The coefficient is instead positive and not significant for women with a general background. Once again, the same conclusions can be reached if different time windows and thresholds are used to perform the same analysis, and also in a generalised fixed effects framework.

One possible explanation which may help to understand the reason for such a distinct impact of motherhood and fatherhood on earnings might be the different responses of women and men in terms of changes in the total amount of weekly working hours after the event. While fathers' average weekly hours worked after the event does not reveal a substantial change compared to childless men, the average of mothers' weekly working hours drastically decreases compared to the average of childless women. Nevertheless, the absence of a differential hours effect between women with a vocational and with a general qualification means that such an hours response is not the cause of the difference in the motherhood wage penalty between the two education groups.

In conclusion, the results achieved in this analysis confirm previous results in the literature with regard to the motherhood wage gap, arguing for the first time that part of this gap could be affected by the different rates of skills depreciation.

It is worth acknowledging that the differential impact of parenthood on wages and the differential magnitude of the motherhood wage gap may stem from gender segregation in education with women still lagging in science, technology, engineering, and mathematics (STEM) fields (Blau and Kahn, 2017). This study only acknowledges differences in education types (vocational versus gender). A further level of analysis should consider and acknowledge gender differences in subject areas which, consequently, may have an impact on the gender wage gap and on the motherhood wage penalty. Those educational differences may have nothing to do with anticipated career interruptions but may stem from gender norms.

Given the established existence of a wage penalty for women who decide to have a child, the country's institutional environment must consider changes to improve family and market labour systems. In particular, as already proven by recent studies, a welfare system that can financially supports mothers, could be beneficial for mothers who intend to keep working after childbirth. Ensuring job security (Hegewisch and Gornick 2013), paid maternity leave (De Henau et al. 2007), providing childcare (Pettit and Hook 2009) and ensuring job flexibility (Neuburger, et al. 2010) are only some of the much-needed steps to be undertaken in order to reduce the motherhood wage gap and ensure gender equality. However, the implementation of those policies is still not enough. Given the abovementioned decrease in terms of women's working hours and given the potential impact of skill depreciation on women's wages, which depends on the time spent out of the labour force, what must be ensured in a welfare system, that aims to guarantee equal opportunity to its citizens, is to implement tools allowing for greater work-flexibility. In other words, guaranteeing a labour market that can reconcile women's work and their caring responsibilities is the key to a potential reduction in the gender wage gap. Boosting the use of strategies such as flexible working hours, job sharing, remote working and compressed hours could be needed in a society aiming to attract more women into the job market in all positions and levels of seniority.

Appendix B

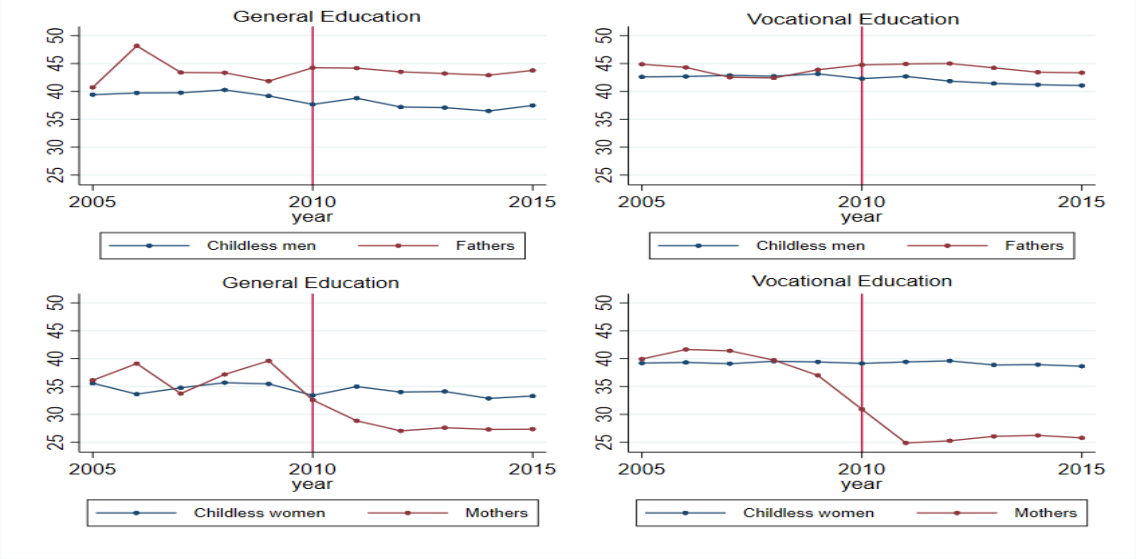

Figure B. 1 Change in weekly working hours by gender across time, before and after the event.

Note: Sample includes individuals aged 18-47 (not currently in education) 2005-2015. Individuals with no qualification or training are excluded from the sample. Treatment: having a child in 2010.

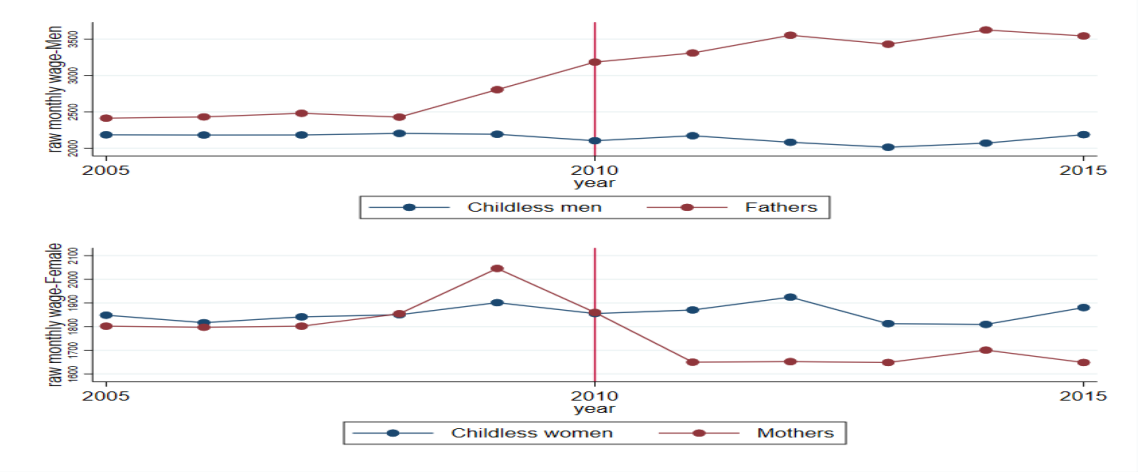

Figure B. 2 Time trend: Raw data monthly wage by gender

Note: Sample includes individuals aged 18-47 (not currently in education) 2005-2015. Individuals with no qualification or training are excluded from the sample. Treatment: having a child in 2010.

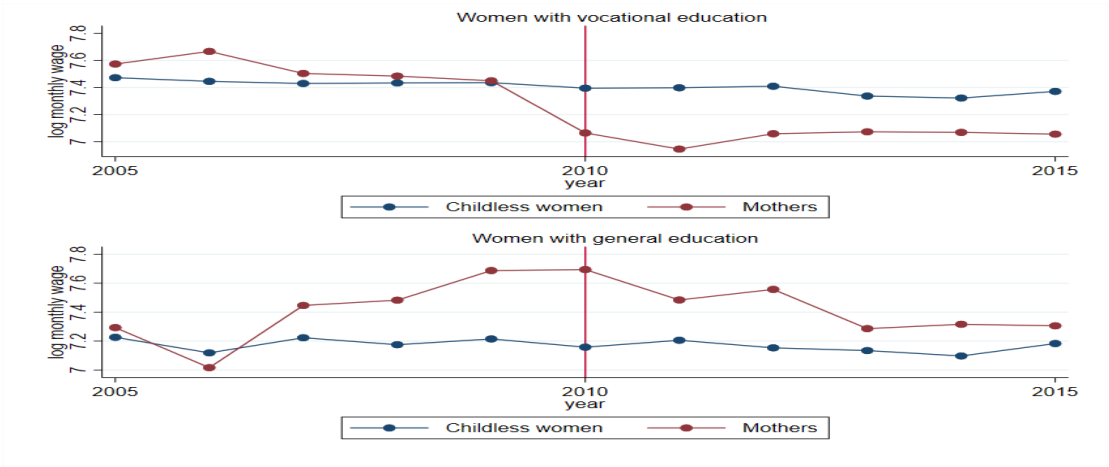

Figure B. 3 Logarithm of the monthly wage by education type (Women)

Note: Sample includes women aged 18-47 (not currently in education) 2005-2015. Women with no qualification or training are excluded from the sample. Treatment: giving birth in 2010. In the upper part of the graph, the trend for women with a vocational qualification as highest qualification is inspected, in the lower one for women with a general qualification as highest qualification. The graphical inspections, which are based now on a smaller number of women observed, continue to show a generally parallel trend both among women with a general and vocational background.

Table B. 1 Definition of the variables used in the analysis.

Variable	**Category**	**Description**
Age	Background characteristics	Continuous-variable in years[39]
West	Background characteristics	Dummy variable (0, 1). 1 if the individual is resident in West Germany; 0 otherwise.
Female	Background characteristics	Dummy variable (0, 1). 1 if the individual is female; 0 otherwise
No-migration background	Background characteristics	Dummy variable (0, 1). 1 if the individual has no migration background; 0 otherwise.
Second-generation background	Background characteristics	Dummy variable (0, 1). 1 if the individual has a second-generation migration background; 0 otherwise.
Migration background	Background characteristics	Dummy variable (0, 1). 1 if the individual is an immigrant; 0 otherwise.
Good health	Background characteristics	Dummy variable (0, 1). 1 if the individual has a rather good health status; 0 otherwise.
Mother	Background characteristics	Dummy variable (0, 1). 1 if the individual has a child; 0 otherwise.
Father	Background characteristics	Dummy variable (0, 1). 1 if the individual has a child; 0 otherwise.
Single	Relationship status	Dummy variable (0, 1). 1 if the reference person has no partner; 0 otherwise
Married	Relationship status	Dummy variable (0, 1). 1 if the reference person has a partner; 0 otherwise
Divorced/Separated	Relationship status	Dummy variable (0, 1). 1 if the reference is legally divorced or separated; 0 otherwise
Widowed	Relationship status	Dummy variable (0, 1). 1 if the reference is widowed; 0 otherwise
Years of Education	Educational background	Continuous variable (in years)
Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has any vocational qualification as highest qualification achieved; 0 otherwise
Level 1 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 1 vocational qualification as highest qualification achieved; 0 otherwise
Level 1 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 1 general qualification as highest qualification achieved; 0 otherwise
Level 2 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 2 vocational qualification as highest qualification achieved; 0 otherwise

[39] For ease of interpretation, the age variable is centered, and it is derived by subtracting the mean age from all the observations related to age in the dataset such that the new mean age is zero.

Level 2 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 2 general qualification as highest qualification achieved; 0 otherwise
Level 3 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 3 vocational qualification as highest qualification achieved; 0 otherwise
Level 3 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 3 general qualification as highest qualification achieved; 0 otherwise
Level 4 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 4 vocational qualification as highest qualification achieved; 0 otherwise
Level 4 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 4 general qualification as highest qualification achieved; 0 otherwise
Employed	Job characteristics	Dummy variable (0, 1). 1 if the individual is employed; 0 otherwise
Monthly wage	Job characteristics	Continuous variable, in Euros
Manager /Professional	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as a manager or professional; 0 otherwise
Clerks/Service workers	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as clerk or service worker; 0 otherwise
Agricultural/Craft/Machine operators	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as a skilled agricultural worker, craft or machine operators; 0 otherwise
Elementary occupations	Job characteristics	Dummy variable (0, 1). 1 if the respondent has an elementary occupation; 0 otherwise
Full-time	Job characteristics	Dummy variable (0, 1). 1 if the respondent works full-time; 0 otherwise
Self-employed	Job characteristics	Dummy variable (0, 1). 1 if the respondent is self-employed; 0 otherwise
Full-time experience	Job characteristics	Continuous variable in years.
Part-time experience	Job characteristics	Continuous variable in years.
Public-Sector	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in a public sector; 0 otherwise

Table B. 2 Descriptive statistics (women sample)

	Treatment: Mothers			Control: No-Mothers			Difference
Variable	N	Mean	SD	N	Mean	SD	
Monthly wage	7774	1745.412	1301.121	16733	2011.827	1380.534	-266.415***
Age	7919	34.031	5.482	17169	29.367	8.013	4.664***
Years of education	7743	13.308	2.740	15676	13.028	2.698	0.280***
Vocational education	7853	0.687	0.464	16753	0.662	0.473	0.025***
Married	7866	0.690	0.462	17112	0.179	0.383	0.511***
Divorced	7866	0.063	0.244	17112	0.042	0.201	0.021***
Widowed	7866	0.002	0.041	17112	0.002	0.043	0.000
Single	7866	0.245	0.430	17112	0.777	0.416	-0.532***
Good health	7914	0.914	0.281	17148	0.914	0.280	0.000
Manager/Professional	7521	0.578	0.494	16051	0.562	0.496	0.016*
Clerks/Service	7521	0.324	0.468	16051	0.353	0.478	-0.029***
Agri/Craft/Machine	7521	0.045	0.208	16051	0.051	0.221	-0.006*
Elementary occupation	7521	0.052	0.223	16051	0.033	0.178	0.019***
Full time	7917	0.309	0.462	17012	0.773	0.419	-0.464***
West	7919	0.797	0.402	17169	0.842	0.365	-0.045***
Public sector	7390	0.249	0.432	16094	0.268	0.443	-0.019**
Work experience FT	7760	6.750	5.240	16968	6.110	7.238	0.640***
Work experience PT	7760	2.732	2.989	16968	1.544	2.831	1.188***
No migration background	7917	0.737	0.440	17141	0.781	0.414	-0.044***
Second generation	7917	0.091	0.288	17141	0.118	0.323	-0.027***
Migrant	7917	0.172	0.377	17141	0.101	0.301	0.071***

Note: The tables show averages of person-year observations, using GSOEP data for employed women aged 18 to 47, and considering a time frame 2005-2015. Individuals with no qualifications are excluded from the sample. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 3 Descriptive statistics (men sample)

	Treatment: Fathers			Control: No-Fathers			Difference
Variable	N	Mean	SD	N	Mean	SD	
Monthly wage	10428	3267.813	1706.113	19477	2326.909	1596.236	940.904***
Age	10683	35.746	5.602	20207	30.112	8.323	5.634***
Years of education	10460	12.829	2.920	18422	12.450	2.667	0.379***
Vocational education	10381	0.687	0.464	19664	0.700	0.458	-0.013**
Married	10602	0.796	0.403	20111	0.150	0.357	0.646***
Divorced	10602	0.032	0.175	20111	0.039	0.193	0.007**
Widowed	10602	0.001	0.034	20111	0.001	0.035	0.000
Single	10602	0.171	0.376	20111	0.810	0.392	-0.639***
Good health	10674	0.931	0.254	20180	0.941	0.236	-0.010***
Manager/Professional	10400	0.514	0.500	18578	0.423	0.494	0.091***
Clerks/Service	10400	0.110	0.313	18578	0.164	0.370	-0.054***
Agri/Craft/Machine	10400	0.327	0.469	18578	0.356	0.479	-0.029***
Elementary occupation	10400	0.050	0.217	18578	0.057	0.231	-0.007*
Full time	10679	0.926	0.262	19801	0.879	0.326	0.047***
West	10683	0.820	0.384	20207	0.798	0.401	0.022***
Public sector	10178	0.162	0.369	18460	0.156	0.363	0.006
Work experience FT	10369	11.665	6.212	19934	6.979	7.554	4.686***
Work experience PT	10369	0.837	2.148	19934	0.871	1.983	-0.034
No migration background	10682	0.683	0.465	20187	0.785	0.411	-0.102***
Second generation	10682	0.108	0.310	20187	0.114	0.318	-0.006
Migrant	10682	0.209	0.406	20187	0.101	0.301	0.108***

Note: The tables show averages of person-year observations, using GSOEP data for employed men aged 18 to 47, and considering a time frame 2005-2015. Individuals with no qualifications are excluded from the sample. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 4 Descriptive analysis of the monthly wage by education type (women)

	AGE: 18-47		
Log Monthly Wage	**Mothers**	**Non-mothers**	**Difference**
Total	7.153	7.311	-0.158***
Vet qualification	7.080	7.409	-0.329***
General qualification	7.329	7.191	0.138***
Difference	-0.249***	0.218***	
	AGE: 18-27		
Log Monthly Wage	**Mothers**	**Non-mothers**	**Difference**
Total	6.635	6.875	-0.240***
Vet qualification	6.776	7.054	-0.278***
General qualification	6.364	6.594	-0.230***
Difference	0.412***	0.460***	
	AGE: 28-37		
Log Monthly Wage	**Mothers**	**Non-mothers**	**Difference**
Total	7.134	7.672	-0.538***
Vet qualification	7.066	7.689	-0.623***
General qualification	7.328	7.665	-0.337***
Difference	-0.262 ***	0.024	
	AGE: 38-47		
Log Monthly Wage	**Mothers**	**Non-mothers**	**Difference**
Total	7.415	7.819	-0.404***
Vet qualification	7.267	7.808	-0.541***
General qualification	7.638	7.911	-0.273**
Difference	-0.371***	-0.103***	

Note: The table provides descriptive statistics on the monthly wage of employed women across different age ranges and by educational background. Sample includes men not currently in education (2005-2015). Individual with no qualification or training are excluded from the sample. The first and the second columns report the mean of the logarithm of the monthly wage for mothers and non-mothers. The last column provides a t-test for the difference in means of the dependent variable between mothers and childless individuals. GSOEP data. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 5 Descriptive analysis of the monthly wage by education type (men)

	AGE: 18-47		
Log Monthly Wage	**Fathers**	**Non-Fathers**	**Difference**
Total	7.929	7.454	0.475 ***
Vet qualification	7.915	7.501	0.414 ***
General qualification	8.008	7.408	0.600 ***
Difference	-0.093 ***	0.093 ***	
	AGE: 18-27		
Log Monthly Wage	**Fathers**	**Non-Fathers**	**Difference**
Total	7.338	6.930	0.408 ***
Vet qualification	7.442	7.039	0.403***
General qualification	7.124	6.718	0.406* **
Difference	0.318 ***	0.321 ***	
	AGE: 28-37		
Log Monthly Wage	**Fathers**	**Non-Fathers**	**Difference**
Total	7.879	7.776	0.103 ***
Vet qualification	7.873	7.793	0.080***
General qualification	7.939	7.785	0.154***
Difference	-0.066**	0.008	
	AGE: 38-47		
Log Monthly Wage	**Fathers**	**Non-Fathers**	**Difference**
Total	8.115	7.982	0.133***
Vet qualification	8.068	7.939	0.129***
General qualification	8.247	8.141	0.106***
Difference	-0.179***	-0.202**	

Note: The table provides descriptive statistics on the monthly wage of employed men across different age ranges and by educational background. Sample includes men not currently in education (2005-2015). Individuals with no qualification or training are excluded from the sample. The first and the second columns report the mean of the logarithm of the monthly wage for fathers and non-fathers. The last column provides a t-test for the difference in means of the dependent variable between fathers and childless individuals. GSOEP data. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 6 Linear Probability model: Employment (women)

	All women	All women	Vocational Education	Vocational Education	General Education	General Education
Time	-0.084***	0.042	-0.096***	0.060	-0.068***	0.067
	[0.011]	[0.083]	[0.014]	[0.100]	[0.020]	[0.143]
Treatment* time	-0.318***	-0.319***	-0.313***	-0.314***	-0.305***	-0.306***
	[0.033]	[0.032]	[0.039]	[0.039]	[0.058]	[0.058]
Age	0.030***	0.014	0.028***	0.007	0.034***	0.020
	[0.002]	[0.009]	[0.002]	[0.010]	[0.004]	[0.015]
Age squared	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	0.009	0.008	-0.000	-0.002	0.009	0.008
	[0.011]	[0.011]	[0.013]	[0.013]	[0.020]	[0.020]
Education						
Level 1 Vet	-0.416***	-0.419***	-0.254**	-0.261**		
	[0.076]	[0.076]	[0.104]	[0.104]		
Level 2 Vet	-0.271***	-0.278***	-0.120	-0.129		
	[0.063]	[0.063]	[0.095]	[0.096]		
Level 3 Vet	-0.258***	-0.264***	-0.273***	-0.277***		
	[0.049]	[0.049]	[0.071]	[0.070]		
Level 1 Gen	-0.593***	-0.599***			-0.589***	-0.586***
	[0.076]	[0.076]			[0.112]	[0.114]
Level 2 Gen	-0.503***	-0.512***			-0.542***	-0.542***
	[0.062]	[0.062]			[0.068]	[0.068]
Level 3 Gen	-0.272***	-0.277***			-0.307***	-0.306***
	[0.046]	[0.046]			[0.034]	[0.034]
Level 4 Gen	0.084	0.076				
	[0.052]	[0.053]				
Relationship status						
Married/Relationship	-0.078***	-0.079***	-0.086***	-0.085***	-0.038	-0.040
	[0.020]	[0.020]	[0.022]	[0.022]	[0.036]	[0.036]
Separated/Divorced	-0.067**	-0.073**	-0.055	-0.059	-0.068	-0.074
	[0.033]	[0.033]	[0.037]	[0.038]	[0.065]	[0.065]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	1.241***	1.134***	1.216***	1.110***	1.189***	1.034***
	[0.047]	[0.094]	[0.072]	[0.114]	[0.042]	[0.170]
Observations	22871	22871	13473	13473	9161	9161
Adjusted R2	0.104	0.109	0.046	0.057	0.128	0.129

Note: Linear probability model. Dependent variable: Individual is employed. Sample includes women aged 18-47 (not currently in education) 2005-2015. Women with no qualification or training are excluded from the sample. Treatment: giving birth in 2010. Time: dummy variable that switches on 1 from 2010 on. Omitted groups: Single, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 7 Linear Probability model: Employment (men)

	All men	All men	Vocational Education	Vocational Education	General Education	General Education
Time	-0.032***	0.068	-0.023**	0.059	-0.041**	0.053
	[0.009]	[0.073]	[0.010]	[0.082]	[0.018]	[0.134]
Treatment* time	-0.016	-0.016	-0.029	-0.029	-0.009	-0.009
	[0.030]	[0.030]	[0.036]	[0.036]	[0.045]	[0.046]
Age	0.015***	0.005	0.011***	0.003	0.019***	0.009
	[0.002]	[0.008]	[0.002]	[0.009]	[0.003]	[0.014]
Age squared	-0.001***	-0.001***	-0.000***	-0.000***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	0.040***	0.041***	0.044***	0.045***	0.008	0.008
	[0.011]	[0.011]	[0.013]	[0.013]	[0.022]	[0.022]
Education						
Level 1 Vet	-0.374***	-0.375***	-0.382***	-0.383***		
	[0.062]	[0.062]	[0.081]	[0.081]		
Level 2 Vet	-0.213***	-0.214***	-0.218***	-0.218***		
	[0.055]	[0.055]	[0.075]	[0.075]		
Level 3 Vet	-0.277***	-0.279***	-0.309***	-0.312***		
	[0.049]	[0.049]	[0.070]	[0.070]		
Level 1 Gen	-0.559***	-0.562***			-0.647***	-0.648***
	[0.065]	[0.065]			[0.148]	[0.147]
Level 2 Gen	-0.527***	-0.529***			-0.612***	-0.615***
	[0.055]	[0.055]			[0.067]	[0.067]
Level 3 Gen	-0.202***	-0.202***			-0.278***	-0.278***
	[0.047]	[0.047]			[0.039]	[0.039]
Level 4 Gen	0.094*	0.093*				
	[0.055]	[0.055]				
Relationship status						
Married/Relationship	0.011	0.011	0.014	0.014	0.048	0.047
	[0.014]	[0.014]	[0.014]	[0.014]	[0.032]	[0.033]
Separated/Divorced	0.018	0.018	0.022	0.022	0.055	0.056
	[0.027]	[0.027]	[0.025]	[0.025]	[0.062]	[0.062]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	1.073***	0.987***	1.124***	1.061***	1.116***	1.021***
	[0.045]	[0.079]	[0.065]	[0.092]	[0.045]	[0.149]
Observations	26016	26016	16499	16499	9190	9190
Adjusted R2	0.070	0.070	0.019	0.020	0.090	0.090

Note: Linear probability model. Dependent variable: Individual is employed. Sample includes men aged 18-47 (not currently in education) 2005-2015. Individual with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. Omitted groups: Single, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 8 Baseline model - Women

	All women	All women	Vocational Education	Vocational Education	General Education	General Education
Time	-0.024	-0.266**	-0.026	-0.255*	-0.009	-0.151
	[0.015]	[0.114]	[0.016]	[0.135]	[0.031]	[0.208]
Treatment* time	**-0.278*** **	**-0.278*** **	**-0.374*** **	**-0.377*** **	**-0.025**	**-0.025**
	[0.058]	[0.058]	[0.069]	[0.069]	[0.087]	[0.087]
Age	0.078***	0.099***	0.080***	0.100***	0.066***	0.078***
	[0.010]	[0.014]	[0.011]	[0.016]	[0.019]	[0.027]
Age squared	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	0.005	0.005	0.017	0.018	-0.027	-0.025
	[0.014]	[0.014]	[0.016]	[0.016]	[0.026]	[0.026]
Education						
Level 1 Vet	0.247*	0.249*	0.339**	0.336**		
	[0.150]	[0.150]	[0.161]	[0.163]		
Level 2 Vet	-0.263**	-0.262**	-0.157	-0.160		
	[0.127]	[0.127]	[0.139]	[0.140]		
Level 3 Vet	-0.048	-0.051	-0.367***	-0.372***		
	[0.099]	[0.099]	[0.121]	[0.120]		
Level 1 Gen	0.123	0.134			0.070	0.070
	[0.157]	[0.156]			[0.345]	[0.338]
Level 2 Gen	0.066	0.066			-0.495***	-0.493***
	[0.138]	[0.138]			[0.185]	[0.187]
Level 3 Gen	-0.501***	-0.504***			-0.512***	-0.509***
	[0.097]	[0.097]			[0.090]	[0.090]
Level 4 Gen	0.113	0.109				
	[0.119]	[0.119]				
Relationship status						
Married/Relationship	-0.030	-0.030	-0.024	-0.023	-0.028	-0.029
	[0.024]	[0.024]	[0.029]	[0.028]	[0.048]	[0.047]
Separated/Divorced	-0.017	-0.020	0.043	0.041	-0.169**	-0.178**
	[0.048]	[0.048]	[0.055]	[0.055]	[0.078]	[0.077]
Job characteristics						
Managers	0.222***	0.222***	0.294***	0.296***	0.170	0.164
	[0.070]	[0.069]	[0.085]	[0.084]	[0.117]	[0.116]
Professionals	0.171**	0.171**	0.219***	0.221***	0.171	0.168
	[0.069]	[0.068]	[0.084]	[0.083]	[0.116]	[0.116]
Technicians	0.167***	0.165***	0.244***	0.244***	0.106	0.100
	[0.063]	[0.063]	[0.077]	[0.077]	[0.112]	[0.111]
Clerks	0.088	0.086	0.148*	0.148*	0.044	0.038
	[0.065]	[0.064]	[0.080]	[0.079]	[0.108]	[0.107]
Service workers	0.054	0.053	0.128	0.130	0.006	0.004
	[0.066]	[0.065]	[0.082]	[0.081]	[0.108]	[0.108]
Skil_agricul/fishery	0.206*	0.208*	0.230	0.223	0.189	0.194
	[0.113]	[0.114]	[0.155]	[0.154]	[0.147]	[0.146]
Craft and trade	-0.013	-0.013	0.020	0.017	-0.113	-0.114
	[0.071]	[0.071]	[0.079]	[0.079]	[0.149]	[0.148]
Machine operators	0.024	0.025	0.055	0.055	-0.051	-0.045
	[0.107]	[0.107]	[0.135]	[0.134]	[0.120]	[0.120]
Full time	0.488***	0.486***	0.426***	0.423***	0.561***	0.562***
	[0.027]	[0.027]	[0.034]	[0.034]	[0.044]	[0.044]
Work Experience PT	-0.030***	-0.031***	-0.040***	-0.041***	-0.011	-0.013
	[0.010]	[0.010]	[0.011]	[0.011]	[0.022]	[0.021]
Work Experience FT	-0.033***	-0.031***	-0.042***	-0.039***	-0.004	-0.004
	[0.010]	[0.010]	[0.012]	[0.012]	[0.020]	[0.020]
Self employed	-0.280***	-0.277***	-0.107	-0.104	-0.418***	-0.414***
	[0.071]	[0.071]	[0.082]	[0.082]	[0.101]	[0.101]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.667***	7.884***	7.796***	7.989***	7.439***	7.592***
	[0.150]	[0.168]	[0.187]	[0.204]	[0.224]	[0.281]
Observations	14839	14839	10041	10041	4716	4716
Adjusted R^2	0.334	0.336	0.246	0.249	0.403	0.406

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2005-2015. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2010. Time: dummy variable that switches on 1 from 2010 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 9 Baseline model - Men

	All men	All men	Vocational Education	Vocational Education	General Education	General Education
Time	-0.016	-0.033	-0.013	-0.072	-0.034	-0.145
	[0.013]	[0.098]	[0.015]	[0.116]	[0.026]	[0.175]
Treatment* time	**0.010**	0.009	**0.014**	0.013	**0.005**	0.002
	[0.035]	[0.035]	[0.041]	[0.041]	[0.068]	[0.069]
Age	0.105***	0.106***	0.113***	0.118***	0.057***	0.068**
	[0.009]	[0.013]	[0.011]	[0.016]	[0.021]	[0.029]
Age squared	-0.002***	-0.002***	-0.003***	-0.003***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	-0.008	-0.007	0.001	0.001	-0.033	-0.032
	[0.014]	[0.014]	[0.015]	[0.015]	[0.032]	[0.032]
Education						
Level 1 Vet	0.187	0.186	0.131	0.130		
	[0.122]	[0.122]	[0.153]	[0.153]		
Level 2 Vet	-0.294***	-0.293***	-0.331**	-0.329**		
	[0.110]	[0.110]	[0.141]	[0.141]		
Level 3 Vet	-0.169*	-0.169*	-0.588***	-0.587***		
	[0.091]	[0.091]	[0.134]	[0.134]		
Level 1 Gen	0.254*	0.257*			-1.000***	-0.991***
	[0.132]	[0.132]			[0.370]	[0.367]
Level 2 Gen	0.139	0.141			-0.683*	-0.703*
	[0.130]	[0.130]			[0.361]	[0.359]
Level 3 Gen	-0.612***	-0.610***			-0.694***	-0.695***
	[0.080]	[0.080]			[0.099]	[0.099]
Level 4 Gen	-0.037	-0.038				
	[0.109]	[0.109]				
Relationship status						
Married/Relationship	0.057**	0.056**	0.025	0.025	0.074*	0.073
	[0.025]	[0.025]	[0.027]	[0.027]	[0.045]	[0.044]
Separated/Divorced	0.056	0.054	0.036	0.034	0.079	0.078
	[0.039]	[0.039]	[0.044]	[0.044]	[0.080]	[0.081]
Job characteristics						
Managers	0.071	0.071	0.045	0.045	0.180*	0.181*
	[0.044]	[0.044]	[0.048]	[0.048]	[0.098]	[0.097]
Professionals	0.034	0.033	-0.014	-0.015	0.189**	0.188**
	[0.043]	[0.043]	[0.047]	[0.047]	[0.095]	[0.094]
Technicians	0.008	0.006	-0.031	-0.033	0.134	0.134
	[0.039]	[0.039]	[0.044]	[0.044]	[0.084]	[0.084]
Clerks	-0.026	-0.027	-0.078*	-0.078*	0.060	0.062
	[0.042]	[0.042]	[0.046]	[0.045]	[0.092]	[0.092]
Service workers	0.010	0.010	-0.020	-0.020	0.150*	0.148*
	[0.047]	[0.047]	[0.060]	[0.060]	[0.082]	[0.082]
Skil_agricul/fishery	-0.052	-0.055	-0.071	-0.076	0.031	0.041
	[0.072]	[0.072]	[0.080]	[0.080]	[0.154]	[0.155]
Craft and trade	0.024	0.023	-0.008	-0.009	0.086	0.084
	[0.036]	[0.036]	[0.041]	[0.041]	[0.087]	[0.087]
Machine operators	0.004	0.004	-0.017	-0.018	0.055	0.058
	[0.036]	[0.036]	[0.042]	[0.041]	[0.081]	[0.081]
Full time	0.666***	0.667***	0.645***	0.645***	0.601***	0.605***
	[0.038]	[0.038]	[0.053]	[0.053]	[0.054]	[0.054]
Work Experience PT	-0.042***	-0.043***	-0.032*	-0.032*	-0.012	-0.015
	[0.013]	[0.013]	[0.016]	[0.016]	[0.026]	[0.026]
Work Experience FT	-0.064***	-0.064***	-0.074***	-0.073***	-0.016	-0.016
	[0.010]	[0.010]	[0.012]	[0.012]	[0.023]	[0.023]
Self employed	-0.077	-0.075	-0.072	-0.071	-0.067	-0.065
	[0.051]	[0.051]	[0.070]	[0.070]	[0.074]	[0.073]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.973***	7.995***	8.261***	8.311***	7.641***	7.748***
	[0.137]	[0.156]	[0.172]	[0.189]	[0.241]	[0.292]
Observations	18296	18296	12959	12959	5143	5143
Adjusted R^2	0.365	0.366	0.302	0.302	0.371	0.372

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes men aged 18-47 (not currently in education) 2005-2015. Individual with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 10 Baseline model - different time windows: 2006-2014 - Women

	All women 2006-2014	All women 2006-2014	Vocational Education 2006-2014	Vocational Education 2006-2014	General Education 2006-2014	General Education 2006-2014
Time	-0.025*	-0.146*	-0.025	-0.151	-0.008	-0.224
	[0.015]	[0.087]	[0.016]	[0.097]	[0.031]	[0.166]
Treatment* time	**-0.243*** **	**-0.244*** **	**-0.323*** **	**-0.326*** **	**-0.053**	**-0.051**
	[0.054]	[0.054]	[0.065]	[0.065]	[0.093]	[0.094]
Age	0.084***	0.099***	0.084***	0.099***	0.080***	0.108***
	[0.012]	[0.016]	[0.014]	[0.018]	[0.023]	[0.029]
Age squared	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	0.015	0.015	0.023	0.024	0.010	0.011
	[0.015]	[0.015]	[0.017]	[0.017]	[0.028]	[0.028]
Education						
Level 1 Vet	0.265	0.267	0.368*	0.366*		
	[0.191]	[0.192]	[0.209]	[0.210]		
Level 2 Vet	-0.247	-0.246	-0.128	-0.129		
	[0.166]	[0.166]	[0.185]	[0.186]		
Level 3 Vet	-0.011	-0.012	-0.431***	-0.435***		
	[0.121]	[0.121]	[0.140]	[0.140]		
Level 1 Gen	0.255	0.259			0.485	0.496
	[0.207]	[0.207]			[0.409]	[0.393]
Level 2 Gen	0.061	0.058			-0.563**	-0.559**
	[0.176]	[0.176]			[0.244]	[0.245]
Level 3 Gen	-0.460***	-0.462***			-0.490***	-0.484***
	[0.119]	[0.119]			[0.110]	[0.109]
Level 4 Gen	0.107	0.102				
	[0.146]	[0.146]				
Relationship status						
Married/Relationship	-0.042	-0.042	-0.025	-0.023	-0.055	-0.052
	[0.027]	[0.027]	[0.031]	[0.031]	[0.058]	[0.058]
Separated/Divorced	-0.010	-0.011	0.080	0.081	-0.268***	-0.272***
	[0.053]	[0.053]	[0.057]	[0.057]	[0.094]	[0.092]
Job characteristics						
Managers	0.242***	0.242***	0.367***	0.364***	0.109	0.102
	[0.087]	[0.088]	[0.104]	[0.104]	[0.133]	[0.134]
Professionals	0.189**	0.188**	0.284***	0.281***	0.089	0.086
	[0.085]	[0.085]	[0.100]	[0.100]	[0.137]	[0.137]
Technicians	0.177**	0.176**	0.296***	0.295***	0.038	0.033
	[0.079]	[0.079]	[0.093]	[0.093]	[0.132]	[0.133]
Clerks	0.093	0.092	0.202**	0.199**	-0.042	-0.047
	[0.080]	[0.081]	[0.096]	[0.096]	[0.124]	[0.125]
Service workers	0.072	0.072	0.191**	0.192**	-0.053	-0.054
	[0.082]	[0.082]	[0.097]	[0.097]	[0.131]	[0.131]
Skil_agricul/fishery	0.240*	0.238*	0.338*	0.325*	0.026	0.023
	[0.126]	[0.126]	[0.173]	[0.171]	[0.148]	[0.147]
Craft and trade	-0.022	-0.023	0.032	0.025	-0.192	-0.190
	[0.086]	[0.086]	[0.095]	[0.095]	[0.177]	[0.176]
Machine operators	0.027	0.030	0.121	0.123	-0.174	-0.174
	[0.138]	[0.138]	[0.177]	[0.176]	[0.150]	[0.151]
Full time	0.488***	0.488***	0.426***	0.424***	0.568***	0.570***
	[0.030]	[0.030]	[0.037]	[0.037]	[0.051]	[0.051]
Work Experience PT	-0.028**	-0.028**	-0.037***	-0.038***	-0.020	-0.022
	[0.012]	[0.012]	[0.013]	[0.013]	[0.025]	[0.024]
Work Experience FT	-0.037***	-0.036***	-0.046***	-0.044***	-0.017	-0.017
	[0.012]	[0.012]	[0.015]	[0.015]	[0.024]	[0.024]
Self employed	-0.298***	-0.299***	-0.144	-0.143	-0.402***	-0.403***
	[0.079]	[0.079]	[0.092]	[0.092]	[0.114]	[0.113]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.671***	7.785***	7.760***	7.868***	7.549***	7.767***
	[0.185]	[0.198]	[0.230]	[0.244]	[0.266]	[0.296]
Observations	11873	11873	8140	8140	3673	3673
Adjusted R^2	0.323	0.323	0.245	0.247	0.384	0.387

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2006-2014. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2010. Time: dummy variable that switches on 1 from 2010 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 11 Baseline model - different time windows: 2007-2013 – Women

	All women 2007-2013	**All women 2007-2013**	**Vocational Education 2007-2013**	**Vocational Education 2007-2013**	**General Education 2007-2013**	**General Education 2007-2013**
Time	-0.018	-0.061	-0.016	-0.147**	0.005	0.039
	[0.015]	[0.065]	[0.016]	[0.069]	[0.033]	[0.134]
Treatment* time	**-0.206*** **	**-0.206*** **	**-0.271*** **	**-0.274*** **	**-0.074**	**-0.073**
	[0.053]	[0.052]	[0.063]	[0.063]	[0.093]	[0.095]
Age	0.084***	0.090***	0.091***	0.113***	0.068**	0.060*
	[0.013]	[0.017]	[0.015]	[0.019]	[0.027]	[0.033]
Age squared	-0.003***	-0.003***	-0.002***	-0.002***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	0.020	0.019	0.022	0.023	0.042	0.041
	[0.018]	[0.018]	[0.019]	[0.019]	[0.031]	[0.031]
Education						
Level 1 Vet	0.157	0.159	0.075	0.074		
	[0.270]	[0.271]	[0.320]	[0.319]		
Level 2 Vet	-0.422*	-0.420*	-0.508*	-0.508*		
	[0.244]	[0.244]	[0.303]	[0.302]		
Level 3 Vet	-0.061	-0.062	-0.457***	-0.460***		
	[0.143]	[0.143]	[0.165]	[0.165]		
Level 1 Gen	0.086	0.088			1.441***	1.417***
	[0.327]	[0.328]			[0.172]	[0.170]
Level 2 Gen	-0.089	-0.090			-0.492	-0.469
	[0.250]	[0.250]			[0.334]	[0.340]
Level 3 Gen	-0.507***	-0.509***			-0.485***	-0.469***
	[0.145]	[0.145]			[0.159]	[0.158]
Level 4 Gen	0.101	0.098				
	[0.187]	[0.187]				
Relationship status						
Married/Relationship	-0.051*	-0.051*	0.000	0.001	-0.113*	-0.108
	[0.030]	[0.030]	[0.033]	[0.034]	[0.067]	[0.067]
Separated/Divorced	-0.050	-0.052	0.071	0.070	-0.368***	-0.378***
	[0.055]	[0.056]	[0.056]	[0.056]	[0.138]	[0.136]
Job characteristics						
Managers	0.233**	0.232**	0.310***	0.307***	0.102	0.092
	[0.099]	[0.099]	[0.111]	[0.110]	[0.134]	[0.134]
Professionals	0.177*	0.176*	0.248**	0.244**	0.073	0.070
	[0.095]	[0.095]	[0.105]	[0.104]	[0.140]	[0.140]
Technicians	0.166*	0.165*	0.248**	0.245**	0.023	0.021
	[0.089]	[0.089]	[0.096]	[0.096]	[0.134]	[0.134]
Clerks	0.104	0.103	0.155	0.151	-0.020	-0.024
	[0.090]	[0.090]	[0.099]	[0.099]	[0.126]	[0.125]
Service workers	0.077	0.076	0.181*	0.181*	-0.072	-0.073
	[0.090]	[0.090]	[0.103]	[0.103]	[0.127]	[0.125]
Skil_agricul/fishery	0.249*	0.246*	0.359**	0.349**	-0.028	-0.034
	[0.132]	[0.132]	[0.174]	[0.172]	[0.151]	[0.147]
Craft and trade	-0.002	-0.003	0.047	0.041	-0.234	-0.243
	[0.103]	[0.103]	[0.105]	[0.104]	[0.222]	[0.222]
Machine operators	-0.038	-0.037	0.051	0.052	-0.287	-0.291
	[0.146]	[0.146]	[0.174]	[0.172]	[0.195]	[0.194]
Full time	0.462***	0.463***	0.415***	0.414***	0.510***	0.515***
	[0.033]	[0.033]	[0.040]	[0.039]	[0.061]	[0.061]
Work Experience PT	-0.031**	-0.032**	-0.051***	-0.051***	-0.007	-0.010
	[0.014]	[0.014]	[0.016]	[0.016]	[0.027]	[0.027]
Work Experience FT	-0.035**	-0.035**	-0.054***	-0.052***	-0.002	-0.005
	[0.014]	[0.014]	[0.016]	[0.016]	[0.028]	[0.028]
Self employed	-0.328***	-0.329***	-0.243**	-0.243**	-0.366***	-0.368***
	[0.095]	[0.095]	[0.113]	[0.114]	[0.134]	[0.133]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.784***	7.832***	8.138***	8.263***	7.380***	7.360***
	[0.229]	[0.236]	[0.296]	[0.300]	[0.295]	[0.308]
Observations	9161	9161	6330	6330	2786	2786
Adjusted R^2	0.304	0.305	0.233	0.235	0.348	0.353

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2007-2013. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2010. Time: dummy variable that switches on 1 from 2010 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 12 Baseline model - different time windows: 2006-2014 - Men

	All Men 2006-2014	**All Men 2006-2014**	**Vocational Education 2006-2014**	**Vocational Education 2006-2014**	**General Education 2006-2014**	**General Education 2006-2014**
Time	-0.012	-0.198***	-0.010	-0.194**	-0.025	-0.245*
	[0.013]	[0.073]	[0.015]	[0.083]	[0.026]	[0.134]
Treatment* time	**0.002**	**0.001**	**0.002**	**0.002**	**0.018**	**0.016**
	[0.034]	[0.034]	[0.039]	[0.039]	[0.068]	[0.068]
Age	0.105***	0.129***	0.113***	0.136***	0.057**	0.085***
	[0.011]	[0.014]	[0.013]	[0.016]	[0.026]	[0.030]
Age squared	-0.002***	-0.002***	-0.003***	-0.003***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	-0.007	-0.006	0.013	0.014	-0.060**	-0.061**
	[0.015]	[0.015]	[0.016]	[0.016]	[0.030]	[0.030]
Education						
Level 1 Vet	0.093	0.094	0.053	0.054		
	[0.149]	[0.149]	[0.187]	[0.187]		
Level 2 Vet	-0.381***	-0.380***	-0.394**	-0.391**		
	[0.132]	[0.132]	[0.171]	[0.171]		
Level 3 Vet	-0.117	-0.117	-0.569***	-0.568***		
	[0.107]	[0.107]	[0.163]	[0.163]		
Level 1 Gen	0.164	0.165			-1.140***	-1.138***
	[0.158]	[0.158]			[0.418]	[0.416]
Level 2 Gen	0.077	0.077			-0.568	-0.599
	[0.152]	[0.152]			[0.398]	[0.398]
Level 3 Gen	-0.614***	-0.613***			-0.653***	-0.655***
	[0.090]	[0.090]			[0.109]	[0.108]
Level 4 Gen	-0.046	-0.046				
	[0.122]	[0.121]				
Relationship status						
Married/Relationship	0.061**	0.061**	0.046	0.046	0.029	0.029
	[0.029]	[0.029]	[0.030]	[0.030]	[0.049]	[0.049]
Separated/Divorced	0.059	0.058	0.060	0.059	0.012	0.016
	[0.047]	[0.047]	[0.052]	[0.052]	[0.094]	[0.095]
Job characteristics						
Managers	0.065	0.066	0.053	0.053	0.198*	0.200*
	[0.051]	[0.051]	[0.057]	[0.057]	[0.115]	[0.114]
Professionals	0.038	0.037	-0.001	-0.003	0.208*	0.208*
	[0.050]	[0.050]	[0.055]	[0.055]	[0.112]	[0.111]
Technicians	0.022	0.021	-0.017	-0.018	0.180*	0.182*
	[0.045]	[0.045]	[0.052]	[0.052]	[0.099]	[0.098]
Clerks	-0.034	-0.034	-0.068	-0.068	0.074	0.079
	[0.048]	[0.048]	[0.053]	[0.053]	[0.115]	[0.115]
Service workers	0.022	0.022	0.023	0.022	0.157*	0.158*
	[0.056]	[0.056]	[0.073]	[0.073]	[0.091]	[0.091]
Skil_agricul/fishery	-0.075	-0.076	-0.098	-0.101	0.060	0.074
	[0.081]	[0.081]	[0.089]	[0.089]	[0.178]	[0.181]
Craft and trade	0.026	0.026	-0.000	-0.000	0.118	0.118
	[0.042]	[0.042]	[0.049]	[0.049]	[0.101]	[0.101]
Machine operators	0.011	0.011	-0.018	-0.018	0.124	0.132
	[0.042]	[0.042]	[0.048]	[0.048]	[0.104]	[0.105]
Full time	0.649***	0.650***	0.608***	0.609***	0.609***	0.614***
	[0.043]	[0.043]	[0.060]	[0.060]	[0.059]	[0.059]
Work Experience PT	-0.037**	-0.037**	-0.034*	-0.033*	-0.012	-0.012
	[0.016]	[0.016]	[0.020]	[0.020]	[0.030]	[0.030]
Work Experience FT	-0.064***	-0.063***	-0.073***	-0.072***	-0.015	-0.014
	[0.012]	[0.012]	[0.014]	[0.014]	[0.028]	[0.028]
Self employed	-0.111*	-0.110*	-0.134	-0.133	-0.103	-0.104
	[0.060]	[0.060]	[0.088]	[0.088]	[0.076]	[0.075]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	8.020***	8.169***	8.305***	8.446***	7.633***	7.821***
	[0.161]	[0.168]	[0.211]	[0.216]	[0.289]	[0.295]
Observations	14781	14781	10589	10589	4037	4037
Adjusted R^2	0.343	0.343	0.272	0.273	0.353	0.355

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes men aged 18-47 (not currently in education) 2006-2014. Individual with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 13 Baseline model - different time windows: 2007-2013 - Men

	All Men 2007-2013	All Men 2007-2013	Vocational Education 2007-2013	Vocational Education 2007-2013	General Education 2007-2013	General Education 2007-2013
Time	0.005	-0.025	0.005	0.035	0.010	-0.170
	[0.014]	[0.056]	[0.016]	[0.062]	[0.027]	[0.118]
Treatment* time	**-0.004**	**-0.004**	**-0.012**	**-0.011**	**0.010**	**0.010**
	[0.030]	[0.030]	[0.034]	[0.034]	[0.071]	[0.071]
Age	0.088***	0.092***	0.104***	0.098***	0.012	0.043
	[0.012]	[0.015]	[0.014]	[0.017]	[0.028]	[0.031]
Age squared	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	-0.003	-0.002	0.013	0.013	-0.027	-0.030
	[0.016]	[0.016]	[0.018]	[0.018]	[0.035]	[0.035]
Education						
Level 1 Vet	-0.054	-0.052	[0.216]	-0.215		
	[0.165]	[0.166]	-0.649***	[0.217]		
Level 2 Vet	-0.523***	-0.522***	[0.200]	-0.648***		
	[0.148]	[0.148]	-0.691***	[0.201]		
Level 3 Vet	-0.194	-0.194	[0.184]	-0.691***		
	[0.123]	[0.123]		[0.185]		
Level 1 Gen	0.069	0.070			0.000	0.000
	[0.189]	[0.189]			[.]	[.]
Level 2 Gen	0.033	0.032			0.083	0.065
	[0.164]	[0.164]			[0.529]	[0.533]
Level 3 Gen	-0.664***	-0.664***			-0.688***	-0.688***
	[0.105]	[0.105]			[0.113]	[0.113]
Level 4 Gen	-0.050	-0.051				
	[0.135]	[0.135]				
Relationship status						
Married/Relationship	0.067*	0.067*	0.053	0.054	0.016	0.016
	[0.034]	[0.034]	[0.035]	[0.035]	[0.063]	[0.062]
Separated/Divorced	0.082	0.083	0.099*	0.101*	-0.029	-0.028
	[0.051]	[0.051]	[0.054]	[0.054]	[0.105]	[0.105]
Job characteristics						
Managers	0.119**	0.119**	0.099	0.100	0.251*	0.252*
	[0.058]	[0.058]	[0.062]	[0.062]	[0.140]	[0.139]
Professionals	0.095*	0.095*	0.025	0.024	0.289**	0.289**
	[0.056]	[0.056]	[0.056]	[0.056]	[0.136]	[0.135]
Technicians	0.072	0.072	0.022	0.021	0.243**	0.245**
	[0.050]	[0.050]	[0.054]	[0.054]	[0.121]	[0.120]
Clerks	-0.012	-0.012	-0.038	-0.039	0.075	0.080
	[0.050]	[0.050]	[0.053]	[0.053]	[0.129]	[0.129]
Service workers	0.034	0.034	-0.002	-0.003	0.131	0.131
	[0.064]	[0.064]	[0.080]	[0.080]	[0.116]	[0.116]
Skil_agricul/fishery	-0.032	-0.031	-0.098	-0.096	0.017	0.027
	[0.102]	[0.102]	[0.117]	[0.117]	[0.210]	[0.213]
Craft and trade	0.060	0.060	0.022	0.022	0.183	0.184
	[0.048]	[0.048]	[0.052]	[0.052]	[0.115]	[0.115]
Machine operators	0.018	0.018	-0.003	-0.003	0.044	0.049
	[0.046]	[0.046]	[0.049]	[0.049]	[0.129]	[0.129]
Full time	0.613***	0.613***	0.548***	0.549***	0.611***	0.612***
	[0.049]	[0.049]	[0.068]	[0.068]	[0.065]	[0.065]
Work Experience PT	-0.027	-0.027	-0.026	-0.026	0.014	0.015
	[0.019]	[0.019]	[0.024]	[0.024]	[0.035]	[0.035]
Work Experience FT	-0.049***	-0.049***	-0.066***	-0.067***	0.025	0.026
	[0.013]	[0.013]	[0.015]	[0.015]	[0.030]	[0.030]
Self employed	-0.099	-0.098	-0.105	-0.104	-0.115	-0.115
	[0.073]	[0.073]	[0.114]	[0.114]	[0.081]	[0.081]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.950***	7.975***	8.473***	8.448***	6.984***	7.140***
	[0.180]	[0.183]	[0.246]	[0.251]	[0.317]	[0.309]
Observations	11557	11557	8342	8342	3092	3092
Adjusted R^2	0.321	0.321	0.242	0.242	0.363	0.364

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes men aged 18-47 (not currently in education) 2007-2013. Individual with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2010 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 14 Placebo test with a fake dummy time 2006 - Women

	All women 2005-2008	**All women 2005-2008**	**Vocational Education 2005-2008**	**Vocational Education 2005-2008**	**General Education 2005-2008**	**General Education 2005-2008**
Time2006	-0.025	0.028	-0.024	-0.008	0.012	0.181**
	[0.017]	[0.033]	[0.019]	[0.035]	[0.040]	[0.074]
Treatment*Time2006	**-0.040**	**-0.040**	**-0.040**	**-0.040**	**-0.121**	**-0.121**
	[0.051]	[0.051]	[0.059]	[0.059]	[0.096]	[0.095]
Age	0.142***	0.123***	0.129***	0.124***	0.055	-0.010
	[0.021]	[0.023]	[0.024]	[0.026]	[0.048]	[0.051]
Age squared	-0.002***	-0.002***	-0.003***	-0.003***	-0.002**	-0.002**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Good Health	0.041	0.041	0.067**	0.067**	-0.028	-0.027
	[0.028]	[0.028]	[0.031]	[0.031]	[0.055]	[0.055]
Education						
Level 1 Vet	0.200	0.202	0.397**	0.397**		
	[0.238]	[0.238]	[0.181]	[0.182]		
Level 2 Vet	-0.436**	-0.430**	-0.201	-0.200		
	[0.201]	[0.199]	[0.124]	[0.124]		
Level 3 Vet	-0.174	-0.176	-0.284*	-0.285*		
	[0.167]	[0.167]	[0.170]	[0.170]		
Level 1 Gen	-0.154	-0.152			-0.788**	-0.767**
	[0.253]	[0.252]			[0.359]	[0.354]
Level 2 Gen	-0.085	-0.081			-0.687*	-0.647*
	[0.237]	[0.236]			[0.359]	[0.355]
Level 3 Gen	-0.598***	-0.599***			-0.582***	-0.569***
	[0.175]	[0.175]			[0.213]	[0.212]
Level 4 Gen	0.096	0.092				
	[0.240]	[0.240]				
Relationship status						
Married/Relationship	-0.043	-0.044	-0.021	-0.021	-0.087	-0.081
	[0.036]	[0.036]	[0.039]	[0.039]	[0.072]	[0.072]
Separated/Divorced	-0.098*	-0.102**	-0.017	-0.018	-0.231**	-0.241**
	[0.050]	[0.050]	[0.052]	[0.052]	[0.105]	[0.104]
Job characteristics						
Managers	0.167	0.165	0.163	0.161	0.216	0.232
	[0.147]	[0.147]	[0.196]	[0.196]	[0.224]	[0.225]
Professionals	0.171	0.168	0.122	0.120	0.325	0.342
	[0.147]	[0.147]	[0.194]	[0.194]	[0.227]	[0.228]
Technicians	0.190	0.187	0.141	0.139	0.317	0.327
	[0.142]	[0.142]	[0.189]	[0.189]	[0.224]	[0.225]
Clerks	0.186	0.183	0.116	0.114	0.390*	0.405*
	[0.147]	[0.147]	[0.196]	[0.196]	[0.219]	[0.221]
Service workers	0.150	0.148	0.114	0.113	0.282	0.305
	[0.137]	[0.137]	[0.183]	[0.183]	[0.227]	[0.225]
Skil_agricul/fishery	0.265	0.260	0.247	0.248	0.309**	0.248*
	[0.172]	[0.174]	[0.244]	[0.244]	[0.131]	[0.135]
Craft and trade	-0.018	-0.020	-0.097	-0.099	0.059	0.037
	[0.110]	[0.110]	[0.148]	[0.148]	[0.100]	[0.098]
Machine operators	0.169	0.166	0.180	0.178	0.164	0.179
	[0.150]	[0.149]	[0.198]	[0.198]	[0.203]	[0.205]
Full time	0.425***	0.428***	0.359***	0.360***	0.600***	0.608***
	[0.047]	[0.047]	[0.053]	[0.053]	[0.092]	[0.091]
Work Experience PT	-0.106***	-0.106***	-0.088***	-0.088***	-0.042	-0.039
	[0.027]	[0.027]	[0.028]	[0.028]	[0.066]	[0.065]
Work Experience FT	-0.104***	-0.105***	-0.095***	-0.095***	-0.016	-0.013
	[0.021]	[0.021]	[0.023]	[0.023]	[0.048]	[0.048]
Self employed	-0.153	-0.155	0.366*	0.366*	-0.572***	-0.585***
	[0.162]	[0.162]	[0.217]	[0.217]	[0.177]	[0.176]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	8.585***	8.521***	8.526***	8.510***	7.414***	7.098***
	[0.306]	[0.306]	[0.326]	[0.326]	[0.565]	[0.568]
Observations	4365	4365	3186	3186	1167	1167
Adjusted R^2	0.232	0.233	0.179	0.179	0.286	0.292

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2005-2008. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2010. Time: dummy variable that switches on 1 from 2006 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 15: Placebo test with a fake dummy time 2006 - Men

	All Men 2005-2008	All Men 2005-2008	Vocational Education 2005-2008	Vocational Education 2005-2008	General Education 2005-2008	General Education 2005-2008
Time2006	-0.009	0.020	0.005	0.034	-0.024	-0.014
	[0.015]	[0.029]	[0.017]	[0.032]	[0.034]	[0.059]
Treatment*Time2006	**-0.074**	**-0.074**	**-0.143***	**-0.143***	**0.263**	**0.263**
	[0.076]	[0.076]	[0.079]	[0.079]	[0.230]	[0.230]
Age	0.117***	0.107***	0.106***	0.096***	0.175***	0.171***
	[0.023]	[0.023]	[0.025]	[0.026]	[0.055]	[0.052]
Age squared	-0.002***	-0.002***	-0.002***	-0.002***	-0.001	-0.001
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Good Health	0.008	0.008	0.004	0.005	0.055	0.055
	[0.026]	[0.026]	[0.026]	[0.026]	[0.080]	[0.080]
Education						
Level 1 Vet	0.448	0.449	0.572	0.569		
	[0.603]	[0.602]	[0.704]	[0.705]		
Level 2 Vet	-0.301	-0.299	-0.112	-0.114		
	[0.581]	[0.581]	[0.688]	[0.689]		
Level 3 Vet	0.038	0.035	-0.538	-0.543		
	[0.432]	[0.433]	[0.550]	[0.550]		
Level 1 Gen	0.189	0.187			0.000	0.000
	[0.606]	[0.606]			[.]	[.]
Level 2 Gen	0.034	0.034			-1.147***	-1.146***
	[0.587]	[0.587]			[0.333]	[0.334]
Level 3 Gen	-0.456	-0.457			-0.637**	-0.638**
	[0.408]	[0.408]			[0.286]	[0.286]
Level 4 Gen	0.180	0.181				
	[0.486]	[0.486]				
Relationship status						
Married/Relationship	0.007	0.007	0.013	0.014	-0.023	-0.023
	[0.028]	[0.028]	[0.034]	[0.034]	[0.044]	[0.044]
Separated/Divorced	-0.052	-0.051	-0.050	-0.050	0.034	0.035
	[0.036]	[0.036]	[0.041]	[0.041]	[0.072]	[0.073]
Job characteristics						
Managers	-0.060	-0.061	-0.067	-0.068	-0.113	-0.113
	[0.083]	[0.083]	[0.090]	[0.090]	[0.198]	[0.199]
Professionals	-0.039	-0.040	-0.063	-0.063	0.007	0.007
	[0.083]	[0.083]	[0.091]	[0.091]	[0.177]	[0.177]
Technicians	-0.078	-0.078	-0.073	-0.073	-0.042	-0.042
	[0.075]	[0.075]	[0.081]	[0.081]	[0.169]	[0.169]
Clerks	-0.096	-0.098	-0.112	-0.113	-0.146	-0.147
	[0.091]	[0.092]	[0.094]	[0.094]	[0.211]	[0.212]
Service workers	-0.017	-0.017	-0.101	-0.101	0.321	0.321
	[0.095]	[0.095]	[0.103]	[0.103]	[0.201]	[0.202]
Skil_agricul/fishery	-0.321	-0.319	-0.355	-0.352	-0.070	-0.073
	[0.211]	[0.210]	[0.228]	[0.228]	[0.180]	[0.186]
Craft and trade	-0.047	-0.047	-0.045	-0.045	-0.148	-0.148
	[0.069]	[0.069]	[0.070]	[0.070]	[0.230]	[0.229]
Machine operators	-0.095	-0.096	-0.120*	-0.120*	0.009	0.008
	[0.070]	[0.070]	[0.072]	[0.072]	[0.196]	[0.197]
Full time	0.551***	0.551***	0.645***	0.644***	0.371***	0.371***
	[0.072]	[0.072]	[0.092]	[0.091]	[0.116]	[0.116]
Work Experience PT	-0.109***	-0.110***	-0.054	-0.055	-0.165**	-0.164**
	[0.037]	[0.038]	[0.048]	[0.048]	[0.069]	[0.069]
Work Experience FT	-0.074***	-0.075***	-0.067***	-0.068***	-0.134**	-0.134**
	[0.023]	[0.023]	[0.025]	[0.025]	[0.059]	[0.059]
Self employed	0.001	0.002	0.006	0.009	-0.038	-0.038
	[0.085]	[0.085]	[0.095]	[0.096]	[0.164]	[0.164]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	8.197***	8.173***	8.030***	8.011***	8.845***	8.833***
	[0.568]	[0.567]	[0.674]	[0.675]	[0.563]	[0.547]
Observations	5497	5497	4123	4123	1341	1341
Adjusted R^2	0.216	0.216	0.194	0.194	0.195	0.195

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes men aged 18-47 (not currently in education) 2005-2008. Individual with no qualification or training are excluded from the sample. Treatment: having a child in 2010. Time: dummy variable that switches on 1 from 2006 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 16 Treatment: giving birth in 2009 (2005-2013) - Women

	All Women	All Women	Vocational Education	Vocational Education	General Education	General Education
Time	0.009	-0.144*	-0.006	-0.177*	0.021	-0.190
	[0.016]	[0.086]	[0.019]	[0.094]	[0.031]	[0.177]
Treatment* time	**-0.248*** **	**-0.250*** **	**-0.325*** **	**-0.325*** **	**-0.051**	**-0.066**
	[0.059]	[0.059]	[0.062]	[0.062]	[0.138]	[0.140]
Age	0.081***	0.098***	0.080***	0.100***	0.078***	0.104***
	[0.012]	[0.015]	[0.013]	[0.017]	[0.025]	[0.033]
Age squared	-0.002***	-0.002***	-0.003***	-0.002***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	0.033**	0.031*	0.042**	0.042**	0.008	0.007
	[0.016]	[0.016]	[0.018]	[0.018]	[0.027]	[0.028]
Education						
Level 1 Vet	0.293*	0.292*	0.350**	0.347**		
	[0.168]	[0.168]	[0.162]	[0.162]		
Level 2 Vet	-0.210	-0.214	-0.133	-0.139		
	[0.144]	[0.144]	[0.138]	[0.139]		
Level 3 Vet	-0.131	-0.134	-0.372***	-0.375***		
	[0.096]	[0.095]	[0.114]	[0.114]		
Level 1 Gen	0.243	0.247			0.427	0.386
	[0.185]	[0.183]			[0.694]	[0.687]
Level 2 Gen	0.173	0.164			-0.427*	-0.427*
	[0.156]	[0.156]			[0.236]	[0.238]
Level 3 Gen	-0.559***	-0.562***			-0.543***	-0.534***
	[0.099]	[0.098]			[0.131]	[0.131]
Level 4 Gen	0.104	0.100				
	[0.137]	[0.138]				
Relationship status						
Married/Relationship	-0.049*	-0.050*	-0.043	-0.043	-0.062	-0.071
	[0.028]	[0.028]	[0.030]	[0.030]	[0.064]	[0.063]
Separated/Divorced	-0.043	-0.047	-0.001	-0.003	-0.254**	-0.279***
	[0.052]	[0.052]	[0.059]	[0.058]	[0.103]	[0.104]
Job characteristics						
Managers	0.209**	0.204**	0.267***	0.262***	0.127	0.124
	[0.082]	[0.082]	[0.093]	[0.092]	[0.135]	[0.136]
Professionals	0.142*	0.140*	0.210**	0.207**	0.085	0.089
	[0.080]	[0.081]	[0.090]	[0.090]	[0.141]	[0.142]
Technicians	0.145**	0.142*	0.194**	0.192**	0.077	0.077
	[0.074]	[0.074]	[0.082]	[0.082]	[0.130]	[0.131]
Clerks	0.092	0.089	0.103	0.100	0.097	0.097
	[0.075]	[0.076]	[0.085]	[0.085]	[0.128]	[0.129]
Service workers	0.061	0.058	0.112	0.109	-0.017	-0.010
	[0.075]	[0.075]	[0.085]	[0.085]	[0.129]	[0.130]
Skil_agricul/fishery	0.209*	0.213**	0.283*	0.279*	0.078	0.104
	[0.107]	[0.107]	[0.148]	[0.147]	[0.147]	[0.139]
Craft and trade	-0.027	-0.030	-0.031	-0.034	-0.108	-0.115
	[0.089]	[0.089]	[0.102]	[0.102]	[0.179]	[0.180]
Machine operators	-0.040	-0.037	-0.010	-0.008	-0.068	-0.052
	[0.141]	[0.142]	[0.174]	[0.174]	[0.161]	[0.164]
Full time	0.498***	0.495***	0.435***	0.433***	0.590***	0.589***
	[0.030]	[0.030]	[0.037]	[0.036]	[0.052]	[0.053]
Work Experience PT	-0.043***	-0.044***	-0.050***	-0.050***	-0.021	-0.026
	[0.012]	[0.012]	[0.013]	[0.013]	[0.027]	[0.027]
Work Experience FT	-0.044***	-0.042***	-0.048***	-0.046***	-0.026	-0.026
	[0.012]	[0.012]	[0.014]	[0.014]	[0.027]	[0.027]
Self employed	-0.250***	-0.249***	-0.160	-0.158	-0.324***	-0.322***
	[0.086]	[0.087]	[0.109]	[0.109]	[0.123]	[0.123]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.722***	7.872***	7.831***	7.991***	7.517***	7.760***
	[0.167]	[0.185]	[0.192]	[0.209]	[0.288]	[0.330]
Observations	11901	11901	8303	8303	3541	3541
Adjusted R^2	0.314	0.315	0.229	0.231	0.373	0.379

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2005-2013. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2009. Time: dummy variable that switches on 1 from 2009 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 17 Treatment: giving birth in 2009 (2005-2013) - Men

	All Men	All Men	Vocational Education	Vocational Education	General Education	General Education
Time	-0.011	-0.012	-0.008	0.081	-0.037	-0.301*
	[0.013]	[0.074]	[0.014]	[0.081]	[0.028]	[0.160]
Treatment* time	**0.017**	**0.016**	**0.024**	**0.023**	**0.030**	**0.028**
	[0.037]	[0.037]	[0.045]	[0.045]	[0.059]	[0.059]
Age	0.107***	0.107***	0.118***	0.106***	0.058**	0.091***
	[0.011]	[0.014]	[0.013]	[0.016]	[0.028]	[0.032]
Age squared	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	0.018	0.019	0.030*	0.031*	-0.013	-0.012
	[0.016]	[0.016]	[0.017]	[0.017]	[0.038]	[0.038]
Education						
Level 1 Vet	0.077	0.081	0.117	0.119		
	[0.146]	[0.146]	[0.172]	[0.172]		
Level 2 Vet	-0.389***	-0.385***	-0.317**	-0.315**		
	[0.129]	[0.129]	[0.156]	[0.157]		
Level 3 Vet	-0.083	-0.081	-0.393***	-0.392***		
	[0.097]	[0.097]	[0.148]	[0.148]		
Level 1 Gen	0.139	0.142			0.000	0.000
	[0.161]	[0.161]			[.]	[.]
Level 2 Gen	0.075	0.077			-0.722*	-0.721*
	[0.146]	[0.146]			[0.418]	[0.421]
Level 3 Gen	-0.580***	-0.578***			-0.724***	-0.723***
	[0.084]	[0.085]			[0.122]	[0.122]
Level 4 Gen	-0.001	0.001				
	[0.125]	[0.125]				
Relationship status						
Married/Relationship	0.028	0.029	0.003	0.004	0.085**	0.085**
	[0.021]	[0.021]	[0.025]	[0.025]	[0.038]	[0.037]
Separated/Divorced	0.045	0.046	0.038	0.039	0.086	0.080
	[0.040]	[0.040]	[0.046]	[0.046]	[0.083]	[0.084]
Job characteristics						
Managers	0.068	0.068	0.040	0.041	0.156	0.158
	[0.049]	[0.049]	[0.051]	[0.051]	[0.132]	[0.132]
Professionals	0.024	0.024	-0.019	-0.020	0.191	0.192
	[0.050]	[0.050]	[0.050]	[0.050]	[0.133]	[0.133]
Technicians	0.006	0.005	-0.033	-0.034	0.166	0.167
	[0.046]	[0.046]	[0.050]	[0.050]	[0.114]	[0.114]
Clerks	-0.058	-0.058	-0.086*	-0.086*	0.028	0.033
	[0.048]	[0.048]	[0.050]	[0.050]	[0.132]	[0.132]
Service workers	-0.022	-0.022	-0.073	-0.073	0.178	0.180
	[0.055]	[0.055]	[0.066]	[0.066]	[0.115]	[0.115]
Skil_agricul/fishery	-0.118	-0.118	-0.187	-0.186	0.008	0.015
	[0.103]	[0.103]	[0.114]	[0.114]	[0.227]	[0.228]
Craft and trade	0.010	0.010	-0.027	-0.027	0.095	0.093
	[0.043]	[0.043]	[0.046]	[0.046]	[0.119]	[0.119]
Machine operators	-0.004	-0.004	-0.024	-0.024	0.006	0.004
	[0.041]	[0.041]	[0.045]	[0.045]	[0.110]	[0.110]
Full time	0.612***	0.613***	0.633***	0.634***	0.511***	0.513***
	[0.041]	[0.041]	[0.057]	[0.057]	[0.060]	[0.059]
Work Experience PT	-0.056***	-0.056***	-0.049***	-0.049***	-0.018	-0.019
	[0.014]	[0.014]	[0.017]	[0.017]	[0.032]	[0.032]
Work Experience FT	-0.070***	-0.070***	-0.082***	-0.082***	-0.014	-0.015
	[0.012]	[0.012]	[0.013]	[0.013]	[0.030]	[0.030]
Self employed	-0.075	-0.074	-0.057	-0.058	-0.155**	-0.151**
	[0.054]	[0.054]	[0.074]	[0.074]	[0.076]	[0.076]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	8.125***	8.125***	8.316***	8.247***	7.574***	7.799***
	[0.158]	[0.166]	[0.197]	[0.207]	[0.298]	[0.311]
Observations	14755	14755	10749	10749	3872	3872
Adjusted R^2	0.341	0.341	0.273	0.273	0.348	0.348

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes men aged 18-47 (not currently in education) 2005-2013. Individual with no qualification or training are excluded from the sample. Treatment: having a child in 2009. Time: dummy variable that switches on 1 from 2009 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 18 Treatment: giving birth in 2011 (2007-2015)- Women

	All Women	All Women	Vocational Education	Vocational Education	General Education	General Education
Time	-0.017	-0.218**	-0.033*	-0.244**	0.056	-0.078
	[0.016]	[0.093]	[0.017]	[0.111]	[0.036]	[0.168]
Treatment* time	**-0.197*** **	**-0.203*** **	**-0.272*** **	**-0.277*** **	**-0.075**	**-0.084**
	[0.050]	[0.050]	[0.059]	[0.059]	[0.084]	[0.084]
Age	0.084***	0.110***	0.095***	0.122***	0.072***	0.089***
	[0.010]	[0.015]	[0.012]	[0.018]	[0.020]	[0.029]
Age squared	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	0.005	0.005	0.007	0.007	-0.000	0.003
	[0.015]	[0.015]	[0.017]	[0.017]	[0.029]	[0.029]
Education						
Level 1 Vet	0.176	0.176	0.352*	0.352*		
	[0.184]	[0.184]	[0.196]	[0.197]		
Level 2 Vet	-0.305*	-0.303*	-0.127	-0.124		
	[0.158]	[0.159]	[0.172]	[0.173]		
Level 3 Vet	-0.077	-0.080	-0.443***	-0.445***		
	[0.116]	[0.116]	[0.141]	[0.141]		
Level 1 Acad	0.080	0.078			0.261	0.278
	[0.198]	[0.198]			[0.408]	[0.387]
Level 2 Acad	-0.046	-0.041			-0.506**	-0.494**
	[0.170]	[0.170]			[0.236]	[0.239]
Level 3 Acad	-0.507***	-0.508***			-0.475***	-0.473***
	[0.114]	[0.114]			[0.108]	[0.108]
Level 4 Acad	0.064	0.061				
	[0.140]	[0.140]				
Relationship status						
Married/Relationship	-0.031	-0.032	-0.005	-0.005	-0.067	-0.068
	[0.026]	[0.026]	[0.028]	[0.028]	[0.056]	[0.055]
Separated/Divorced	-0.029	-0.030	0.061	0.059	-0.303***	-0.298***
	[0.053]	[0.052]	[0.057]	[0.056]	[0.115]	[0.111]
Job characteristics						
Managers	0.222***	0.221***	0.270***	0.272***	0.183	0.178
	[0.072]	[0.072]	[0.089]	[0.089]	[0.114]	[0.113]
Professionals	0.173**	0.170**	0.216**	0.215**	0.154	0.147
	[0.071]	[0.070]	[0.089]	[0.089]	[0.111]	[0.110]
Technicians	0.167**	0.163**	0.221***	0.217***	0.116	0.110
	[0.066]	[0.065]	[0.084]	[0.083]	[0.106]	[0.105]
Clerks	0.072	0.069	0.111	0.109	0.007	0.001
	[0.067]	[0.067]	[0.085]	[0.085]	[0.098]	[0.098]
Service workers	0.045	0.042	0.104	0.104	0.012	0.007
	[0.066]	[0.065]	[0.086]	[0.086]	[0.097]	[0.097]
Skil_agricul/fishery	0.251*	0.249*	0.259	0.256	0.181	0.172
	[0.133]	[0.134]	[0.190]	[0.191]	[0.154]	[0.154]
Craft and trade	-0.060	-0.062	-0.063	-0.066	-0.114	-0.115
	[0.082]	[0.082]	[0.096]	[0.095]	[0.151]	[0.149]
Machine operators	-0.062	-0.067	0.004	0.000	-0.159	-0.163
	[0.100]	[0.100]	[0.135]	[0.135]	[0.110]	[0.112]
Full time	0.492***	0.491***	0.455***	0.455***	0.529***	0.528***
	[0.029]	[0.029]	[0.035]	[0.035]	[0.052]	[0.052]
Work Experience PT	-0.038***	-0.039***	-0.057***	-0.058***	-0.019	-0.021
	[0.012]	[0.012]	[0.012]	[0.012]	[0.025]	[0.025]
Work Experience FT	-0.033***	-0.033***	-0.051***	-0.050***	-0.011	-0.012
	[0.011]	[0.011]	[0.013]	[0.013]	[0.022]	[0.022]
Self employed	-0.336***	-0.336***	-0.256***	-0.253***	-0.369***	-0.369***
	[0.070]	[0.070]	[0.091]	[0.092]	[0.093]	[0.093]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.748***	7.961***	7.932***	8.137***	7.478***	7.644***
	[0.164]	[0.180]	[0.199]	[0.216]	[0.230]	[0.285]
Observations	11904	11904	7943	7943	3895	3895
Adjusted R^2	0.341	0.342	0.262	0.264	0.402	0.405

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2007-2015. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2011. Time: dummy variable that switches on 1 from 2011 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 19 Treatment: giving birth in 2011 (2007-2015)- Men

	All Men	All Men	Vocational Education	Vocational Education	General Education	General Education
Time	0.002	-0.067	0.006	-0.108	-0.026	-0.147
	[0.014]	[0.081]	[0.015]	[0.094]	[0.031]	[0.149]
Treatment* time	**-0.019**	**-0.025**	**-0.029**	**-0.035**	**0.069**	**0.064**
	[0.030]	[0.030]	[0.034]	[0.034]	[0.056]	[0.057]
Age	0.097***	0.105***	0.111***	0.125***	0.029	0.044
	[0.010]	[0.015]	[0.012]	[0.016]	[0.023]	[0.031]
Age squared	-0.003***	-0.002***	-0.003***	-0.003***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	-0.003	-0.002	0.007	0.009	-0.034	-0.035
	[0.015]	[0.015]	[0.016]	[0.016]	[0.031]	[0.031]
Education						
Level 1 Vet	0.151	0.146	0.093	0.089		
	[0.122]	[0.122]	[0.162]	[0.163]		
Level 2 Vet	-0.323***	-0.324***	-0.362**	-0.361**		
	[0.113]	[0.114]	[0.151]	[0.152]		
Level 3 Vet	-0.154*	-0.160*	-0.562***	-0.567***		
	[0.093]	[0.093]	[0.154]	[0.155]		
Level 1 Gen	0.275**	0.276**			-0.428	-0.424
	[0.139]	[0.139]			[0.450]	[0.450]
Level 2 Gen	0.145	0.147			-0.194	-0.230
	[0.134]	[0.135]			[0.442]	[0.442]
Level 3 Gen	-0.557***	-0.559***			-0.689***	-0.693***
	[0.080]	[0.080]			[0.101]	[0.100]
Level 4 Gen	0.055	0.052				
	[0.108]	[0.107]				
Relationship status						
Married/Relationship	0.028	0.028	0.001	0.002	0.066	0.063
	[0.026]	[0.026]	[0.028]	[0.028]	[0.056]	[0.057]
Separated/Divorced	0.023	0.024	0.060	0.059	-0.019	-0.012
	[0.046]	[0.046]	[0.055]	[0.055]	[0.080]	[0.081]
Job characteristics						
Managers	0.144***	0.145***	0.100*	0.100*	0.237**	0.237**
	[0.048]	[0.048]	[0.052]	[0.052]	[0.115]	[0.114]
Professionals	0.079	0.078	0.018	0.017	0.234**	0.234**
	[0.048]	[0.048]	[0.051]	[0.051]	[0.109]	[0.108]
Technicians	0.047	0.045	0.010	0.008	0.179*	0.181*
	[0.044]	[0.044]	[0.049]	[0.049]	[0.098]	[0.097]
Clerks	0.014	0.012	-0.045	-0.047	0.095	0.099
	[0.044]	[0.044]	[0.047]	[0.047]	[0.098]	[0.097]
Service workers	0.034	0.033	-0.031	-0.031	0.197**	0.191**
	[0.054]	[0.054]	[0.071]	[0.071]	[0.089]	[0.089]
Skil_agricul/fishery	0.003	0.005	-0.010	-0.010	0.030	0.037
	[0.076]	[0.075]	[0.072]	[0.072]	[0.183]	[0.185]
Craft and trade	0.056	0.057	0.019	0.019	0.155*	0.158*
	[0.041]	[0.041]	[0.046]	[0.046]	[0.085]	[0.084]
Machine operators	0.037	0.035	0.006	0.002	0.102	0.108
	[0.041]	[0.041]	[0.046]	[0.046]	[0.095]	[0.095]
Full time	0.684***	0.685***	0.646***	0.645***	0.639***	0.644***
	[0.043]	[0.043]	[0.062]	[0.062]	[0.062]	[0.062]
Work Experience PT	-0.033**	-0.035**	-0.031	-0.031	0.030	0.028
	[0.016]	[0.016]	[0.021]	[0.021]	[0.028]	[0.027]
Work Experience FT	-0.052***	-0.052***	-0.070***	-0.069***	0.017	0.018
	[0.011]	[0.011]	[0.013]	[0.013]	[0.025]	[0.025]
Self employed	-0.057	-0.056	0.029	0.031	-0.151	-0.151
	[0.059]	[0.059]	[0.078]	[0.078]	[0.094]	[0.093]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.802***	7.877***	8.195***	8.303***	7.139***	7.266***
	[0.147]	[0.162]	[0.189]	[0.202]	[0.271]	[0.316]
Observations	14556	14556	10199	10199	4219	4219
Adjusted R^2	0.365	0.367	0.303	0.305	0.384	0.387

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes men aged 18-47 (not currently in education) 2007-2015. Individual with no qualification or training are excluded from the sample. Treatment: having a child in 2011. Time: dummy variable that switches on 1 from 2011 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 20 Treatment: giving birth in 2008 (2005-2011) - Women

	All Women	All Women	Vocational Education	Vocational Education	General Education	General Education
Time	-0.008	-0.160**	0.004	-0.050	-0.058*	-0.425***
	[0.015]	[0.077]	[0.016]	[0.085]	[0.035]	[0.163]
Treatment* time	**-0.218*** **	**-0.216*** **	**-0.303*** **	**-0.303*** **	**-0.035**	**-0.035**
	[0.061]	[0.061]	[0.073]	[0.073]	[0.091]	[0.091]
Age	0.086***	0.109***	0.079***	0.087***	0.090***	0.151***
	[0.014]	[0.019]	[0.016]	[0.020]	[0.028]	[0.042]
Age squared	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Good health	0.021	0.022	0.028	0.029	0.009	0.014
	[0.017]	[0.017]	[0.018]	[0.018]	[0.037]	[0.037]
Education						
Level 1 Vet	0.238	0.239	0.297*	0.295*		
	[0.199]	[0.199]	[0.170]	[0.170]		
Level 2 Vet	-0.301*	-0.300*	-0.211	-0.211		
	[0.170]	[0.171]	[0.138]	[0.138]		
Level 3 Vet	-0.037	-0.037	-0.327**	-0.327**		
	[0.126]	[0.126]	[0.134]	[0.133]		
Level 1 Gen	0.196	0.208			0.399	0.345
	[0.220]	[0.219]			[0.757]	[0.766]
Level 2 Gen	0.088	0.091			-0.547**	-0.555**
	[0.187]	[0.187]			[0.252]	[0.249]
Level 3 Gen	-0.437***	-0.436***			-0.497***	-0.497***
	[0.133]	[0.133]			[0.152]	[0.151]
Level 4 Gen	0.216	0.216				
	[0.179]	[0.179]				
Relationship status						
Married/Relationship	0.035	0.035	-0.003	-0.004	0.133**	0.128**
	[0.031]	[0.031]	[0.032]	[0.031]	[0.065]	[0.065]
Separated/Divorced	-0.039	-0.042	-0.046	-0.047	-0.042	-0.057
	[0.053]	[0.053]	[0.061]	[0.061]	[0.098]	[0.097]
Job characteristics						
Managers	0.158*	0.155*	0.265**	0.264**	0.182	0.166
	[0.094]	[0.094]	[0.105]	[0.105]	[0.155]	[0.154]
Professionals	0.064	0.063	0.149	0.149	0.134	0.121
	[0.095]	[0.095]	[0.109]	[0.108]	[0.164]	[0.164]
Technicians	0.082	0.081	0.184*	0.184*	0.073	0.059
	[0.087]	[0.087]	[0.101]	[0.100]	[0.152]	[0.152]
Clerks	0.040	0.038	0.107	0.108	0.159	0.149
	[0.088]	[0.088]	[0.103]	[0.103]	[0.147]	[0.146]
Service workers	0.020	0.018	0.088	0.088	0.050	0.043
	[0.084]	[0.084]	[0.097]	[0.097]	[0.144]	[0.144]
Skil_agricul/fishery	0.211**	0.215**	0.340**	0.347**	0.143	0.134
	[0.104]	[0.104]	[0.144]	[0.144]	[0.173]	[0.166]
Craft and trade	-0.014	-0.016	0.003	0.003	-0.159	-0.178
	[0.093]	[0.094]	[0.100]	[0.100]	[0.191]	[0.193]
Machine operators	-0.022	-0.024	0.010	0.008	0.090	0.092
	[0.135]	[0.136]	[0.160]	[0.161]	[0.212]	[0.215]
Full time	0.529***	0.529***	0.474***	0.474***	0.639***	0.638***
	[0.036]	[0.036]	[0.043]	[0.043]	[0.066]	[0.066]
Work Experience PT	-0.038***	-0.039***	-0.035**	-0.036**	-0.029	-0.033
	[0.014]	[0.014]	[0.015]	[0.015]	[0.031]	[0.031]
Work Experience FT	-0.049***	-0.048***	-0.052***	-0.052***	-0.028	-0.028
	[0.014]	[0.014]	[0.016]	[0.016]	[0.028]	[0.028]
Self employed	-0.149	-0.147	0.012	0.013	-0.258**	-0.252**
	[0.094]	[0.094]	[0.130]	[0.130]	[0.125]	[0.124]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.827***	7.984***	7.900***	7.957***	7.516***	7.952***
	[0.206]	[0.219]	[0.229]	[0.238]	[0.311]	[0.384]
Observations	8934	8934	6362	6362	2545	2545
Adjusted R^2	0.295	0.297	0.224	0.225	0.341	0.345

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2005-2011. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2008. Time: dummy variable that switches on 1 from 2008 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 21 Treatment: giving birth in 2008 (2005-2011)- Men

	All Men	All Men	Vocational Education	Vocational Education	General Education	General Education
Time	-0.007	-0.070	-0.010	-0.062	-0.007	-0.166
	[0.013]	[0.057]	[0.015]	[0.063]	[0.028]	[0.113]
Treatment* time	**-0.003**	**-0.003**	**-0.022**	**-0.022**	**0.084**	**0.086**
	[0.032]	[0.032]	[0.032]	[0.032]	[0.091]	[0.091]
Age	0.106***	0.117***	0.119***	0.128***	0.066	0.094*
	[0.014]	[0.016]	[0.014]	[0.017]	[0.042]	[0.049]
Age squared	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Good health	0.016	0.016	0.017	0.017	0.011	0.010
	[0.018]	[0.018]	[0.019]	[0.019]	[0.048]	[0.048]
Education						
Level 1 Vet	0.105	0.108	0.255	0.256		
	[0.200]	[0.200]	[0.228]	[0.228]		
Level 2 Vet	-0.464**	-0.462**	-0.288	-0.288		
	[0.181]	[0.181]	[0.213]	[0.213]		
Level 3 Vet	-0.064	-0.063	-0.402**	-0.403**		
	[0.127]	[0.127]	[0.191]	[0.191]		
Level 1 Gen	0.068	0.069			-0.289**	-0.290**
	[0.207]	[0.207]			[0.125]	[0.125]
Level 2 Gen	-0.015	-0.013			-0.690	-0.692
	[0.197]	[0.197]			[0.471]	[0.471]
Level 3 Gen	-0.573***	-0.572***			-0.693***	-0.693***
	[0.114]	[0.114]			[0.163]	[0.163]
Level 4 Gen	-0.057	-0.054				
	[0.166]	[0.166]				
Relationship status						
Married/Relationship	0.008	0.008	0.009	0.008	0.050	0.048
	[0.023]	[0.023]	[0.028]	[0.028]	[0.044]	[0.044]
Separated/Divorced	0.006	0.006	0.023	0.023	0.007	0.004
	[0.043]	[0.043]	[0.048]	[0.048]	[0.091]	[0.092]
Job characteristics						
Managers	0.043	0.043	0.051	0.051	-0.002	-0.001
	[0.056]	[0.056]	[0.058]	[0.058]	[0.148]	[0.148]
Professionals	0.013	0.013	-0.004	-0.004	0.065	0.067
	[0.056]	[0.056]	[0.053]	[0.053]	[0.144]	[0.144]
Technicians	0.011	0.011	-0.015	-0.015	0.114	0.116
	[0.048]	[0.048]	[0.051]	[0.051]	[0.120]	[0.121]
Clerks	-0.065	-0.065	-0.097*	-0.097*	-0.031	-0.025
	[0.053]	[0.053]	[0.055]	[0.055]	[0.133]	[0.134]
Service workers	-0.019	-0.018	-0.066	-0.066	0.073	0.078
	[0.061]	[0.061]	[0.072]	[0.072]	[0.130]	[0.131]
Skil_agricul/fishery	-0.182	-0.181	-0.287*	-0.287*	-0.171	-0.161
	[0.129]	[0.129]	[0.158]	[0.158]	[0.252]	[0.257]
Craft and trade	-0.008	-0.008	-0.040	-0.039	0.008	0.009
	[0.046]	[0.046]	[0.047]	[0.047]	[0.152]	[0.152]
Machine operators	-0.025	-0.025	-0.042	-0.042	-0.057	-0.057
	[0.044]	[0.044]	[0.046]	[0.046]	[0.117]	[0.118]
Full time	0.553***	0.552***	0.599***	0.598***	0.380***	0.381***
	[0.049]	[0.049]	[0.064]	[0.064]	[0.078]	[0.078]
Work Experience PT	-0.063***	-0.063***	-0.064***	-0.064***	-0.019	-0.019
	[0.017]	[0.017]	[0.022]	[0.022]	[0.042]	[0.043]
Work Experience FT	-0.065***	-0.065***	-0.080***	-0.080***	-0.019	-0.020
	[0.014]	[0.014]	[0.015]	[0.015]	[0.042]	[0.043]
Self employed	-0.075	-0.074	-0.069	-0.069	-0.129	-0.125
	[0.055]	[0.055]	[0.077]	[0.077]	[0.079]	[0.079]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	8.236***	8.289***	8.356***	8.396***	7.861***	8.003***
	[0.207]	[0.211]	[0.241]	[0.246]	[0.398]	[0.420]
Observations	10938	10938	8038	8038	2811	2811
Adjusted R^2	0.311	0.311	0.267	0.267	0.273	0.273

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes men aged 18-47 (not currently in education) 2005-2011. Individual with no qualification or training are excluded from the sample. Treatment: having a child in 2008. Time: dummy variable that switches on 1 from 2008 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 22 Treatment: giving birth in 2012 (2009-2015) - Women

	All Women	All Women	Vocational Education	Vocational Education	General Education	General Education
Time	-0.019	-0.141**	-0.003	-0.098	-0.051*	-0.093
	[0.015]	[0.070]	[0.016]	[0.082]	[0.030]	[0.126]
Treatment* time	-0.127**	-0.132***	-0.173**	-0.177**	-0.094	-0.104
	[0.050]	[0.050]	[0.071]	[0.071]	[0.065]	[0.065]
Age	0.087***	0.106***	0.099***	0.113***	0.103***	0.111***
	[0.013]	[0.017]	[0.015]	[0.020]	[0.025]	[0.032]
Age squared	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Good health	0.002	0.001	0.004	0.005	-0.005	-0.007
	[0.017]	[0.017]	[0.019]	[0.019]	[0.031]	[0.031]
Education						
Level 1 Vet	0.124	0.124	0.278*	0.279*		
	[0.177]	[0.177]	[0.160]	[0.162]		
Level 2 Vet	-0.346**	-0.346**	-0.182	-0.181		
	[0.149]	[0.149]	[0.129]	[0.131]		
Level 3 Vet	-0.082	-0.083	-0.531***	-0.534***		
	[0.134]	[0.134]	[0.165]	[0.165]		
Level 1 Gen	0.094	0.086			0.343	0.340
	[0.187]	[0.185]			[0.419]	[0.395]
Level 2 Gen	-0.036	-0.034			-0.510**	-0.523**
	[0.176]	[0.177]			[0.259]	[0.260]
Level 3 Gen	-0.492***	-0.496***			-0.390***	-0.394***
	[0.128]	[0.128]			[0.117]	[0.116]
Level 4 Gen	-0.059	-0.059				
	[0.155]	[0.155]				
Relationship status						
Married/Relationship	-0.037	-0.038	-0.041	-0.041	-0.030	-0.031
	[0.028]	[0.027]	[0.030]	[0.030]	[0.055]	[0.054]
Separated/Divorced	-0.035	-0.035	-0.009	-0.010	-0.094	-0.089
	[0.058]	[0.058]	[0.060]	[0.062]	[0.140]	[0.137]
Job characteristics						
Managers	0.222***	0.219***	0.185*	0.186*	0.331**	0.319**
	[0.077]	[0.077]	[0.099]	[0.098]	[0.135]	[0.134]
Professionals	0.158**	0.154**	0.116	0.117	0.258**	0.248**
	[0.074]	[0.074]	[0.097]	[0.097]	[0.126]	[0.124]
Technicians	0.165**	0.158**	0.157*	0.155*	0.192	0.175
	[0.068]	[0.068]	[0.089]	[0.088]	[0.120]	[0.119]
Clerks	0.080	0.075	0.079	0.079	0.049	0.035
	[0.071]	[0.071]	[0.094]	[0.093]	[0.110]	[0.109]
Service workers	0.005	-0.001	0.008	0.008	0.069	0.057
	[0.067]	[0.067]	[0.090]	[0.090]	[0.110]	[0.109]
Skil_agricul/fishery	-0.017	-0.028	0.014	-0.001	0.025	0.019
	[0.123]	[0.124]	[0.193]	[0.194]	[0.152]	[0.144]
Craft and trade	-0.049	-0.051	-0.078	-0.080	-0.036	-0.042
	[0.093]	[0.092]	[0.106]	[0.106]	[0.190]	[0.188]
Machine operators	0.034	0.029	0.065	0.061	-0.057	-0.060
	[0.080]	[0.080]	[0.099]	[0.099]	[0.123]	[0.124]
Full time	0.473***	0.472***	0.439***	0.439***	0.479***	0.474***
	[0.033]	[0.033]	[0.041]	[0.041]	[0.055]	[0.055]
Work Experience PT	-0.035**	-0.037**	-0.062***	-0.062***	-0.027	-0.031
	[0.014]	[0.014]	[0.016]	[0.016]	[0.028]	[0.028]
Work Experience FT	-0.032**	-0.032**	-0.055***	-0.054***	-0.026	-0.030
	[0.013]	[0.013]	[0.015]	[0.015]	[0.027]	[0.027]
Self employed	-0.318***	-0.317***	-0.260***	-0.259***	-0.363***	-0.367***
	[0.076]	[0.076]	[0.094]	[0.093]	[0.109]	[0.109]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.824***	7.975***	8.127***	8.231***	7.642***	7.749***
	[0.183]	[0.195]	[0.205]	[0.223]	[0.269]	[0.309]
Observations	9511	9511	6185	6185	3266	3266
Adjusted R^2	0.313	0.315	0.254	0.255	0.351	0.353

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2009-2015. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2012. Time: dummy variable that switches on 1 from 2012 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 23 Treatment: giving birth in 2012 (2009-2015) - Men

	All Men	All Men	Vocational Education	Vocational Education	General Education	General Education
Time	-0.023	0.012	-0.014	-0.024	-0.051*	0.020
	[0.014]	[0.061]	[0.016]	[0.071]	[0.029]	[0.113]
Treatment* time	-0.027	-0.030	-0.034	-0.037	0.016	0.015
	[0.030]	[0.030]	[0.030]	[0.030]	[0.070]	[0.070]
Age	0.110***	0.103***	0.119***	0.120***	0.054**	0.042
	[0.012]	[0.016]	[0.014]	[0.019]	[0.027]	[0.036]
Age squared	-0.003***	-0.003***	-0.003***	-0.003***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]
Good health	0.004	0.003	0.011	0.010	-0.005	-0.006
	[0.020]	[0.020]	[0.021]	[0.021]	[0.042]	[0.042]
Education						
Level 1 Vet	0.402***	0.400***	0.321	0.321		
	[0.148]	[0.148]	[0.200]	[0.200]		
Level 2 Vet	-0.101	-0.102	-0.193	-0.191		
	[0.138]	[0.138]	[0.189]	[0.190]		
Level 3 Vet	-0.159	-0.160	-0.459**	-0.456**		
	[0.114]	[0.114]	[0.216]	[0.217]		
Level 1 Gen	0.448***	0.448***			-1.274***	-1.277***
	[0.167]	[0.167]			[0.197]	[0.196]
Level 2 Gen	0.349**	0.350**			-1.057***	-1.064***
	[0.169]	[0.169]			[0.138]	[0.139]
Level 3 Gen	-0.525***	-0.527***			-0.712***	-0.710***
	[0.098]	[0.098]			[0.108]	[0.108]
Level 4 Gen	0.184	0.181				
	[0.132]	[0.131]				
Relationship status						
Married/Relationship	0.007	0.008	-0.036	-0.035	0.089	0.090
	[0.030]	[0.030]	[0.033]	[0.033]	[0.061]	[0.061]
Separated/Divorced	0.067	0.069	0.074	0.074	0.066	0.068
	[0.070]	[0.070]	[0.089]	[0.089]	[0.079]	[0.079]
Job characteristics						
Managers	0.174***	0.174***	0.124**	0.124**	0.294**	0.295**
	[0.055]	[0.055]	[0.057]	[0.057]	[0.130]	[0.130]
Professionals	0.069	0.068	0.021	0.020	0.194*	0.195*
	[0.052]	[0.052]	[0.057]	[0.057]	[0.111]	[0.110]
Technicians	0.059	0.058	0.049	0.049	0.132	0.132
	[0.049]	[0.049]	[0.053]	[0.053]	[0.107]	[0.107]
Clerks	0.042	0.042	-0.002	-0.003	0.117	0.118
	[0.049]	[0.050]	[0.054]	[0.054]	[0.105]	[0.105]
Service workers	0.039	0.038	-0.010	-0.010	0.179*	0.181*
	[0.063]	[0.063]	[0.081]	[0.081]	[0.103]	[0.103]
Skil_agricul/fishery	0.067	0.068	0.082	0.082	0.170	0.174
	[0.069]	[0.069]	[0.072]	[0.071]	[0.109]	[0.109]
Craft and trade	0.098**	0.098**	0.089*	0.088*	0.138	0.138
	[0.046]	[0.046]	[0.051]	[0.051]	[0.095]	[0.095]
Machine operators	0.059	0.058	0.041	0.040	0.159	0.159
	[0.044]	[0.044]	[0.046]	[0.046]	[0.111]	[0.111]
Full time	0.709***	0.709***	0.686***	0.686***	0.688***	0.689***
	[0.048]	[0.048]	[0.072]	[0.072]	[0.068]	[0.068]
Work Experience PT	-0.039**	-0.040**	-0.024	-0.025	0.009	0.010
	[0.018]	[0.018]	[0.023]	[0.023]	[0.033]	[0.033]
Work Experience FT	-0.053***	-0.053***	-0.067***	-0.067***	0.009	0.009
	[0.012]	[0.013]	[0.014]	[0.015]	[0.030]	[0.030]
Self employed	-0.036	-0.037	0.004	0.003	-0.018	-0.018
	[0.065]	[0.064]	[0.080]	[0.080]	[0.116]	[0.116]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.664***	7.633***	7.976***	7.995***	7.425***	7.345***
	[0.173]	[0.187]	[0.233]	[0.245]	[0.299]	[0.349]
Observations	11438	11438	7868	7868	3451	3451
Adjusted R^2	0.359	0.359	0.306	0.307	0.376	0.376

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes men aged 18-47 (not currently in education) 2009-2015. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2012. Time: dummy variable that switches on 1 from 2012 on. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 24 Triple Interaction Model - Education

	All women	All women
Time	0.066**	-0.164
	[0.028]	[0.117]
Treatment*Time	**-0.105**	-0.105
	[0.094]	[0.093]
Vet	0.204***	0.204***
	[0.050]	[0.050]
Treatment*Vet	0.138	0.146
	[0.227]	[0.227]
Time*Vet	-0.123***	-0.125***
	[0.030]	[0.030]
Treatment*Time*Vet	**-0.282****	-0.281**
	[0.118]	[0.118]
Age	0.093***	0.114***
	[0.010]	[0.014]
Age squared	-0.003***	-0.003***
	[0.000]	[0.000]
Good health	0.011	0.011
	[0.015]	[0.015]
Relationship status		
Married/Relationship	-0.035	-0.036
	[0.025]	[0.024]
Separated/Divorced	-0.020	-0.023
	[0.048]	[0.048]
Job characteristics		
Managers	0.214***	0.214***
	[0.069]	[0.069]
Professionals	0.190***	0.190***
	[0.068]	[0.068]
Technicians	0.144**	0.142**
	[0.062]	[0.062]
Clerks	0.066	0.064
	[0.064]	[0.063]
Service workers	0.025	0.025
	[0.064]	[0.064]
Skil_agricul/fishery	0.138	0.141
	[0.103]	[0.104]
Craft and trade	-0.060	-0.060
	[0.070]	[0.070]
Machine operators	0.016	0.017
	[0.109]	[0.109]
Full time	0.491***	0.489***
	[0.027]	[0.027]
Work Experience PT	-0.033***	-0.034***
	[0.010]	[0.010]
Work Experience FT	-0.043***	-0.041***
	[0.010]	[0.010]
Self employed	-0.302***	-0.300***
	[0.071]	[0.072]
Individual FE	Yes	Yes
Time FE	No	Yes
Constant	7.568***	7.773***
	[0.129]	[0.151]
Observations	14757	14757
Adjusted R2	0.302	0.304

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2005-2015. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2010. Time: dummy variable that switches on 1 from 2010 on. Vet takes value one when the highest qualification achieved is a vocational qualification. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 25 Triple Interaction Model – Change in occupation

	All women	All women	Vocational Education	Vocational Education	General Education	General Education
Time	0.007	0.042	0.028	0.069	0.002	0.469**
	[0.018]	[0.157]	[0.017]	[0.130]	[0.029]	[0.216]
Treatment*Time	-0.102*	-0.104*	0.001	-0.000	0.001	-0.006
	[0.060]	[0.060]	[0.050]	[0.050]	[0.083]	[0.084]
Mover*Time	-0.089**	-0.090**	-0.042	-0.043	-0.024	-0.021
	[0.041]	[0.041]	[0.033]	[0.033]	[0.070]	[0.070]
Treatment*Mover*Time	-0.176	-0.175	0.091	0.095	-0.076	-0.064
	[0.170]	[0.172]	[0.090]	[0.091]	[0.204]	[0.207]
Age	0.092***	0.084***	0.112***	0.105***	0.027	-0.020
	[0.014]	[0.020]	[0.015]	[0.020]	[0.034]	[0.038]
Age squared	-0.002***	-0.002***	-0.002***	-0.002***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Good health	0.041**	0.039**	0.005	0.005	-0.002	0.000
	[0.019]	[0.019]	[0.018]	[0.018]	[0.049]	[0.049]
Education						
Level 1 Vet	0.330	0.323	-0.004	-0.013		
	[0.242]	[0.242]	[0.229]	[0.228]		
Level 2 Vet	-0.221	-0.230	-0.582***	-0.584***		
	[0.214]	[0.214]	[0.209]	[0.209]		
Level 3 Vet	0.026	0.019	-0.696***	-0.701***		
	[0.135]	[0.135]	[0.193]	[0.193]		
Level 1 Gen	0.255	0.257			0.000	0.000
	[0.335]	[0.334]			[.]	[.]
Level 2 Gen	0.041	0.026			-0.675	-0.689
	[0.226]	[0.226]			[0.551]	[0.553]
Level 3 Gen	-0.446***	-0.449***			-0.635***	-0.621***
	[0.128]	[0.128]			[0.138]	[0.138]
Level 4 Gen	0.264	0.258				
	[0.167]	[0.168]				
Relationship status						
Married/Relationship	-0.017	-0.017	0.050	0.050	0.145**	0.153**
	[0.030]	[0.030]	[0.033]	[0.033]	[0.060]	[0.059]
Separated/Divorced	-0.025	-0.029	0.048	0.046	0.147	0.160
	[0.056]	[0.056]	[0.048]	[0.048]	[0.106]	[0.110]
Job characteristics						
Full time	0.536***	0.535***	0.611***	0.611***	0.566***	0.579***
	[0.043]	[0.043]	[0.070]	[0.070]	[0.078]	[0.077]
Work Experience PT	-0.041***	-0.041***	-0.034*	-0.034*	0.016	0.013
	[0.013]	[0.013]	[0.020]	[0.020]	[0.038]	[0.038]
Work Experience FT	-0.048***	-0.047***	-0.081***	-0.080***	0.012	0.009
	[0.015]	[0.015]	[0.015]	[0.016]	[0.036]	[0.036]
Self employed	-0.224**	-0.220**	-0.145	-0.145	-0.081	-0.079
	[0.105]	[0.105]	[0.095]	[0.095]	[0.075]	[0.074]
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes	No	Yes
Constant	7.859***	7.857***	8.522***	8.520***	7.381***	7.155***
	[0.216]	[0.230]	[0.243]	[0.250]	[0.301]	[0.320]
Observations	6192	6192	6536	6536	2143	2143

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2005-2015. Individual with no qualification or training are excluded from the sample. Treatment: giving birth in 2010. Time: dummy variable that switches on 1 from 2010 on. Mover takes value one is the individual has changed occupation after the Treatment. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B. 26 Generalised Fixed Effect (2005-2015) - Women

	All women	Vocational Education	General Education
Mother	-0.141***	-0.197***	-0.030
	[0.017]	[0.019]	[0.033]
Age	0.034***	0.034***	0.022**
	[0.005]	[0.005]	[0.010]
Age squared	-0.003***	-0.003***	-0.003***
	[0.000]	[0.000]	[0.000]
Good health	-0.001	0.013	-0.032
	[0.012]	[0.013]	[0.025]
Education			
Level 1 Vet	0.265***	0.381***	
	[0.078]	[0.088]	
Level 2 Vet	-0.245***	-0.129*	
	[0.061]	[0.074]	
Level 3 Vet	-0.093**	-0.369***	
	[0.044]	[0.058]	
Level 1 Gen	0.215**		-0.013
	[0.088]		[0.250]
Level 2 Gen	0.006		-0.661***
	[0.071]		[0.129]
Level 3 Gen	-0.539***		-0.527***
	[0.044]		[0.043]
Level 4 Gen	0.100*		
	[0.051]		
Relationship-status			
Married/Relationship	-0.046***	-0.056***	-0.013
	[0.016]	[0.018]	[0.031]
Separated/Divorced	-0.024	-0.007	-0.095
	[0.030]	[0.033]	[0.063]
Widowed	-0.142	-0.111	-0.212
	[0.167]	[0.210]	[0.265]
Job Characteristics			
Manager/Professional	0.235***	0.305***	0.139**
	[0.029]	[0.034]	[0.054]
Clerk/Service	0.135***	0.193***	0.050
	[0.028]	[0.033]	[0.051]
Agri/Craft/Machine	0.096***	0.146***	-0.054
	[0.033]	[0.039]	[0.064]
Full-time	0.514***	0.482***	0.548***
	[0.011]	[0.013]	[0.020]
Working Experience PT	0.009*	0.006	0.028**
	[0.005]	[0.006]	[0.012]
Working Experience FT	0.007	0.001	0.037***
	[0.005]	[0.006]	[0.011]
Self-employed	-0.246***	-0.148***	-0.332***
	[0.025]	[0.034]	[0.037]
Dummy years	Yes	Yes	Yes
Constant	7.171***	7.192***	7.102***
	[0.069]	[0.084]	[0.112]
Observations	22439	15254	7067

Note:Generalised fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes men aged 18-47 (not currently in education) 2005-2015. Individual with no qualification or training are excluded from the sample. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01

Table B. 27 Generalised Fixed Effect (2005-2015) - Men

	All men	Vocational Education	General Education
Father	0.002	-0.009	0.039
	[0.013]	[0.015]	[0.026]
Age	0.096***	0.107***	0.057***
	[0.004]	[0.005]	[0.011]
Age squared	-0.002***	-0.002***	-0.002***
	[0.000]	[0.000]	[0.000]
Good health	0.011	0.017	-0.013
	[0.011]	[0.012]	[0.023]
Education			
Level 1 Vet	0.243***	0.260***	
	[0.050]	[0.057]	
Level 2 Vet	-0.307***	-0.267***	
	[0.043]	[0.051]	
Level 3 Vet	-0.163***	-0.470***	
	[0.038]	[0.054]	
Level 1 Gen	0.223***		-0.623***
	[0.057]		[0.204]
Level 2 Gen	0.121**		-0.644***
	[0.058]		[0.157]
Level 3 Gen	-0.628***		-0.722***
	[0.036]		[0.039]
Level 4 Gen	0.015		
	[0.044]		
Relationship Status			
Married/Relationship	0.028**	0.002	0.065***
	[0.013]	[0.014]	[0.025]
Separated/Divorced	0.019	0.021	0.004
	[0.025]	[0.027]	[0.054]
Widowed	0.189	0.000	0.239
	[0.377]	[.]	[0.385]
Job Characteristics			
Manager/Professional	0.017	-0.024	0.143***
	[0.017]	[0.020]	[0.036]
Clerk/Service	-0.031*	-0.076***	0.060*
	[0.018]	[0.021]	[0.035]
Agri/Craft/Machine	0.010	-0.026	0.076**
	[0.016]	[0.018]	[0.033]
Full-time	0.655***	0.670***	0.546***
	[0.013]	[0.017]	[0.021]
Working Experience PT	-0.029***	-0.023***	-0.009
	[0.006]	[0.007]	[0.012]
Working Experience FT	-0.058***	-0.069***	-0.018
	[0.005]	[0.005]	[0.012]
Self employed	-0.090***	-0.062***	-0.112***
	[0.017]	[0.022]	[0.029]
Dummy years	Yes	Yes	Yes
Constant	7.905***	8.116***	7.679***
	[0.060]	[0.073]	[0.113]
Observations	27409	19193	7868

Note: Fixed effect model. Dependent variable: Logarithm of the monthly wage. Sample includes women aged 18-47 (not currently in education) 2005-2015. Individual with no qualification or training are excluded from the sample. Omitted groups: Single, Elementary Occupations, Level 4 Vocational (column 1,2,3,4), Level 4 General (column 5,6). Age variable is centered. GSOEP data. Standard errors in brackets. Significance level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix C

Institutional Background

The German school system is characterized by four different levels (Table 3.1):

- Early childhood education
- Primary education
- Secondary education
- Tertiary education

The curriculum is the same for all pupils until Primary education (age 9) but then gives way to a stratified system where pupils have to select between primarily a general or a vocational route.

German secondary education can be split into two different levels:

- Sekundarstufe I, that is lower secondary education which involves students aged ten to fifteen/sixteen.
- Sekundarstufe II, that is upper secondary education for pupils of age fifteen/sixteen to eighteen.

At this level, the German system allows students to choose between two different paths of secondary education, either a vocational or a general orientated path.

The German vocational education system is mostly based on the so-called “dual system” which can mainly be defined as a work-based education system that aims to help students adapt to the work environment and to decrease the high rates of unemployment. Full-time school vocational education, instead, occupies a less important position in Germany.

The institutions related to the vocational educational path are the following:

- *Hauptschule*: general elementary education which covers grade 5 to grade 9, leads to either a vocational or a university entrance qualification. Sometimes it can include grade 10, and it

ends with a "*Hauptschulabschluss*" (certificate of completion of the *Hauptschule*). Afterwards, students will be enrolled in a vocational school, namely the *Berufsschule*. The latter delivers practically orientated classes that seek to prepare students for higher vocational education, or for the labour market. Students usually attend the *Berufsschule* part-time in conjunction with on-the-job training or apprenticeship.

- *Realschule*: general intermediate education which covers grade 5 to grade 10, ending with a "*Realschulabschluss*". It provides students with more extensive knowledge and puts more emphasis on language and mathematic skills rather than manual activities if compared with *Hauptschule*. Both *Hauptschule* and *Realschule* are designed for those pupils who would like access to an apprenticeship. However, while the *Hauptschule* leads more to manual trade, the *Realschule* is more suitable for those who want to start an apprenticeship in a medical profession such as nursing or in commercial trade. The *Realschule* entitles students to enter into a *Fachoberschule* which provides two years of education and will lead students to the achievement of the "*Fachhochschulreife".* The latter is a prerequisite for jobs in the civil service, administration, business and to enter the university of applied sciences *"Fachhochschulen*". If a 13th grade is accomplished, the student will achieve a "*Fachgebundene Hochschulreife*" or an "*Abitur*".
- *Gesamtschule* or comprehensive school: this is an alternative to both *Hauptschule* and *Realschule*. The comprehensive school aims to avoid forcing children to choose their educational paths too early in life. It includes students of all ability levels from grade 5 through to grade 10. Students who conclude the *Gesamtschule* at the 9th grade achieve the *Hauptschule* certificate, while those who complete the *Gesamtschule* at the 10th grade will accomplish the *Realschule* certificate.

If students wish to follow instead an general path they will need to enrol in a *Gymnasium*, a general advanced education, which covers grade 5 to grade 13, leading to the *Hochschulreife*, also called "*Abitur*", the maturity certificate. It prepares students for university study or a dual general vocational

credential. The Gymnasium is based on a mandatory study of core subjects including languages, literature and arts, social sciences, mathematics, and natural sciences.

The German tertiary education system is relatively less stratified compared with the secondary educational system.

The different institutions supplying German students with tertiary education are of the following types:

- *Universitäten,* universities: these institutions are general-based, and the main program is characterized by theoretical and research-oriented components.
- *Fachhochschulen*, universities of applied sciences: mainly based on technical disciplines, design, agricultural economy, business, and social work; these institutions provide practically orientated programs in order to meet the needs of the labour market. The main feature of this qualification is the inclusion of the *"Praxissemester"*, that is paid training, in the core program of study.

Table C. 1 German educational system

<table>
<tr><th></th><th>Grade</th><th colspan="3">Education system</th><th>Age</th></tr>
<tr><td>Tertiary Education</td><td></td><td colspan="2">Fachhochschule</td><td colspan="2">Universitäten</td><td></td></tr>
<tr><td rowspan="10">Secondary Education</td><td>13</td><td colspan="2" rowspan="3">Berufsschule (dual system), Berufsfachschulen,Fachoberschule</td><td rowspan="10">Gesamtschule</td><td rowspan="10">Gymnasium</td><td>18/19</td></tr>
<tr><td>12</td><td>17</td></tr>
<tr><td>11</td><td>16</td></tr>
<tr><td>10</td><td>some schools have grade 10</td><td rowspan="6">Realschule</td><td>15</td></tr>
<tr><td>9</td><td rowspan="5">Hauptschule</td><td>14</td></tr>
<tr><td>8</td><td>13</td></tr>
<tr><td>7</td><td>12</td></tr>
<tr><td>6</td><td>11</td></tr>
<tr><td>5</td><td>10</td></tr>
<tr><td rowspan="4">Primary education</td><td>4</td><td colspan="4" rowspan="4">Grundschule</td><td>9</td></tr>
<tr><td>3</td><td>8</td></tr>
<tr><td>2</td><td>7</td></tr>
<tr><td>1</td><td>6</td></tr>
<tr><td rowspan="5">Early childhood education</td><td rowspan="5"></td><td colspan="4" rowspan="5">Kinderkrippe, Kindergarten, Kindertagesstatte</td><td>5</td></tr>
<tr><td>4</td></tr>
<tr><td>3</td></tr>
<tr><td>2</td></tr>
<tr><td>1</td></tr>
</table>

CHAPTER 4

4. Is this really a man's world? The effect of vertical and horizontal segregation in the UK

4.1. Introduction

Even though in the past few decades gender wage differentials have been narrowing over time, the phenomenon of the gender wage gap is still persistent, and it keeps raising concerns from inequality perspectives. While the abovementioned narrowing trend has been extensively documented by the literature (Blau and Kahn, 2003, Goldin, 2014, Kahn, 2015, Klasen, 2016), the analysis of the gender wage gap has shifted focus onto the main drivers of this longstanding phenomenon looking at both the supply and the demand side of the labour market.

What scholars have agreed on is the declining importance of observable labour market characteristics in explaining gender wage differentials given the significant progress of women in terms of years of schooling, job tenure, and labour force participation. Nevertheless, many pieces of research have demonstrated the important role played by occupational gender segregation in accounting for a large part of the gender wage gap (England et al., 1996, Grönlund and Magnusson, 2013, Triventi, 2013, Leuze and Strauß, 2016).

The literature refers to gender-based occupational segregation as the phenomenon according to which the share of women or men in occupations is so high that they can easily be defined as either male-dominated or female-dominated occupations (Melkas and Anker, 1997). Ever since women participated in large numbers in the labour market, the degree of female participation in certain occupations and, to some extent in certain sectors, has greatly varied compared with that registered by men (Hegewisch et al., 2010, Ellingsæter, 2013). While male-dominated occupations mainly refer to professions like engineers, technicians, and craftsmen; female-dominated occupations are those

directed towards the areas of personal services sector, generally characterized by lower pay than male-dominated jobs (Anderson and Tomaskovic-Devey, 1995, Leuze and Strauß, 2016, Borrowman and Klasen, 2020). It is common practice in the literature to distinguish two aspects of gender occupational segregation. While horizontal segregation refers to the tendency of women to be underrepresented in certain occupations or sectors of the labour market, vertical segregation refers to the underrepresentation of women in occupations or sectors at the top of an order based on "desirable" attributes, such as income, prestige, and job stability (Bettio et al., 2009, p.14). In the literature, the latter form of segregation is defined as the "glass ceiling" effect.

The effect of gender occupational segregation has been extensively investigated and different explanations have been provided for its existence. Cultural explanations point out that the polarization in terms of occupation could be partially attributed to gender stereotypes regarding the roles played by women and men in society, where women are still perceived as those who should take on the main family responsibilities and childbearing duties (Cejka and Eagly, 1999, Charles and Bradley, 2009). On the other hand, choice theories, which are more human capital oriented, support the idea that women anticipate more job disruption over their career, are found less likely to invest in education and, consequently, end up being employed in different sectors when compared to continuous workers, i.e. men. By the same token, career breaks due to family responsibilities cause many women to have less work experience which in return will lead them to select jobs characterized by lower returns from experience and to suffer penalties for the temporary withdrawal from the labour force (Anker, 1998). This logic has held for several decades until when the assumption that women are less likely to invest in education and to prove a stable attachment to the labour force has been shown to be substantially wrong given the crucial improvements made by women in terms of years of schooling (DiPrete and Buchmann, 2013) and labour force commitment (Anker, 1998). Nevertheless, women are still found to take different educational choices with strongly different educational patterns compared to men (Polachek, 1981, Stohmeyer, 2007).

While the second chapter of this thesis has contributed to the literature by providing evidence on the differences in age-wage profiles between women and men in 19 countries followed by the third chapter which has exploited the different implications of motherhood and fatherhood on wages as one of the possible drivers of the gender wage gap, this chapter will attempt to produce new pieces of evidence on the gender wage gap by focusing on the magnitude of the gender wage gap across the entire wage distribution by education and occupation types. The analysis presented in this chapter is unique as it introduces two distinctive elements to the gender wage gap analysis by considering both the role played by occupation segregation by gender and gender differences in terms of educational achievements (general versus vocational) in leading to gender differences in wages.

The chapter does not aim to estimate the causal effect of occupational and educational choices on the gender wage gap, but it rather follows a strongly comparative approach to examine, between and within occupation and education types, the changes in the gender gap over the wage distribution. In doing so, the chapter implements a grade transformation analysis and relative distribution methods by comparing the reference population (the distribution of male real hourly wages), with the comparison population (the distribution of female real hourly wages). The aim is to provide a much richer informative framework around the existence of the gender wage gap by moving away from analysis merely focused on the evaluation of the mean gender wage gap. Consequently, this analysis will not consider the gender wage gap as a constant effect, but it will rather try to investigate a great deal of data variation over the wage distribution to shed light on the nature of this ongoing phenomenon.

In particular, using the UK Labour Force Survey microdata, the chapter investigates gender differences over the wage distribution of the British working-age population. The results are in line with what is suggested by the previous literature and reveal inequality among women and men in terms of hourly wages, with the female subsample revealing a greater relative density than the male subsample in regions below the 20th percentile of the male subsample and being instead underrepresented from the 80th percentile upwards.

Given the abovementioned, the chapter takes a step further and investigates the pattern of gender differences over the wage distribution across occupation types. The aim is to exploit the variation in terms of the degree of female participation in each occupation type to investigate its impact on the gender distributional wage gap. By grouping occupations into three broad occupation types, namely male-dominated, mixed, and female-dominated occupations, the chapter investigates whether gender segregation, within specific occupation types, might lead to a different impact on the pattern of relative wages. The results reveal that women who can secure employment in male-dominated occupations have a narrower gender wage gap over the wage distribution. In contrast women in female-dominated occupations still face a significant glass ceiling effect.

Finally, the analysis explores the existence of any correlation between the type of educational background and gender differences over the wage distribution. In particular, the chapter is unique in examining the implications of having a general versus a vocational qualification as the highest qualification achieved over gender wage distributional differences. Results confirm the existence of a different pattern in the glass ceiling effect that varies according to the highest educational qualification achieved by the individual. Women with a vocational qualification face a tougher glass ceiling in male-dominated occupations and mixed occupations rather than in female-dominated occupations. On the other hand, women with a general qualification face their lowest glass ceiling in male-dominated occupations as compared to mixed and female-dominated occupations.

The remainder of this chapter is set out as follows. In the next section, there is an exhaustive review of the pertinent literature on the gender wage gap and its main drivers with a clear focus on vertical and horizontal segregation. Section 3 explains the methodology that has been implemented. Section 4 describes the data while the main empirical results are presented in Section 5. Finally, Section 6 concludes this chapter.

4.2. Literature review

A large part of the literature has documented the narrowing tendency of the gender wage gap (Goldin, 2014, Chzhen and Mumford, 2011), which has been mainly justified by significant women's progress in terms of labour force participation, human capital investment, accumulation of labour market experience and by the higher proportion of women in male-dominated occupations over recent decades. However, despite the progress made by women, who have enhanced their labour-market characteristics, and by society, with important changes in social norms and policy reforms implemented in most countries, women still struggle to get on in the labour market as well as men. On average, there is still a 15% gap in terms of hourly earnings between men and women holding similar qualifications across 25 European countries (Ciminelli et al., 2021).

In light of the declining importance of observable labour-market characteristics in "justifying" the existence of earning differences between women and men, scholars have focused their attention on the "unexplained" part of the gender wage gap, thus the part which cannot be explained by differences in labour market characteristics, with the aim to detect the unobservable drivers of the gender wage gap and elaborate the appropriate policy mix to address this ongoing phenomenon.

The unexplained side of the gender wage gap has been found to be closely related to occupational and sectoral segregation (Weichselbaumer and Winter-Ebmer, 2005). Indeed, despite the dramatic reduction of the gender wage gap, occupational segregation has still been persistent over time (Das and Kotikula, 2019)

Given that, this chapter will focus on both horizontal and vertical segregation. The former is better known as occupational segregation, the latter acknowledged as the glass ceiling effect.

4.2.1. Horizontal Segregation

Gender occupational segregation concerns the unevenness in the distribution of men and women across different occupational categories. Segregation is considered one of the major forms of labour market rigidity, unravelling the labour market into segments that prevent the complete mobility of labour between occupations.

For many decades, women have shown a tendency to work in a small number of predominantly female occupations. Women have self-selected themselves into female occupations such as "nurse, pre-kindergarten and kindergarten teacher, elementary school teacher, dietitian, or librarian" (Blau and Kahn, 2000, p. 5), which are usually characterized by lower wages (Levanon et al., 2009) if compared with predominantly male occupations. Bettio et al. (2009) estimate, through the computation of the Index of Dissimilarity (ID) and the Standardised Index (IP), that 25.3% of workers in 2007 should have changed their occupations to achieve a gender-equal employment distribution. Those disparities have been reducing over time but do still exist.

In the United Kingdom, Olsen and Walby (2004) reveal that occupational segregation is more concentrated among part-time workers and that for every 10% rise in the percentage of males in a given occupation, there is a 1.3% rise in the wage rate. Overall, they find that segregation can account for up to 17% of the pay gap. Similar results are also achieved by Mumford and Smith (2008).

Segregation is, however, difficult to analyse because of the different datasets and definitions (Brynin, 2017) and, as debated by Goldin (2014), the discrepancy between women's and men's earnings cannot be seen merely as a pure reflection of occupational sorting. Women earn less than men within occupations as well. Consequently, scholars have been starting to wonder: Is there a glass ceiling preventing women from advancing upwards in their careers?

4.2.2. Vertical Segregation

According to the Bureau of Labor Statistics (2021), at the end of 2020, women constitute 55.9% of the labour force in the USA but hold only 29.9% of chief executive positions. In the United Kingdom the Financial Times Stock Exchange[40] (FTSE) 100, met the 33% target for women on boards at the beginning of 2020; however, when it comes to chief executive positions, just eight of those are held by women. By the same token, data from the European Institute for Gender Equality shows that in 2017 women made up only 25% of board members of the major listed companies in the European Union, although the situation varies significantly among the EU Member States.

The abovementioned data should lead to the realization that studying the degree to which gender pay gaps vary across the wage distribution is essential for a comprehensive analysis of the gender wage gap and that the phenomenon of the glass ceiling could explain an accountable portion of gender differences in earnings.

The phenomenon referred to by the literature as the glass ceiling is defined as "a gender inequality in the chance of advancement into higher levels", "not explained by other job-relevant characteristics of the employee", "greater at higher levels of an outcome" and increasing "over the course of a career" (Cotter et al., 2001, pp 656-657). Hence, the existence of the glass ceiling suggests that differences in women's and men's wages are wider at the top of the wage distribution rather than at the middle or the bottom. Therefore, in order to address the problem of whether women end up facing a glass ceiling, an examination of the gender wage gap across the wage distribution is very much needed.

However, even if the mean gender wage gap has been widely considered in the labour economics literature, only recently scholars' attention has moved towards the analysis of the degree to which the gender gap varies across the wage distribution.

[40] The FTSE100 Index is a share index of the 100 companies listed on the London Stock Exchange with the highest market capitalisation.

Using 1998 Swedish data, Albrecht et al. (2003) find that the gender wage gap is expanding across the wage distribution with a sharp increase at the upper tail. They consider this finding evidence of the glass ceiling effect. Through the implementation of an Oaxaca decomposition, the authors further investigate the reasons behind the existence of such a gap, coming to the conclusion that after adjusting for individual background characteristics, half of the gender wage gap at the top of the wage distribution can be attributed to differences in reward to labour market characteristics and about a half to gender differences in the characteristics themselves.

Using harmonized data from the European Union Household Panel, Arulampalam et al. (2007) estimate the gender wage gap within a quantile framework by sectors and across the wage distribution for eleven countries, revealing the existence of a glass ceiling at the top of the wage distribution and in a few cases of a "sticky floors"[41] effect at the bottom of the wage distribution. The magnitude of the gap is shown to vary across countries and sectors with the private sector reporting a greater gap compared to the public sector. Similar findings are also shown by Kee (2006) using the Household, Income and Labour Dynamics in Australia (HILDA) survey while Barón and Cobb-Clark (2010) highlight a similar pattern of the glass ceiling effect in both private and public sectors. In line with the findings of Albrecht et al. (2003), the authors also reveal an important role of gender differences in terms of labour market experience and a negligible impact of gender differences in educational attainments and demographic characteristics. On the other side, De la Rica et al. (2008) uncover an interesting composition effect behind the magnitude of the glass ceiling once women's educational attainments are taken into account, providing some evidence of a larger glass ceiling effect for highly educated women. At the other end, they also reveal a glass floor effect for lower educated women with a decreasing gender wage gap at the bottom of the wage distribution.

[41] The metaphoric expression "sticky floor" refers to a discriminatory employment pattern that consists in keeping certain groups of individuals in the lowest standing of the job scale. In contrast with the "glass ceiling" effect, the "sticky floor" effect refers to the obstacles faced at the very start of the career and concerns those individuals who remain in low-paying and low-status positions who struggle to advance further in their careers (Carli et al., 2016).

By focusing on full-time workers in 2005 and using a quantile decomposition method, Chzhen and Mumford (2011) find a strong relationship in the data between high-skilled, white-collar occupations and carrying out managerial duties with the glass ceiling effect in Britain. Additionally, an even wider gap is found once allowing for positive selection into full-time employment with a selection corrected gap equal to twice the raw gap across most of the wage distribution.

4.3. Reasons behind vertical and horizontal segregation

Having identified that the glass ceiling is a real concern, the literature has also devoted efforts to investigating the reasons behind this phenomenon. Many contenders have been recognised from the literature as potential explanations of the glass ceiling effect. Some attribute its existence to wage discrimination and job constraints faced by women and largely imposed by employers who have prejudices based on gender stereotyping according to which men are perceived as more career-oriented while women are those expected to play a greater role in family commitments and child-rearing (Becker, 1975b, Stiglitz, 1973). There is no doubt such discrimination still exists today. To give an instance, some of the explanations provided by a range of FTSE 350[42] Chairs and CEOs for not appointing women to FTSE 350 company boards were summarized in a report published by the UK Government in May 2018 and go from "I don't think women fit into the board environment" to "most women don't want the hassle or pressure of sitting on a board" to "my other board colleagues wouldn't want to appoint a woman on our board" (Hampton, 2018, p. 23). Nevertheless, those contenders by themselves do not explain the age-pay gap relationship according to which the latter greatly expands with age; neither wage differences between mothers and childless women with the latter showing wages similar to those earned by men having the same background characteristics (Goldin, 2014); therefore, they cannot be considered as the main drivers of women's relative labour market underperformance (Flory et al., 2015).

[42] The FTSE350 Index is a weighted index of the top 350 companies by free float market capitalisation on the London Stock Exchange.

Other scholars instead highlight gender differences in some psychological traits such as the different willingness to compete (Gneezy et al., 2003, Niederle and Vesterlund, 2007, Buser et al., 2014) or the dissimilar ability to bargain for a better salary or higher promotions (Babcock et al., 2003) or the diverse level of risk aversion (Dohmen et al., 2011). However, those differences do not explain why the time out of labour force or the working intensity in terms of weekly working hours have a larger effect on the earnings in some occupations but not in others.

In a very influential contribution, Goldin (2014) emphasizes the fact that after controlling for differences in human capital investments, job experience, and preferences for full/part-time work, the majority of earnings differentials are found to come from *within* rather than *between* occupations. Consequently, what happens within each occupation is a greater obstacle to gender equality than occupational segregation itself. Goldin, indeed, shows that the residual gender wage gap is not uniform across occupations and that women in some specific occupations (business occupations), experience, on average, a wider gender pay gap than the one faced in other occupations (science, technology). The former are often occupations that disproportionately reward those who work longer and inflexible hours. This implies that even if women and men are equally productive, women, who bear the burden of family responsibilities and childcare, end up not being able to achieve men's accomplishments in occupations in which earnings are in a non-linear relationship with worked hours.

Preference-based explanations have also been analysed in the literature (Hakim, 2000). A recent study by Redmond and McGuinness (2019) on full-time employees in Europe, displays a U-shaped gender wage gap, higher at the bottom and the top of the wage distribution. The authors provide some support for the theory of compensating differentials by highlighting the importance of the role played by four job preferences - benefit and pay; being close to home; job security; and gaining work experience - behind much of the gender wage gap found at the top of the wage distribution.

Finally, some scholars suggest that differences in educational attainments could still play an important role in defining the magnitude of gender inequality. Indeed, even if women have overtaken men in terms of years of schooling, the same convergence still did not happen in terms of educational tracks,

with lower female participation in those degrees associated with better labour market prospects (Bertrand, 2017). According to the Report on Gender Equality in EU (2021, p. 29), still in 2018 “fewer than 3 out of 10 graduates in education, health, and welfare, humanities and art are men”, with women making up 74.1% of the total. On the other hand, the share of female graduates in Information and Communications Technology (ICT) fields is just over 20%”. In line with a human capital approach, the reason behind this gap might be related to the issue of skill depreciation faced by women during career interruptions mainly due to birth-related leave. Given that women anticipate that their participation in the labour market will not be continuous and that their skills will be subject to depreciation during periods out of the labour force, they will better invest in skills for which the depreciation value is low. Lastly, feminist economic theories suggest that gender differences in educational tracks have been shaped by the labour market: women are well aware of the market constraints that they are going to face and decide to invest in degrees that have a higher likelihood to secure them entrance into the labour market (Borrowman and Klasen, 2020).

4.3.1. Motivation and contribution

In the reviewed literature there is a consensus about the role played by horizontal and vertical segregation in explaining the existence of the gender wage gap. Women are observed to self-select themselves into female occupations characterized by poorer job prospects as compared to those recognized as male-dominated occupations. Nevertheless, gender wage disparities cannot be merely attributed to occupational sorting but every analysis of the gender wage gap should also consider the degree to which this phenomenon varies over the wage distribution.

The analysis in this chapter is unique since, to my knowledge, it is the first to study gender earning differences within occupations and across different occupation types by implementing a grade of the transformation approach. The idea is to provide more detailed information on disparities in terms of women's and men’s wage distributions, by looking at the location of the earnings of women in terms of their position in the men’s wage distribution, and to analyse whether women who end up self-

selecting themselves into female-dominated occupations do any better than those who instead decide to enter into male-dominated occupations.

Moreover, given the above-mentioned conflicting opinions concerning the effect played by the educational background on the gender earnings gap, this chapter examines the difference in the highest qualification achieved by individuals taking into consideration whether the highest qualification achieved is a vocational or a general qualification. In particular, given the existence of a strong trade-off between early advantage and late disadvantage in labour market outcomes for individuals with vocational education compared with those having a general education background (Ryan, 2001, Zimmerman, 2013, Hanushek et al., 2017), and given that the skills developed following a vocational educational path depreciate quicker if compared with those acquired following a general path (Weber, 2014, Hanushek et al., 2017), this study analyses whether the choice of studying for a vocational or general qualification could end up making a difference in terms of whether entering into a female, mixed or male-dominated occupation and the impact of this choice in terms of the gender wage gap over the wage distribution across different occupation types.

4.4. Methodology

Even though there has been a movement towards more nonparametric and distribution-oriented analytic methods over the past few years, studies concerning the analysis of inequality between reference and comparison groups, have largely relied on linear models and their extensions to ultimately model the conditional mean or capture a rough measure of dispersion over time. As a result, the majority of the studies concerning inequality do not consider the rich detail of distributional patterns in the data leaving the latter untapped. On the other side, the analysis of distributional differences comprises both usual mean-shifts and changes in variance but also more subtle comparisons of changes in the upper and lower tails of the distributions. With regards to the analysis conducted in this chapter, namely the comparison between women's and men’s earnings and the existence of a glass ceiling over the wage distribution, there is much more in the data to be discovered

rather than the convergence in median earnings between women and men. Given the abovementioned, this analysis will focus on what are defined as relative distribution methods, which combine graphical tools of exploratory data analysis with statistical summaries, decomposition, and inference. In particular, after providing a short recap of the probability density and cumulative density functions, as essential knowledge for the implementation of the relative distribution technique, the section will then investigate the strategy adopted in more detail. A discussion of the model implemented will then follow.

4.4.1. Fundamental distributional definitions

Let the function $f(y)$ be the probability density function (PDF) of a continuous random variable Y, that is the distribution of probability over the outcome set, defined as all possible values that Y takes in the population. The probability density function describes the relationship between the outcomes of a continuous random variable and its probability. If the probability density around a point y is large, that means that the random variable Y is likely to be close to y. The PDF of a continuous random variable acts exactly like the probability mass function for a discrete random variable. Hence, for $f(y)$ to be a valid PDF, $f(y)$ has to be non-negative for each possible value y:

$f(y) \geq 0$ for all y

and its integral over the entire space must be equal to 1.

$$\int_{-\infty}^{+\infty} f(y)dy = 1$$

More specifically the PDF enables the probability of a random variable Y to be computed within a particular interval. This probability is given by the integral of Y 's PDF over that interval; that is, for an interval $I = [a, b]$ with $a \leq b$, the probability that $a \leq Y \leq b$ is given by the area below the density function but over the horizontal axis and between the lowest (a) and the greatest (b) values of the interval will be:

$P(a \leq Y \leq b) = \int_a^b f(y)dy$ where $a \leq b$

Distributions are also characterized by the function $F(y)$ defined as the cumulative distribution function (CDF) where:

$F(y) = P\ (Y \leq y)$ for all y

The latter indicates the probability that a random variable Y takes a value less than or equal to y. In the case of a continuous random variable, the CDF consists of the area under the probability density function from minus infinity to y.

$F(y) = \int_{-\infty}^{y} f(t)dt$ for each y in the outcome space

In other words, the CDF can be computed by integrating the PDF.

Finally, another way to think about the CDF is through the use of a quantile function, known as the inverse cumulative distribution function and essential for the implementation of the relative distribution:

$Q(p) = F^{-1}(p)$

Where Q(p) is the quantile function, expressed through either deciles or percentiles, that identifies the value y of the random variable at which the probability of the variable being at or below x is p.

4.4.2. The relative distribution

Following the approach of Handcock and Morris (1999, 2006), let Y_0 be a random variable indicating a measurement for the reference population and $F_0(y)$, and $f_0(y)$ namely the CDF and the PDF of the reference population.

Let Y be the measurement observed for another population, that is the comparison population. Hence, $F(y)$ and $f(y)$ define the CDF and the PDF of the comparison population.

Finally, both F and F_0 are assumed to be absolutely continuous with common support.

It follows that the relative distribution of Y to Y_0 can be defined as the distribution of the random variable:

$$R = F_0(Y)$$

where *R*, known as the grade of transformation, is a random variable defined as the relative distribution of Y to Y_0 and is obtained from Y by transforming it by the CDF for Y_0, F_0 . R is continuous within the outcome space [0,1] The observations for *R, r,* are defined as relative data.

Being *R* a random variable itself, it is characterized by both a PDF and CDF.

Using the inverse cumulative distribution, mentioned in the previous section, it is possible to express the CDF of *R*, that is the relative CDF, as follows:

$$G(r) = F(F_0^{-1}(r)) = F(Q_0(r)) \quad where\ 0 \leq r \leq 1$$

With $G(r)$ representing a proportion of the comparison population below the level of a proportion *r* of the reference population (Handcock and Morris, 2006).

Consequently, the PDF of *R*, known as the relative density, can be obtained by computing the derivative of the CDF of *R*, $G(r)$:

$$g(r) = \frac{f(F_0^{-1}(r))}{f_0(F_0^{-1}(r))} = \frac{f(Q_0(r))}{f_0(Q_0(r))} \qquad where\ 0 \leq r \leq 1$$

It follows that the relative density represents the ratio of the density function of the comparison population to the density function of the reference population at the rth quantile (percentile) of level $F_0^{-1}(r)$. The relative density will describe where the individuals at each quantile (percentile) in the comparison distribution are located in terms of quantiles (percentiles) of the reference distribution. When the relative density function takes a value above 1 it suggests that the comparison population has a greater density at the specific rth quantile (percentile) if compared to the reference population. On the other hand, when the density function takes a value lower than 1, it indicates the opposite.

Finally, if the value is equal (or close enough) to one, it is a signal that the two populations have a similar density at that specific quantile (percentile).

More specifically, in this analysis the reference population is composed of male real hourly wages; the comparison population of female real hourly wages.

Given that the relative data have a straightforward interpretation, that is the quantile (percentile) rank that women's hourly wages would have in men's hourly wages distribution, the relative distribution is an interesting approach for the purpose of this analysis (Handcock and Morris, 1998). While the comparison between the PDF overlay would have required the construction of the difference between the two curves at each point of the scale, the relative distribution approach provides an immediate and precise comparison in terms of a ratio.

4.4.3. Model

This chapter aims to investigate the changing influence of background, family and job characteristics, and educational attainments, on the relative wage distribution across different types of occupations and qualifications, and more specifically to examine the extent of their impact on the glass ceiling phenomenon. The baseline model implemented in this analysis can be expressed as follows:

$$R_{ijsq} = \beta_0 + \beta_1 Background_{ijsq} + \beta_2 Family_{ijsq} + \beta_3 Job_{ijsq} + \varepsilon_{ijsq}$$

The dependent variable, that is the grade of transformation computed as described in the previous section, identifies for each woman *i* in a specific occupation *j*, included in occupation type *s*, and with qualification type *q*, a random variable defined as R_{ijsq} which will represent the position of each woman *i*'s wage in the male wage distribution in each two-digit occupation *j*- of occupation type *s* - and qualification type *q*. In particular, this analysis considers three different occupation types, that is female, mixed and male-dominated occupations, and two education types, that is vocational versus general education.

4.5. Data

The data source used for this study comes from the UK Labour Force Survey (LFS), covering the years 2014-2019. The LFS is a nationally representative survey of 38,000 households living in the UK, representing about 0.15% of the population in Great Britain; hence the LFS is considered the largest household survey in the UK. Since 1973 the LFS delivers information concerning the UK labour market to enable the implementation and evaluation of labour market policies. The survey was conducted every two years until 1983 prior to becoming yearly. From 1992 the survey started to be carried out quarterly and it became also known as the Quarterly Labour Force Survey. The LFS utilizes a rotating sample approach; consequently, each household, living at a specific address, is included in the sample only for five consecutive quarters, defined as waves. Each quarter, one-fifth of the sample is updated so that Wave 1 identifies the first quarter in which a given address is included in the sample for the first time. Each participating household member, over the age of 16, is invited to complete a questionnaire, by proxies on behalf of individuals who are not present at the time of the interview, or self-reported by respondents. The majority of the households are interviewed face to face in Wave 1, for their first inclusion; the subsequent interviews for Waves 2, 3, 4 and 5 are instead conducted by telephone. In order to assure that the computed statistics are representative of the underlying population, sampling weights are included in the LFS data.

4.5.1. The Sample

The data used in this study cover information provided by working-age adults, age-range 18-65, in their first appearance in the survey only; hence only information collected through Wave 1 interviews is included in this analysis. This ensures that individuals only appear once in the final data set. Pooled across the years, this produces an analytical sample of 184,883 individuals, 95,646 women, and 89,237 men. The estimating sample does not differ significantly from the full sample in terms of background characteristics.

4.5.2. Variables

Dependent variable

As mentioned in the methodology section, the dependent variable is a random variable generated by calculating where the wage of a woman would rank on the men's wage distribution within a specific occupation and a given occupation type. The rank is computed by comparing the natural logarithm of women's and men's average gross hourly pay[43]. To limit the influence of outliers, this analysis trims the bottom and the top one per cent of the wage distribution. The wage is then adjusted for inflation using the Consumer Price Index provided by the Office for National Statistics[44] (ONS) (base year 2015).

Key variables

Occupation Type

This study identifies three different occupation types, namely male, mixed and female-dominated occupations. Following the approach adopted by Jacobs (1989), the following thresholds are adopted:

- Male-dominated occupations: those occupations in which the percentage of working women is in the range from 0 to 29.9%
- Mixed occupations: those in which the percentage of women is in the range from 30% to 69.9%

[43] Given that the rank of female wages within the male distribution has been computed without conditioning on any covariates, it is important to check whether there is a balance in terms of covariates across women and men. Table D.1, D.2, and D.3 show the mean for the reference (men) and comparison (women) population and the t-test on the difference in mean between women and men in either male-dominated, mixed, or female-dominated occupations. The difference in the mean is insignificant for the majority of the covariates considered and the bias reported is, on average, less than 5%. Given the results of the test, and given the large number of observations considered in each subsample, the performed test gives a certain level of confidence that the reference and comparison groups are quite balanced in terms of covariates.

[44] Consumer Price Index – ONS Available at: https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/l522/mm23

- Female-dominated occupations: those in which the percentage of women is in the range from 70% to 100%

According to the percentage of women and men falling in each occupation considered (Figure D.1), Table 4.1 shows the occupations[45] that this study defines as male-dominated, mixed and female-dominated.

It is interesting to notice that occupations defined as female-dominated are the ones associated with the lowest mean of the hourly wage. Besides, among those occupations classified as mixed, the ones characterized by a higher women's involvement are, on average, also the ones with the lower mean of the hourly wage (Figure 4.1).

Table 4.1 Occupation types

Male-dominated Occupations	Mixed Occupations	Female-dominated Occupations
SOC21 Science, research, engineering and technology professionals	SOC11 Corporate managers and directors	SOC22 Health professionals
SOC31 Science, engineering and technology associate professionals	SOC12 Other managers and proprietors	SOC23 Teaching and educational professionals
SOC33 Protective service occupations	SOC24 Business, media and public service professionals	SOC32 Health and social care associate professionals
SOC51 Skilled agricultural and related trades	SOC34 Culture, media and sports occupations	SOC41 Administrative occupations
SOC52 Skilled metal, electrical and electrical trade	SOC35 Business and public service associate professions	SOC42 Secretarial and related occupations
SOC53 Skilled construction and building trade	SOC54 Textiles, printing and other skilled trades	SOC61 Caring personal service occupations
SOC81 Process, plant and machine operatives	SOC71 Sales occupations	SOC62 Leisure, travel and related personal service occupations
SOC82 Transport and mobile machine drivers and operatives	SOC72 Customer service occupations	
SOC91 Elementary trades and related occupations	SOC92 Elementary administration and Service occupations	

[45] UK LFS data use the SOC2010 occupational classification system. Table D.4 in Appendix D reports all the occupations classified according to SOC2010 by sub-major group and minor group. This study uses the sub-major group specification.

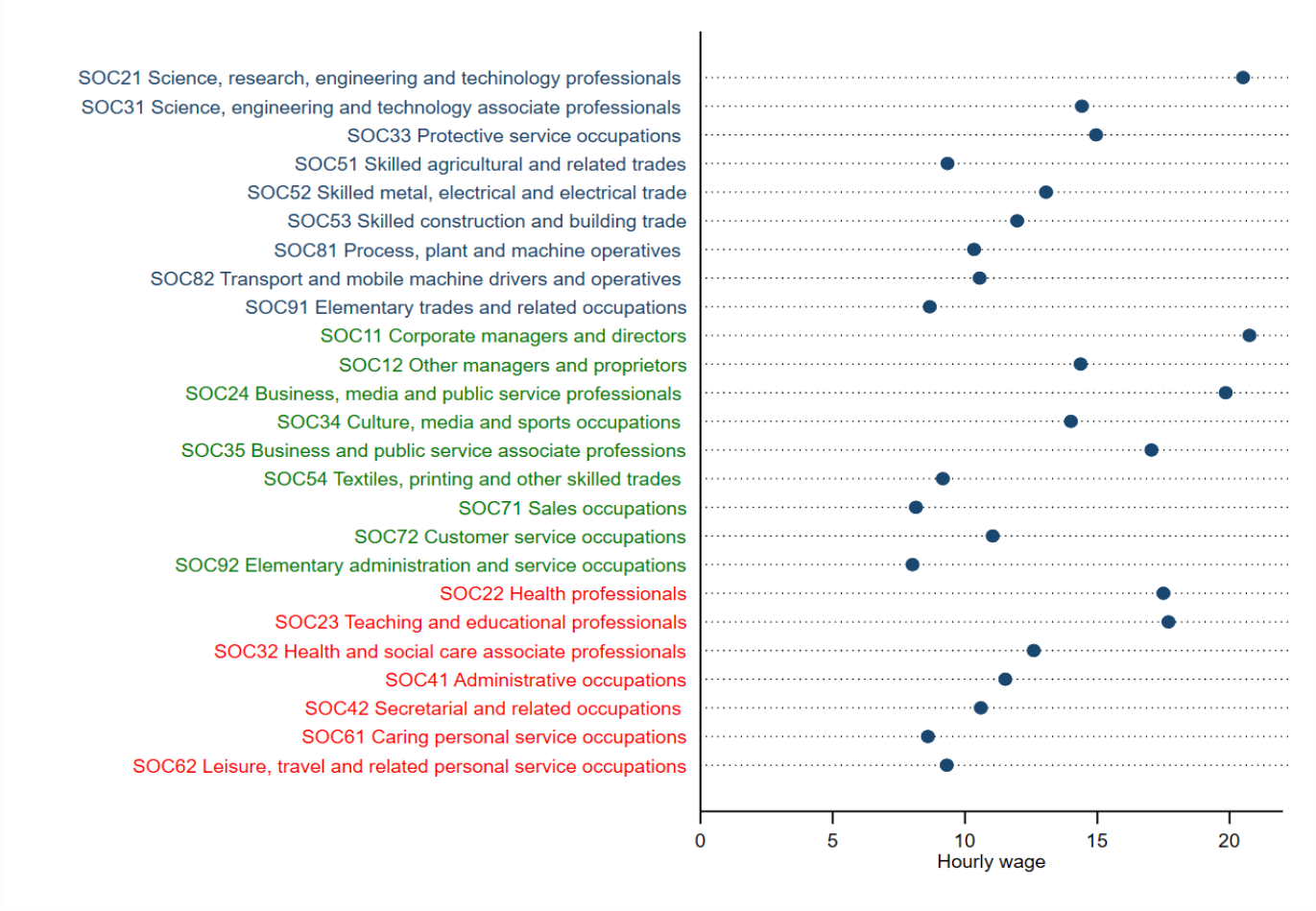

Figure 4.1 Mean hourly wage by occupations

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. Male-dominated occupations in blue, Mixed occupations in green, Female-dominated occupations in red.

The violin plot (Figure 4.2) displays the full range of variation in the logarithm of the hourly wages of women and men in different occupation types with the upper and lower line of the box representing the 75th and the 25th percentiles of the logarithm of the hourly wage, the white dot representing the median logarithm of the hourly wage and the top and the bottom extending lines showing the range. Finally, the blue overlaid area shows the density of the data. The figure clearly reveals the existence of substantial gender differences in terms of median values across occupation types with women showing always the lowest value if compared to men. In particular women in mixed occupations do show a strongly different distribution of the logarithm of the hourly wage if compared with the men's wage distribution with women being mainly segregated at the bottom of the wage distribution.

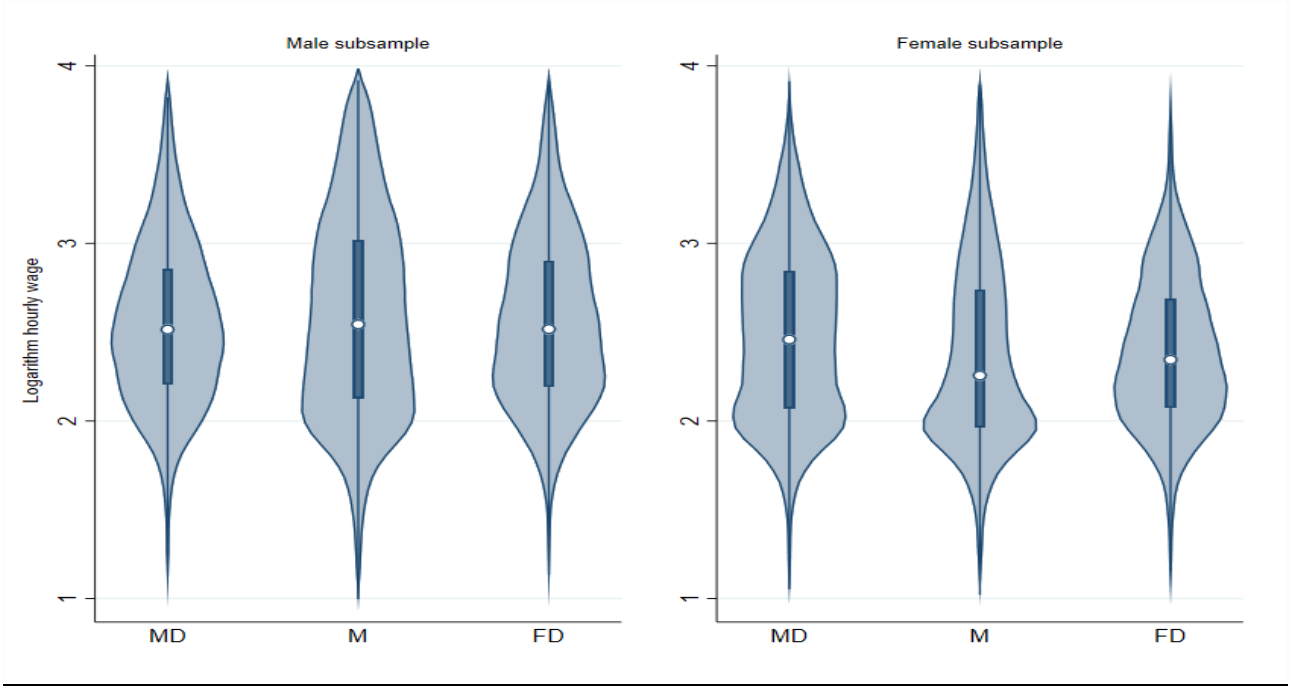

Figure 4.2 Violin plot of the wage distribution by gender and across occupation

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. MD indicated male-dominated occupations, M Mixed occupations, FD female-dominated occupations.

Highest qualification achieved

One of the reasons this chapter uses LFS data lies in the detailed information provided concerning the qualifications held by each member of participating households. Respondents are asked to specify all the qualification types held and among all the qualifications reported, they are then asked to indicate the highest qualification achieved within each qualification type. Among all the highest qualifications reported within each type and by each respondent, this study focuses on the highest qualifications achieved among each type.

In terms of levels, according to the Regulated Qualifications Framework[46] (RQF), qualifications can be split into 8 levels as shown in Table 4.2. For each qualification level, Table 4.2 identifies both vocational (in grey) and general qualifications (in white) types.

[46] The Regulated Qualification Framework (RQF) is the regulatory qualification framework for England. Once a qualification is accepted for use by the Office of Qualifications and Examinations Regulation (Ofqual) - the independent regulator of qualifications, examinations, and assessment in England- this will be located in the Register of Regulated Qualifications, with information on its level and size to identify its location in one of the levels of the RQF. Each qualification level is associated with some generic skills and knowledge that a learner should acquire once that given qualification is achieved. The size of a qualification is instead measured in

While many could be familiar with different types and levels of general qualifications, the wide range of vocational qualification types could be somehow misleading. In general usage, it is common practice to link each qualification to the best-known qualification falling in the same level. For instance, with a view to making a clear comparison between vocational and general qualifications, a Level 2 vocational qualification is tantamount to holding five or more grade A*-C GCSEs. Level 3 is theoretically comparable to attaining two or more A levels. Those studying at vocational Level 1, instead, are those individuals who are likely to not have the ability to handle a vocational Level 2 course, and so opt initially for a Level 1 course, to then continue to Level 2. From vocational Level 4 on, qualifications will fall into tertiary level education and will usually be characterized by a minimum of two years of study at a college/newer university, thus they are usually equivalent to a degree (McIntosh and Morris, 2016). Across and within the various levels, there are several qualifications, which can be broadly classified by the type, and then within type by the subject of study. The Business and Technology Education Council (BTEC) offers over 2,000 qualifications from entry-level to professional courses in a broad range of subject areas, though they are best known for business-related and technological qualifications. City and Guilds qualifications span across eight levels and more than 25 industries even though they are best known for providing construction skills. They are designed to be undertaken both in the workplace or in a classroom or a combination of the two. Royal Society of Arts (RSA) certifications comprise professional typing and word processing courses, useful to enhance computerised administrative skills and increase the probability of getting a secretarial job. Finally, the National Vocational Qualifications (NVQs) are usually work-based; competencies are acquired through on-the-job training and abilities tested by engaging with the job effectively. The General National Vocational Qualifications (GNVQs) are instead more college-based than their NVQ equivalents.

hours needed in order to attain the qualification itself. The Register of Regulated Qualifications also includes qualifications regulated by the qualifications regulator in Northern Ireland.

Table 4.2 Qualifications in the UK: General vs Vocational qualifications

Level	Common qualifications
Level 1	Foundation Diploma, GCSE (grades D–G), Scottish National level below and equal to level 4
	NVQ Level 1, City and Guilds foundation-part 1, GNVQ foundation level, BTEC first certification, RSA level 1, Entry level qualification, Level 1 Award, Basic Skill qualification, Key Skill qualification, YT/YTP Certificate
Level 2	Higher diploma, O-level - GCSE (grades A*–C), Scottish National level 5, intermediate Welsh Baccalaureate
	NVQ Level 2, City and Guilds Craft- part 2, GNVQ intermediate, BTEC level 2, RSA level 2, Level 2 Diploma/Certificate
Level 3	Advanced diploma, A-level, International Baccalaureate, SCE higher, Scottish Baccalaureate, Advanced Welsh Baccalaureate
	NVQ Level 3, City and Guilds Advanced Craft, GNVQ Advanced, BTEC National, RSA level 3, Level 3 Award/Certificate
Level 4	Certificate of Higher Education
	NVQ Level 4, Higher National Certificate (HNC), BTEC Professional award, certificate and diploma level 4, RSA level 4, Level 4 Award/ Certificate/Diploma, Nursing
Level 5	Diploma of Higher Education, Foundation degree, Teaching foundation stage/ primary education/secondary education/further education.
	Higher National Diploma (HND), BTEC Professional Award, Level 5 Certificate/Diploma/ Award
Level 6	First Degree/ Foundation degree
	BTEC Advanced Professional award, Level 6 Certificate/Diploma/Award
Level 7	Master's degree, Integrated master's degree
	BTEC Advanced Professional award, Postgraduate certificate/ diploma level 7
Level 8	NVQ Level 5
	Doctorates

In terms of levels, as expected, the majority of vocational qualifications acquired in the UK are found in Levels 2 and 3. The distributions of the qualifications between women and men are observed to be quite similar (Figure 4.3).[47]

[47] Descriptive statistics showing the number of individuals that hold respectively a vocational and a general qualification as their highest qualification, disaggregated by type and level are provided in the appendix Table D.5

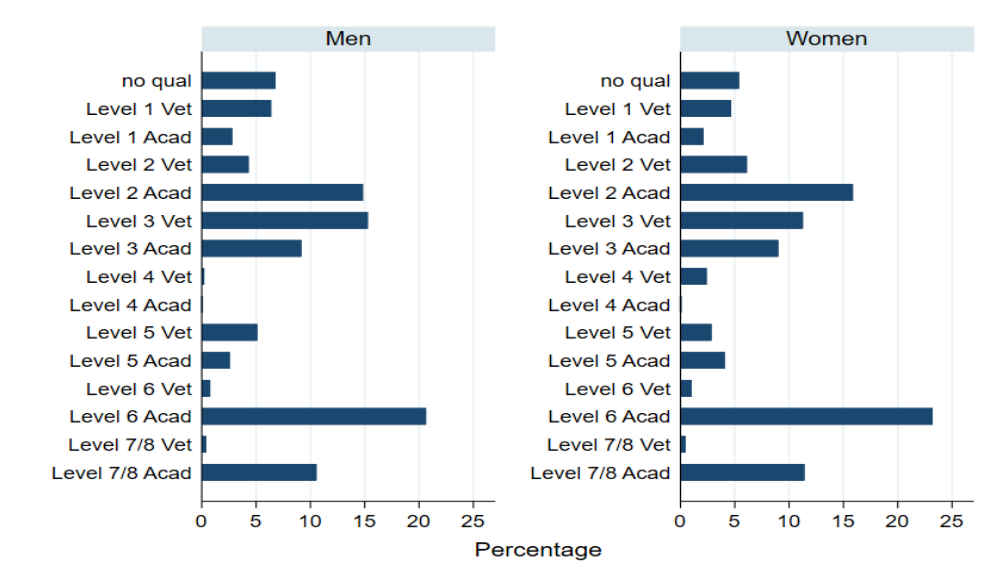

Figure 4.3 Distribution of vocational and general qualifications among men and women

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

Gender differences in terms of the distribution of educational qualifications can be noticed only when comparing across occupation types (Figure 4.4). While women appear to be higher educated in male-dominated occupations if compared with men in the same category, men in female-dominated occupations tend to be more educated if compared with women in the same category. This confirms what the literature has suggested: it is mainly particularly highly educated women who have made significant progress entering male-dominated occupations (Yavorsky and Dill, 2020). Women in female-dominated occupations are mostly represented by those women who have changed their labour market behaviours and do not find large incentives to invest in their education given that they anticipate work interruptions and a less stable attachment to the labour force. Distributions are instead quite similar in mixed occupations.

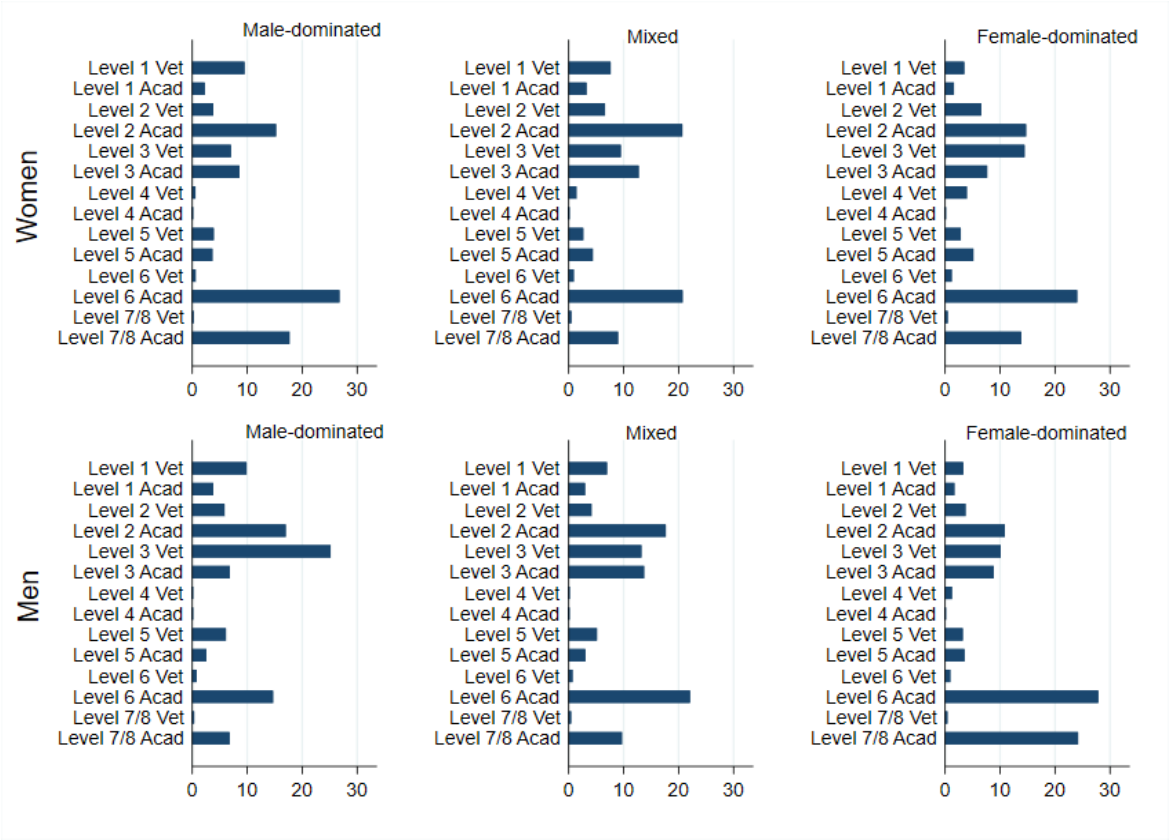

Figure 4.4 Distribution of qualifications among men and women across different occupation types

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

In terms of gender differences in the subject of specialization Figure 4.5 clearly depicts, as expected, the existence of gender educational segregation. Women are highly polarized into fields such as art, humanities and language, medical-related (e.g., nursing), education, and enrolled in training/apprenticeship related to social, personal and caring services. Only a small percentage of women specializes in highly remunerative disciplines (e.g., STEM). On the contrary, men show a higher likelihood to be specialized in Engineering and Construction and show a higher percentage than women in terms of qualifications into STEM fields. The same pattern occurs even when the comparison is made between women and men across different educational backgrounds (vocational versus general as in Figure D.2, D.3).

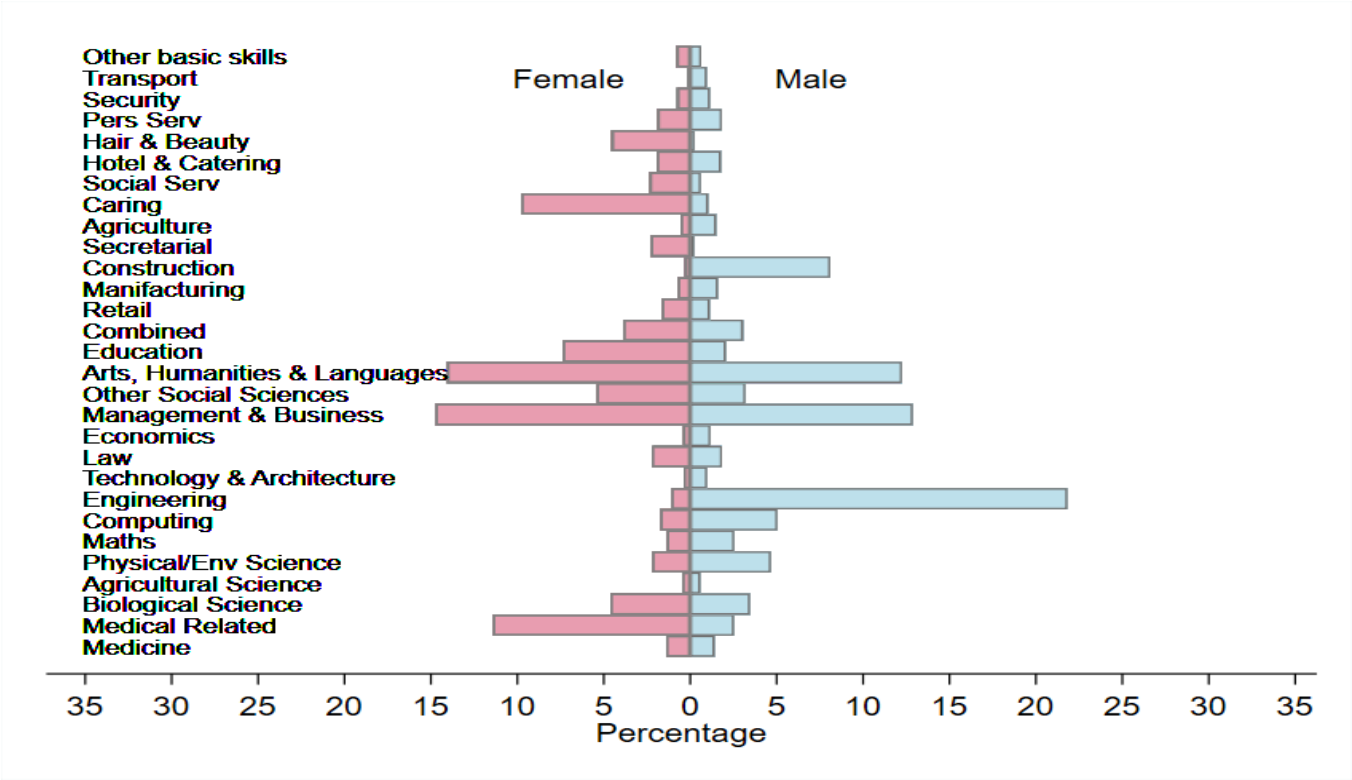

Figure 4.5 Distribution of qualifications by field of specialization among men and women

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. Data concerning the subject area are not offered for every qualification achieved in the UK LFS. The Figure shows the subject areas only for the highest qualification achieved, when available.

Figure 4.6 shows the lowess smoothed values of the logarithm of the hourly wage across ages, separating employed women and men across different occupations. The graph confirms that the degree of curvature in the relationship between age and the logarithm of the hourly wage differs based on whether an individual chooses a female, mixed, or male-dominated occupation and strictly depends on whether the highest qualification achieved by the individual is vocational or general. Indeed, while men holding a general qualification are mostly indifferent, in terms of age-wage relationship, to the occupation type in which they are able to secure employment; the same cannot be said for men with a vocational background. The diagram drawn for men with a vocational background shows, in fact, the biggest difference among occupations in terms of the age-logarithm of the hourly wage relationship. The contrary can be seen for women: the difference in age-logarithm of hourly wage slope looks larger for women with a general background rather than for those with a vocational one. This suggests that even if vocationally qualified women are going into the more male-dominated occupations, they do not seem to be getting the wage boost that men get with similar vocational qualifications.

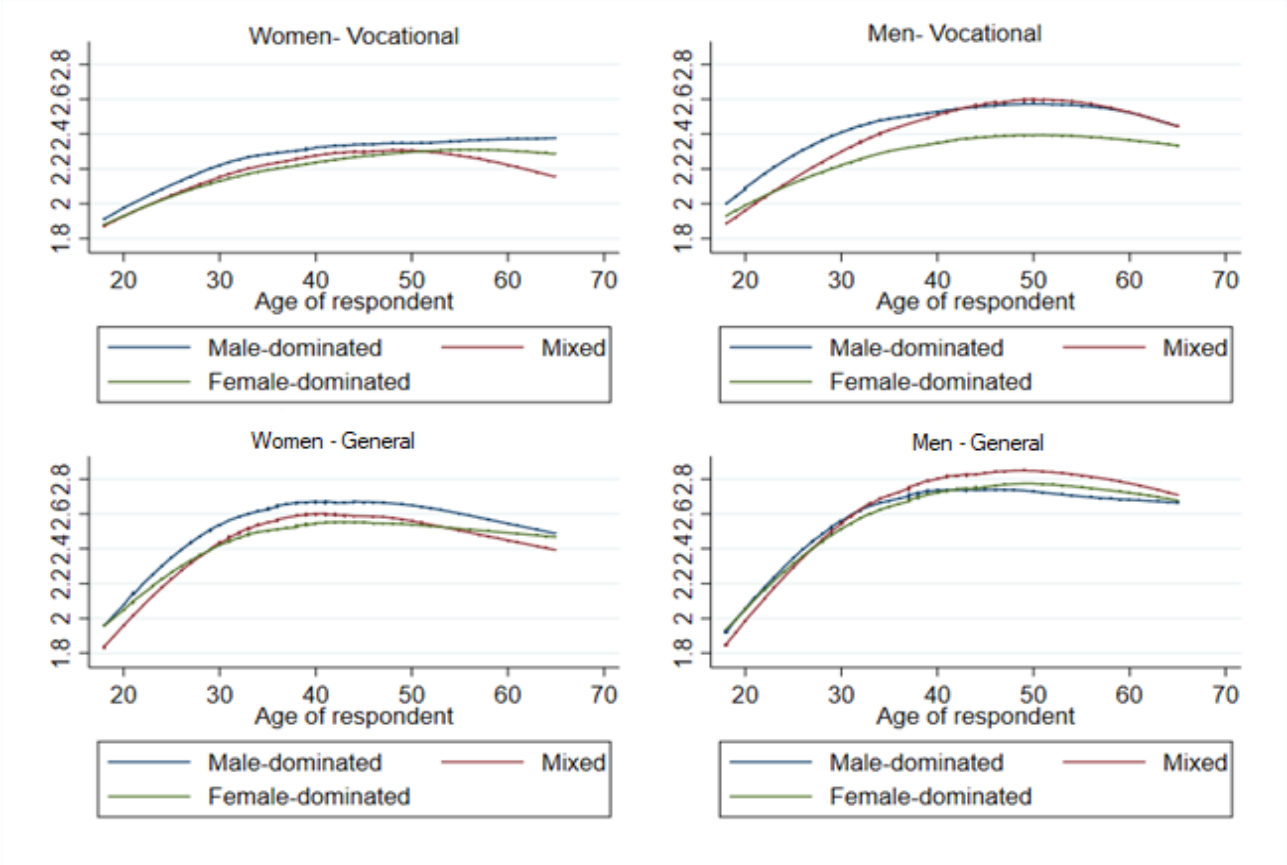

Figure 4.6 Age-log hourly wage relationship for women/men across education types

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

Control variables

To control for all the possible variables that may impact an individual's hourly wage and affect the gender wage gap, the model also considers a large number of exogenous factors as required to identify a ceteris paribus link between the relative wage, occupation type, and educational background.

The control variables combine individual demographics including gender, ethnicity, relationship status, number of children, and the geographic area (whether the individual resides in London or not) and a set of firm and job characteristics including firm size, occupation, and whether the firm is a public or private company. A full list and a detailed description of both key and control variables are provided in Table D.6.

Given the noticeable differences in the age-wage profiles across both occupation types and education qualifications held, as reported in Figure 4.6, the gender wage gap is consequently expected to be different. Figure 4.7 shows the differences in the adjusted means of the hourly wage across occupation

and education type, significant at the 5% level when the confidence interval excludes zero. As expected, the difference between the sexes is increasing in age with women's hourly wage being very close to men's at the beginning of their careers (age 18-25), and with a sharp increase in the wage gap over the fertility period. The largest gender difference is reported, on average, in mixed occupations. However, while the difference in terms of gender wage gap across education types is subtle in mixed and female-dominated occupations, the difference becomes evident in male-dominated occupations with women with a general qualification doing relatively better than those holding a vocational qualification.

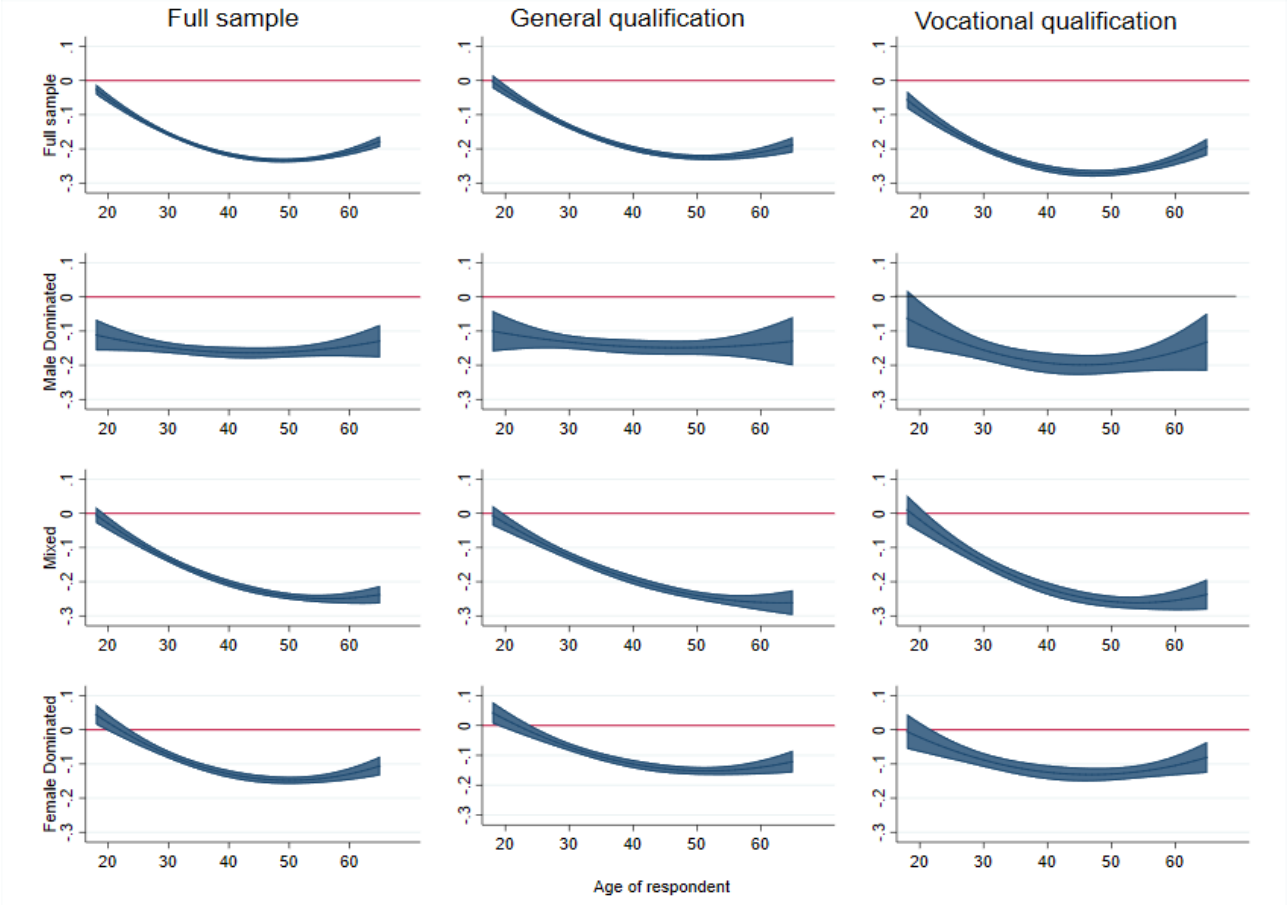

Figure 4.7 Gender comparison of the adjusted mean of the logarithm of the hourly wage by education and occupation type.

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. Controls include age, age squared, relationship and health status, number of children, education level, size of the firm, whether the firm is a public or a private one, ethnicity, and whether the individual is resident in London.

4.5.3. Descriptive statistics

Descriptive statistics of the analytical sample are provided in Appendix D. The analysis of the raw data reveals the existence of a gender wage gap across different occupation types (Table D.7 and Table D.8) both among individuals with a vocational and among those with a general qualification as the highest qualification (Table D.9).

While men do not report a tangible difference in terms of the logarithm of the hourly wage across different occupation types, women show, on average, a higher wage when working in male-dominated rather than mixed or female-dominated occupations. However, the latter seems to hold only for women with a general background who register the smallest gender wage gap in male-dominated occupations. This may be because women working in male-dominated occupations tend to hold, on average, higher qualification levels (levels 6, 7, and 8 general). Women with a vocational background show, instead, the smallest gap in female-dominated occupations. The widest gender pay gap is registered in mixed occupations both among individuals with a general or a vocational qualification. This wider gap could be partially explained given that women and men tend to locate themselves in different occupations with women picking those characterized, on average, by the lowest returns. Women in mixed-occupations are more concentrated in “Sales occupations” – SOC 71- (18%) and in “Elementary administration and service occupations”- SOC 92- (23%), while in addition to the latter men tend to work more as “Corporate managers and directors” -SOC 11- (22%) and as “Business, Media and Public Service professionals” – SOC 24 (18%).

The situation is quite different in male-dominated occupations where women are mostly located in occupations that are characterized, on average, by higher wages such as “Science, research, engineering and technology professionals”- SOC 21- (34%) and “Science, engineering, and technology associate professionals – SOC 31- (15%), while men within the same occupation type secure employment more as “Science, research, engineering and technology professionals”- SOC 21- (23%) and in “Skilled metal, electrical and electronic trades”- SOC 52- (19%).

Nevertheless, women and men in female-dominated occupations are also most likely to choose different career paths with women in "Caring, personal service occupations" -SOC 61- (27%) and "Administrative occupations" – SOC 41- (26%) and men more likely to select the latter (34%) and to work as "Teaching and other educational professionals" (22%).

Finally, it is worth mentioning that, in line with what the literature has suggested, on average female-dominated occupations are more likely to be found in the public sector, which allows individuals more flexibility and provides a more family-friendly environment (Gornick et al., 1997, Korpi, 2000).

4.6. Results

As mentioned in the previous section, this analysis will not only be based on a parametric approach with the computation of official statistics, such as difference in mean or median wages; neither will it be relying exclusively on regression models to account for the effects of covariates. Much less will it be based on the implementation of a counterfactual approach. The aim of this work will be to uncover gender inequality by exploring the detailed information inherent in distributions. Therefore, the chapter will adopt a relative distribution approach.

It should be clear that when implementing a distributional comparison, visualization techniques can be considered at the heart of the analysis; for this reason, the following findings will be the result of a combined approach based on both graphical inspections and statistical inference.

The relative CDF of the logarithm of the hourly wage between the male subsample, the reference group, and the female subsample, the comparison group, can be visualized in Figure 4.8. The right and the upper axes represent the quantiles for women, $Q(r)$, and men, $Q_0(r)$, respectively, expressed in the logarithm of the hourly wage. The x-axis shows the cumulative proportions of the male sample, $G_0(r)$, the y axis the cumulative proportions of the female sample, $G(r)$, both axes are ordered by the level of the logarithm of the hourly wage. Each point on the curve maps quantiles of the two distributions and represents a specific earning level. This means that for each point of the relative

CDF curve, the y-axis will show the proportion of women earning at or below that level of the logarithm of the hourly wage; the x-axis will provide the same information for the men subsample. At the median of the male subsample, r =0.5, the wage level can be read in the upper axis $Q_0(r) = 2.53$. The relative CDF at r =0.5 would be 0.63, meaning that 63% of women experience a lower wage level than this. The median wage level, $Q(0.5)$, for the women subsample is shown on the right axis and it is about 2.4. About 65% of the male cohort had a higher gain than this. Moreover, from an analysis of Figure 4.8, the female subsample appears to be overrepresented in the early part of the wage distribution when compared to the males' wage distribution. The value of the 20% quantile in the male sample, for instance, is equal to the 30% quantile in the female subsample ($G(r) = 30$) given that the curve crosses point (0.2, 0.32). Therefore, while in the male sample, 20% of men show a logarithm of the hourly wage equal of at most to 2.092; in the female cohort, this proportion increases to 30%. That is, relative to the male subsample, the logarithm of the hourly wage of 2.092 or less is overrepresented in the female subsample.

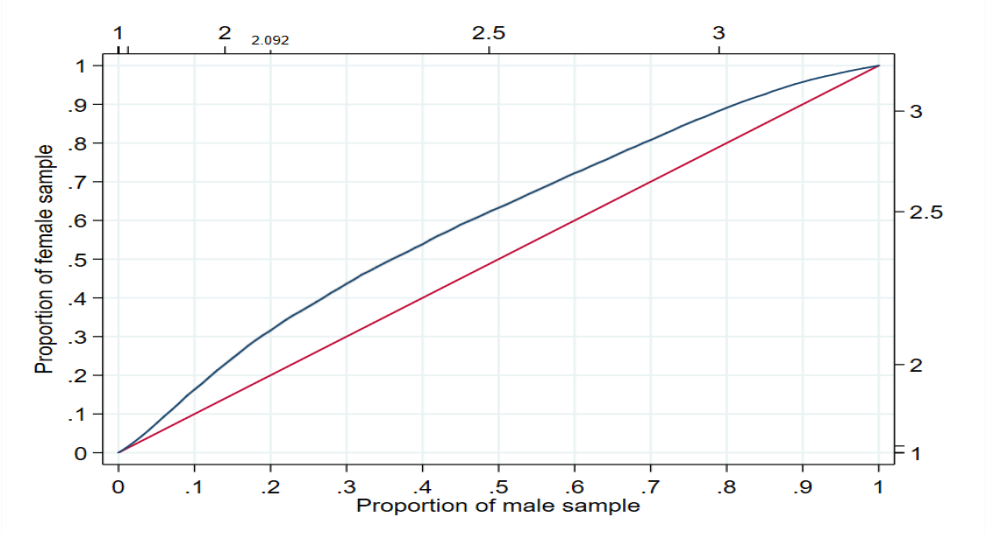

Figure 4.8 Relative CDF

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

The relative over- and underrepresentation of the female sample with respect to the distribution of wages in the male sample can be observed in the relative PDF. A relative density greater than 1 implies that the female subsample is overrepresented at the corresponding level of wage, values lower

than one means that the female subsample is underrepresented relative to the male subsample. Figure 4.9 shows a bar chart in which the area of each bar is proportional to the women's share of the logarithm of the hourly wage relative to men for each quantile. The solid line represents the relative density curve. The shaded area around the density curve shows the confidence interval. Looking at Figure 4.9, it is possible to notice that the largest gender distributional differences in terms of the logarithm of the hourly wage are at the lower and upper end of the wage distribution. The female subsample has a considerably greater density than the male subsample in regions below the 20% quantile of the male sample with an overrepresentation factor of 1.6 to 1.5, and a larger density below about the 30% quantile. At quantiles above that, the female subsample is underrepresented (especially from the 80% quantile), while there is a reduced divergence at the middle of the distribution (from the 30% to the 80% quantile).

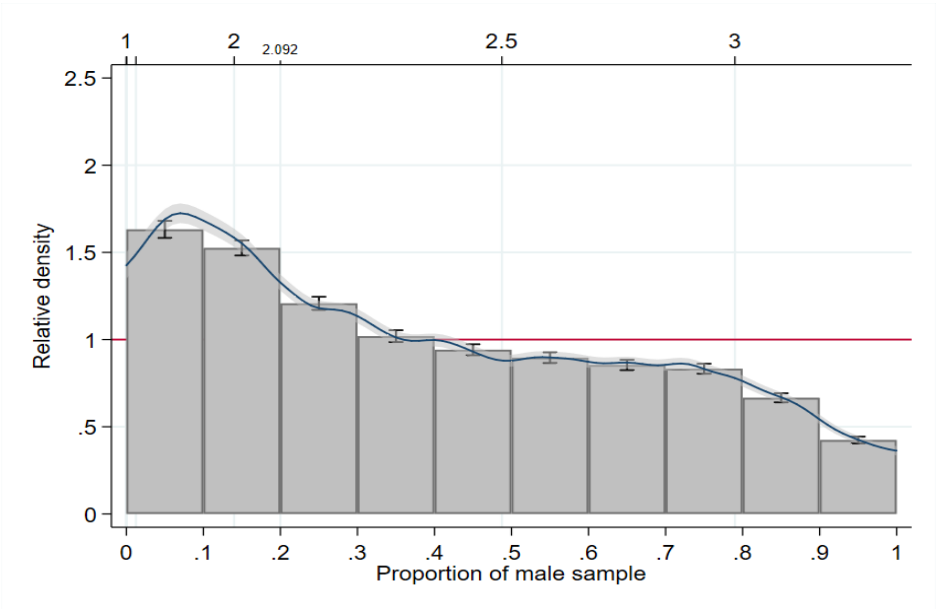

Figure 4.9 Relative PDF

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

One of the main features of this methodology is the possibility to decompose the relative distribution into a location and a shape component (Handcock and Morris, 1998). The location component indicates whether the difference between the comparison and the reference distribution is due to a change in the median of the wage distribution. In this case, the comparison distribution would simply

be a shifted version of the reference distribution with a homogeneous subtraction (addition) to all levels of the logarithm of the hourly wage that moves the overall distribution to the left (right), while leaving the shape unchanged. The shape component instead indicates whether the distributional difference is due to changes in the spread, the skew and other distributional characteristics without any location shift. In this case, the difference between the comparison and the reference distribution could be attributed to a difference in terms of polarization. Figure 4.10 represents the location and shape decomposition of the relative distribution of the hourly wage. The figure on the left depicts the overall relative density. The second represents the result of the median shift in wages between the male and female subsample, highlighting what the relative density would have looked like if there had been no change in distributional shape. In other words, the male wage distribution is adjusted in such a way that it has the same shape and scale as the female subsample distribution while keeping its location. It can be noticed that the distribution for the female subsample is left-shifted if compared to the male distribution once we depurate the overall effect by the shape component. Indeed, at the lower end of the distribution, there are relatively more observations for the female subsample than the male subsample. In the bottom decile, the relative density is about 2.6, well above the value of 1.6 observed in the actual data. The upper decile is also slightly greater than what is observed in the actual data. The third panel instead shows the shape effect, useful to detect the relative density net of the location effect. The picture shows that the comparison distribution has relatively less spread over the distribution than the location-adjusted one, and it highlights a greater convergence of the hourly wage towards the median with an important decrease of the relative density in the first decile of the wage distribution. At the top of the distribution, the shape component operating by itself would have increased the relative density even more in the upper decile. The graphical analysis of the shape and location component is reinforced by the implementation of a comparison of the entropy (Kullback-Leibler divergence) as suggested by Bernhardt et al. (1999). In this regard, Table D.10 confirms that the impact of the location component seems to be more predominant (61%) than the shape component (39%).

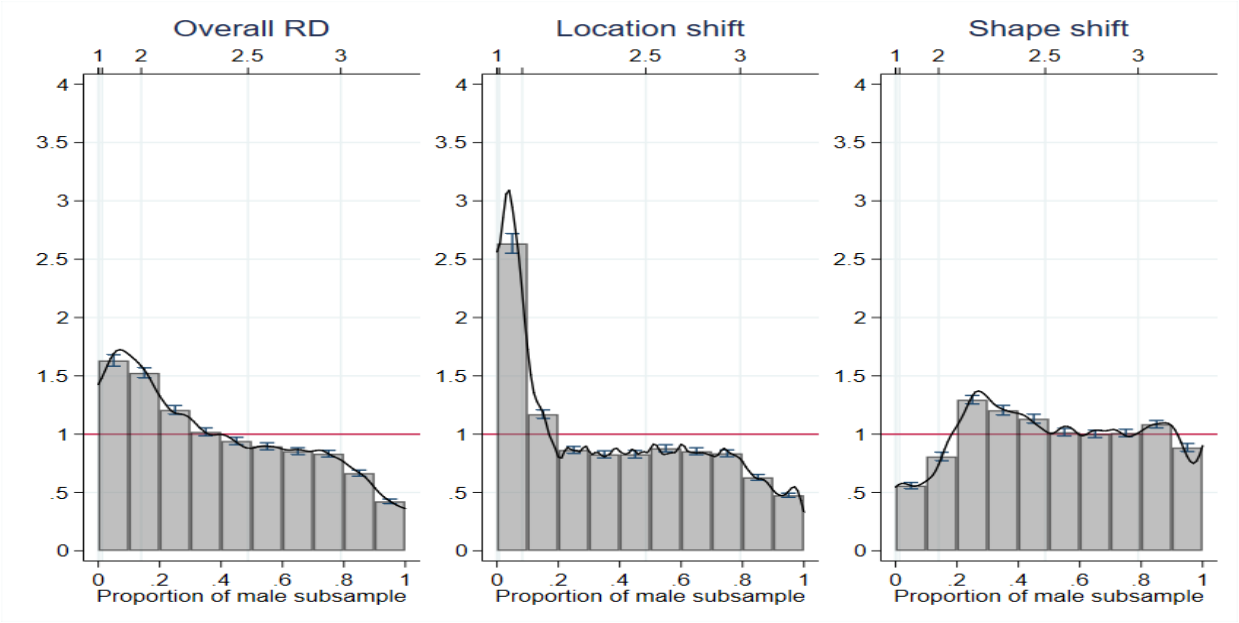

Figure 4.10 Location, scale, and shape decomposition

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

Figure 4.11 describes what happens to the relative density in case we consider the comparison between male and female samples across occupation types. Women are overrepresented in the first part of the distribution and underrepresented at the top decile of the distribution in mixed and female-dominated occupations while the line in the male-dominated occupations is definitely flatter, being close to a relative density of one across most of the distribution, except for the very top and bottom of the wage distribution. This can lead to the conclusion that women who are able to secure employment in male-dominated occupations do on average almost as well as men in those occupations, whereas in female-dominated occupations, there is still, surprisingly, a glass ceiling for women. Indeed, the underrepresentation of women at the top of the wage distribution may lead to the conclusion that women keep suffering the effect of vertical segregation even within female occupations and, consequently, they keep struggling to reach better and highly paid positions.

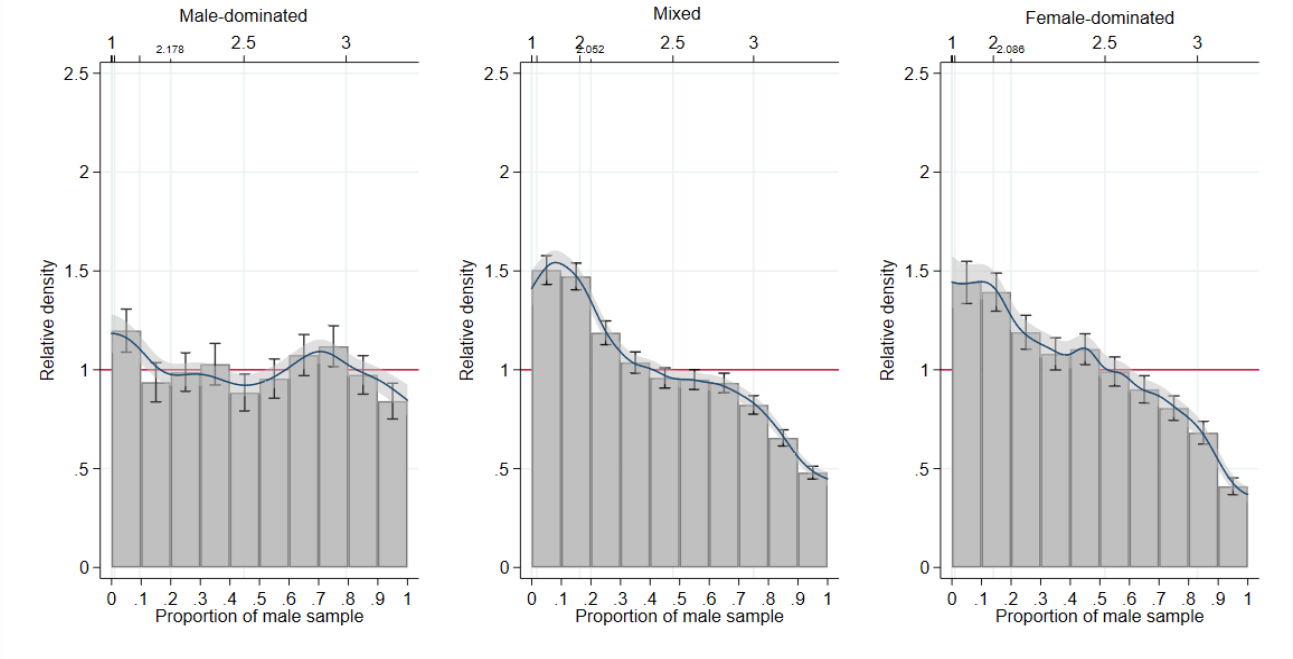

Figure 4.11 Relative PDF across occupation type

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

It is interesting to analyse what happens when the comparison between individuals with a vocational qualification as the highest qualification versus individuals with a general qualification is considered (Figure 4.12).

It is possible to notice that women with vocational qualifications face a tougher glass ceiling in male-dominated occupations (bottom left graph) and, especially, mixed occupations (bottom middle graph) than in female-dominated occupations (bottom right graph). In contrast, women with general qualifications face their lowest/easiest glass ceiling in male-dominated occupations (top left graph) compared to mixed (top middle) or female-dominated occupations (top right).[48]

Consequently, from a relative analysis, aspiring women with the ambition to reach the upper quartile facing the smoother glass ceiling would be advised to join female-dominated occupations if they have a vocational background. Of course, women may care more about their absolute wage rather than

[48] The shares of employed women in male, mixed or female-dominated occupations and with either a vocational or general background are reported in Table D.11. The glass ceiling appears to be less severe for general educated women in male-dominated occupations (top left). This is only 5% of all women and only 7% of women with general qualifications. In contrast, where women face the toughest/most severe glass ceiling, hence vocational qualified women in male-dominated or mixed occupations, the share is this represents (2+11=) 13% of all women, and (5+37=) 42% of all women with vocational qualifications.

their relative position, and so may prefer a relatively low wage in male-dominated that might still be higher than a relatively higher wage in a female-dominated occupation.

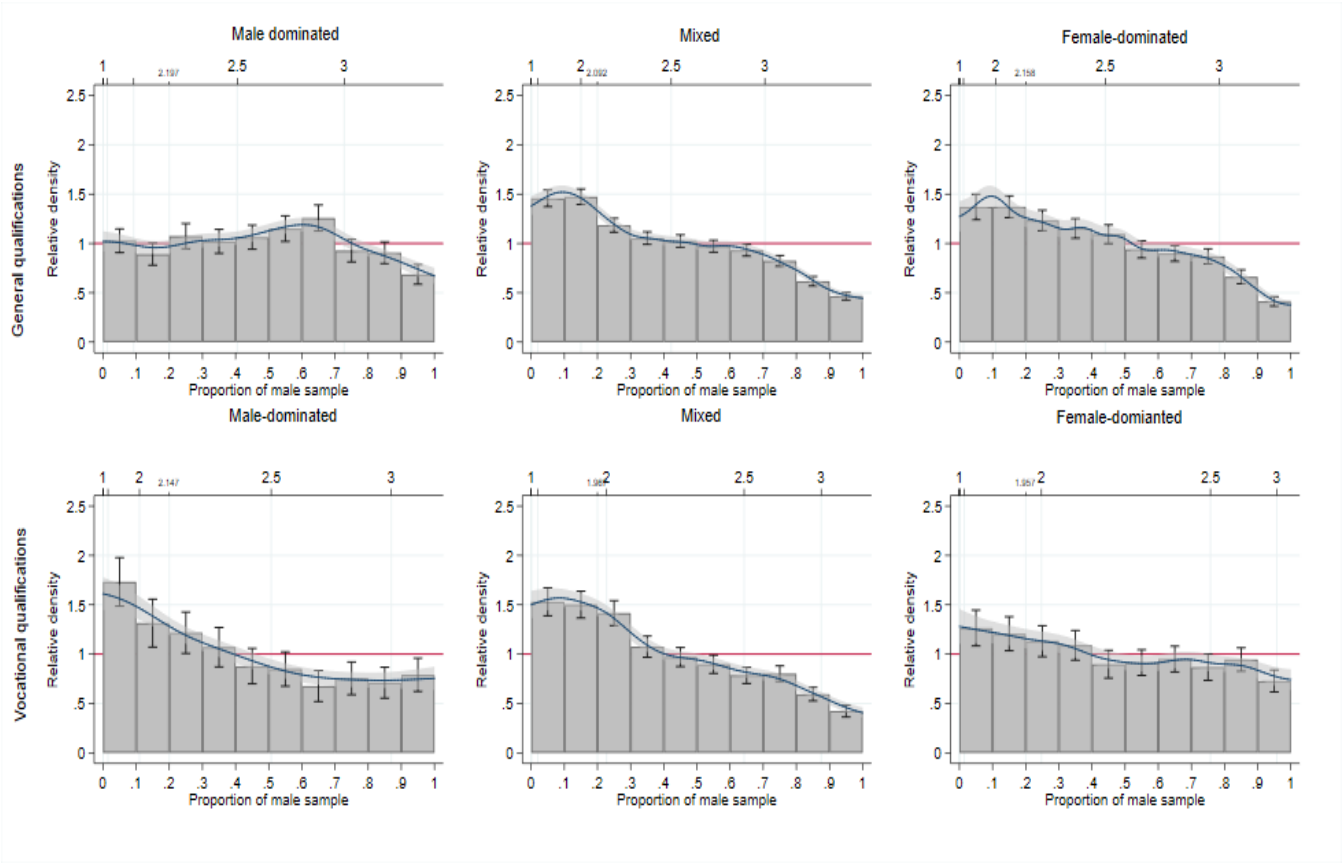

Figure 4.12 Relative PDF across occupation and education type

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

When comparing wages between women and men it may be appropriate to make the two subsamples more comparable by considering also the background characteristics. Perhaps, part of the gender difference across the wage distributions derives from the discrepancy in terms of the composition of the background characteristics, and not from gender per se. When controlling for the type of highest qualification achieved, relationship status, region, experience, job characteristics, and children (Figure 4.13) the wage distribution is still largely the same. This suggests that whatever is explaining the different distributions, it is not the observed characteristics of men and women[49].

[49] Figure D.3 shows the relative density balanced versus unbalanced data by education and occupation types. The same conclusion can be drawn.

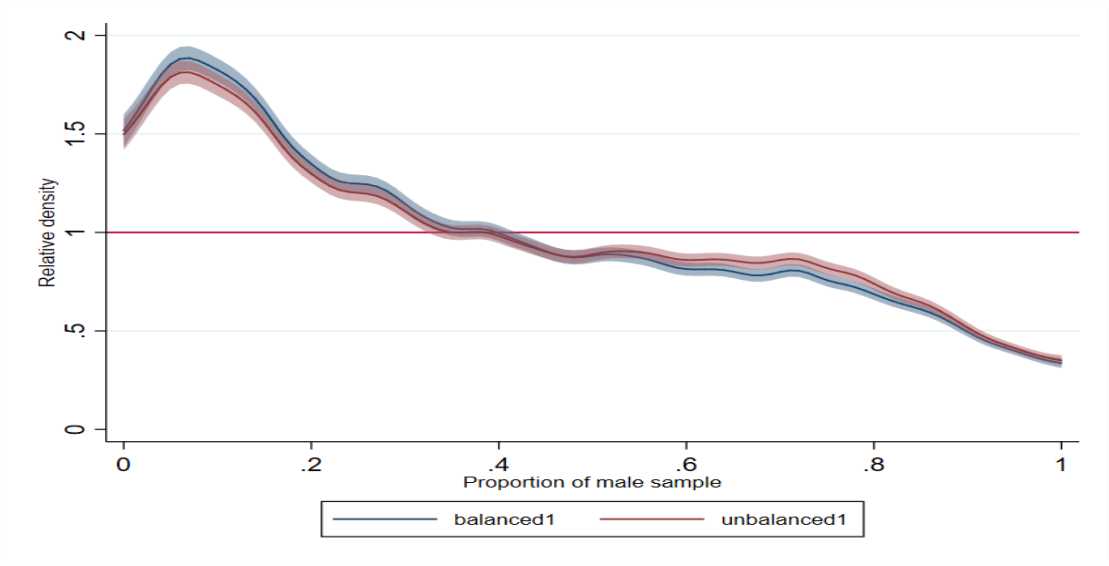

Figure 4.13 Relative density balanced versus unbalanced data

LFS 2014-2019. Working-age population (18-65) only.

In order to establish whether being in a male, mixed or female-dominated occupation and having either a vocational or a general qualification as the highest qualification could impact the magnitude of the gender wage gap and, more specifically, the existence/intensity of the glass ceiling phenomenon over the wage distribution, the wage of each woman observed in the sample is utilised to estimate where that wage would locate each woman in the men's distribution of the hourly wage within the same occupation and qualification type. The variable rank thus computed is then used as the dependent variable in an individual-based regression.

Table 4.3 reports the results for the different specifications. Columns 1, 2 and 3 present the changing relative wage position within male-dominated occupations; columns 4, 5 and 6 refer instead to women in mixed occupations; finally, columns 7, 8 and 9 consider women in female-dominated occupations. In each specification, the first column shows the results when all women with any educational background are considered[50], the second when only those women having a vocational qualification as the highest qualification are taken into account and, finally, the third when only those with general qualifications as their highest qualification are examined.

50 Base category: no qualifications

The human capital measures (qualification type and level) are found to be significant and to have the expected relationship with the relative wage: higher educated women, on average, perform better in relative wage terms. Looking at the age coefficient, an increase in age leads to an increase in terms of relative wages, especially for women employed in male-dominated occupations. It is also possible to notice that female relative pay increases with age, especially for those women with a general qualification as the highest qualification rather than a vocational one. This is quite expected given the trade-off between early advantages and late disadvantages for individuals having a vocational qualification versus those having a general one as the highest qualification achieved.

Having one or more children makes a real difference in terms of female relative pay for those women employed in female-dominated or mixed occupations, while it seems to not be an issue for those women who were able to secure a job in male-dominated occupations. The female relative wage for women having children decreases, on average, even more for women with a vocational background confirming what the third chapter has already stated: women with a vocational background end up experiencing a wider motherhood wage gap if compared with those women having a general background. Finally, being married is negatively related to the relative wage in female-dominated occupations.

It is also worth mentioning that, looking at Table 4.3, a narrower wage gap is observed for Black, Asian, Chinese and other ethnicity background women for those who were able to secure a job in a male-dominated occupation.

Table 4.3 Determinants of women's position in the male wage distribution

	MD- All	MD- Vet	MD- Gen	M- All	M-Vet	M-Gen	FD-All	FD-Vet	FD-Gen
Age	0.0323***	0.0198***	0.0418***	0.0227***	0.0166***	0.0263***	0.0271***	0.0214***	0.0309***
	(0.00255)	(0.00464)	(0.00332)	(0.000880)	(0.00165)	(0.00112)	(0.000929)	(0.00151)	(0.00121)
Age squared	-0.0318***	-0.0198***	-0.0421***	-0.0228***	-0.0173***	-0.0265***	-0.0268***	-0.0217***	-0.0306***
	(0.00309)	(0.00561)	(0.00406)	(0.00108)	(0.00202)	(0.00139)	(0.00112)	(0.00182)	(0.00146)
Public	-0.0240**	-0.0269	-0.0234*	-0.0392***	-0.0223**	-0.0493***	-0.00577	0.0436***	-0.0338***
	(0.00833)	(0.0184)	(0.00955)	(0.00375)	(0.00714)	(0.00466)	(0.00300)	(0.00521)	(0.00373)
Married	-0.00241	-0.00889	0.00341	-0.00169	-0.00145	-0.000688	-0.00428**	-0.00286	-0.00463*
	(0.00395)	(0.00721)	(0.00510)	(0.00163)	(0.00294)	(0.00213)	(0.00157)	(0.00259)	(0.00202)
1 Child	0.0134	-0.0169	0.0109	0.000369	-0.0118	0.00288	-0.0153***	-0.0301***	-0.0114*
	(0.00938)	(0.0183)	(0.0116)	(0.00383)	(0.00733)	(0.00472)	(0.00370)	(0.00642)	(0.00461)
2 Children	0.0412***	0.0563**	0.0191	0.00831*	-0.00606	0.0106*	-0.0193***	-0.0390***	-0.0151**
	(0.0104)	(0.0205)	(0.0126)	(0.00419)	(0.00804)	(0.00512)	(0.00391)	(0.00695)	(0.00481)
3 Children	-0.0212	-0.0993*	-0.00966	-0.0205**	-0.0467***	-0.0132	-0.0422***	-0.0621***	-0.0386***
	(0.0209)	(0.0423)	(0.0249)	(0.00749)	(0.0134)	(0.00961)	(0.00662)	(0.0116)	(0.00823)
4+Children	0.0191	-0.123	0.0825	-0.0180	-0.0145	-0.0534**	-0.0571***	-0.0758***	-0.0514**
	(0.0434)	(0.0792)	(0.0555)	(0.0134)	(0.0222)	(0.0188)	(0.0124)	(0.0193)	(0.0167)
Vet_level1	0.0357*			0.0334***			0.0317**		
	(0.0179)			(0.00814)			(0.0114)		
Vet_level2	0.0686**	0.0481*		0.0181*	-0.0138		0.0275**	-0.00420	
	(0.0225)	(0.0216)		(0.00785)	(0.00843)		(0.00985)	(0.00941)	
Vet_level3	0.103***	0.0709***		0.0320***	-0.00326		0.0665***	0.0294***	
	(0.0196)	(0.0194)		(0.00714)	(0.00779)		(0.00909)	(0.00868)	
Vet_level4	0.0655	0.0622		0.0766***	0.0570**		0.0183	-0.0257*	
	(0.0515)	(0.0507)		(0.0186)	(0.0186)		(0.0107)	(0.0103)	
Vet_level5	0.172***	0.148***		0.0808***	0.0503***		0.111***	0.0734***	
	(0.0223)	(0.0223)		(0.0100)	(0.0104)		(0.0116)	(0.0112)	
Vet_level6	0.0598	0.0341		0.00919	-0.0154		0.0889***	0.0546***	
	(0.0482)	(0.0470)		(0.0147)	(0.0149)		(0.0146)	(0.0143)	
Vet_level7	0.189*	0.158*		0.0934***	0.0675***		0.111***	0.0745***	
	(0.0776)	(0.0751)		(0.0189)	(0.0188)		(0.0224)	(0.0220)	
Gen_level1	0.0218			0.00237			0.0134		
	(0.0287)			(0.0101)			(0.0137)		
Gen_level2	0.0812***		0.0631*	0.0373***		0.0361***	0.0772***		0.0654***
	(0.0165)		(0.0278)	(0.00636)		(0.00939)	(0.00904)		(0.0115)
Gen_level3	0.164***		0.158***	0.0802***		0.0869***	0.118***		0.112***
	(0.0189)		(0.0294)	(0.00712)		(0.00997)	(0.00976)		(0.0121)
Gen_level4	0.434*		0.419*	-0.00146		-0.00678	0.130*		0.120
	(0.180)		(0.184)	(0.0753)		(0.0765)	(0.0607)		(0.0612)
Gen_level5	0.0906***		0.0760*	0.0674***		0.0681***	0.0766***		0.0706***
	(0.0241)		(0.0330)	(0.00944)		(0.0118)	(0.0103)		(0.0126)
Gen_level6	0.186***		0.175***	0.121***		0.121***	0.0858***		0.0839***
	(0.0157)		(0.0273)	(0.00635)		(0.00939)	(0.00892)		(0.0114)
Gen_level7	0.199***		0.186***	0.152***		0.151***	0.125***		0.125***
	(0.0168)		(0.0279)	(0.00740)		(0.0102)	(0.00929)		(0.0117)
Size_1_25	-0.0532***	-0.0487**	-0.0516***	-0.0864***	-0.0653***	-0.0976***	-0.0427***	-0.0357***	-0.0470***
	(0.00945)	(0.0186)	(0.0117)	(0.00318)	(0.00598)	(0.00400)	(0.00324)	(0.00554)	(0.00408)
Size_25_49	-0.0430***	-0.0157	-0.0491**	-0.0563***	-0.0433***	-0.0607***	-0.0429***	-0.0452***	-0.0416***
	(0.0122)	(0.0241)	(0.0153)	(0.00452)	(0.00833)	(0.00569)	(0.00376)	(0.00649)	(0.00469)
Black	-0.00166	0.0553	-0.0142	-0.0445***	-0.0314	-0.0484***	-0.0263**	0.00856	-0.0460***
	(0.0285)	(0.0650)	(0.0330)	(0.00981)	(0.0182)	(0.0126)	(0.00801)	(0.0133)	(0.0103)
Asian	-0.0276	-0.00253	-0.0211	-0.0368***	-0.00466	-0.0430***	-0.0359***	-0.0252*	-0.0373***
	(0.0146)	(0.0314)	(0.0179)	(0.00731)	(0.0150)	(0.00885)	(0.00683)	(0.0127)	(0.00826)
Chinese	0.0479	0.0127	0.0526	-0.0232	0.000228	-0.0316	-0.0132	0.0592	-0.0410
	(0.0392)	(0.174)	(0.0409)	(0.0187)	(0.0466)	(0.0215)	(0.0230)	(0.0453)	(0.0268)
Other	-0.0343	-0.0503	-0.0269	-0.0187	-0.0108	-0.0182	-0.0378***	-0.0116	-0.0477***
	(0.0223)	(0.0451)	(0.0276)	(0.00983)	(0.0198)	(0.0120)	(0.00989)	(0.0184)	(0.0119)
London	0.111***	0.163***	0.104***	0.106***	0.120***	0.107***	0.129***	0.123***	0.130***
	(0.0135)	(0.0351)	(0.0150)	(0.00491)	(0.0114)	(0.00570)	(0.00500)	(0.0102)	(0.00584)
Bad health	-0.00638	0.00447	-0.0182	-0.0340***	-0.0330***	-0.0382***	-0.0333***	-0.0235**	-0.0408***
	(0.0126)	(0.0228)	(0.0162)	(0.00471)	(0.00823)	(0.00628)	(0.00454)	(0.00721)	(0.00599)
cons	-0.478***	-0.137	-0.671***	-0.133***	0.0379	-0.210***	-0.243***	-0.0855**	-0.308***
	(0.0498)	(0.0885)	(0.0688)	(0.0171)	(0.0317)	(0.0226)	(0.0192)	(0.0296)	(0.0255)
N	5153	1252	3525	30519	8149	20141	38158	12398	24755

*Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. MD refers to male-dominated occupation, M to mixed occupations, FD to female-dominated occupations. Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.*

4.6.1. Robustness check

- Common support assumption

As mentioned in the methodology section, the trustworthiness of the results achieved within relative distribution approach relies on the validity of the common support assumption. In other words, one must assume that enough wage distributional overlap between men's and women's wage distributions exists. Ignoring the problem may result in biases because the comparison group (men) may not be comparable to the reference group (women). This section aims at providing a graphical inspection of the reliability of the common support assumptions. In particular, Figure 4.14 tests this hypothesis for the overall sample, and Figure 4.15 for the subsamples of male-dominated, mixed and female-dominated occupations by the education type (general and vocational). It can be noticed that both when looking at the overall sample and at more granular cells, there is indeed an overlap of the two distributions.

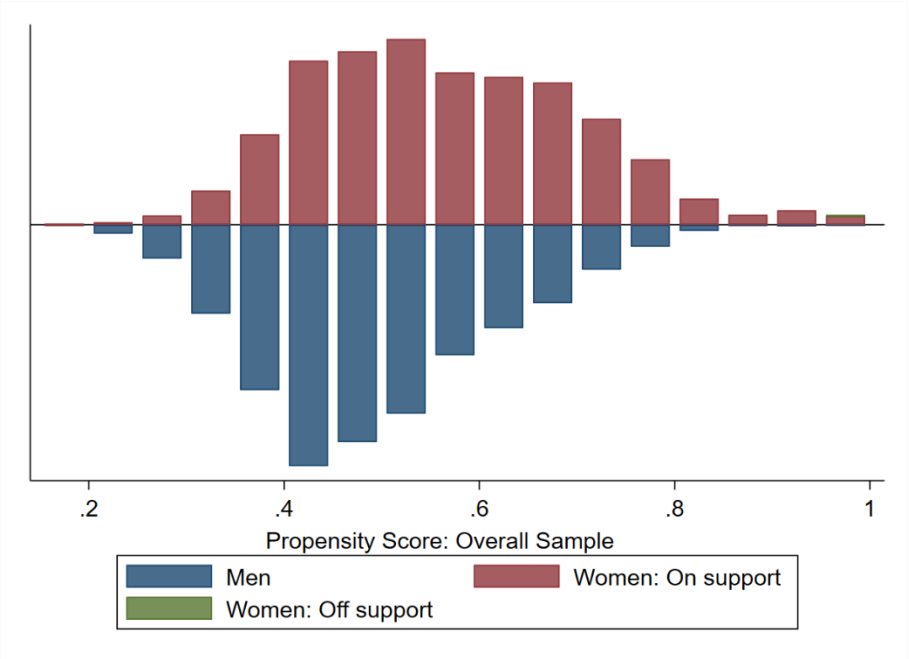

Figure 4.14 Common support – overall sample
Note: LFS 2014-2019. Working-age population (18-65) only.

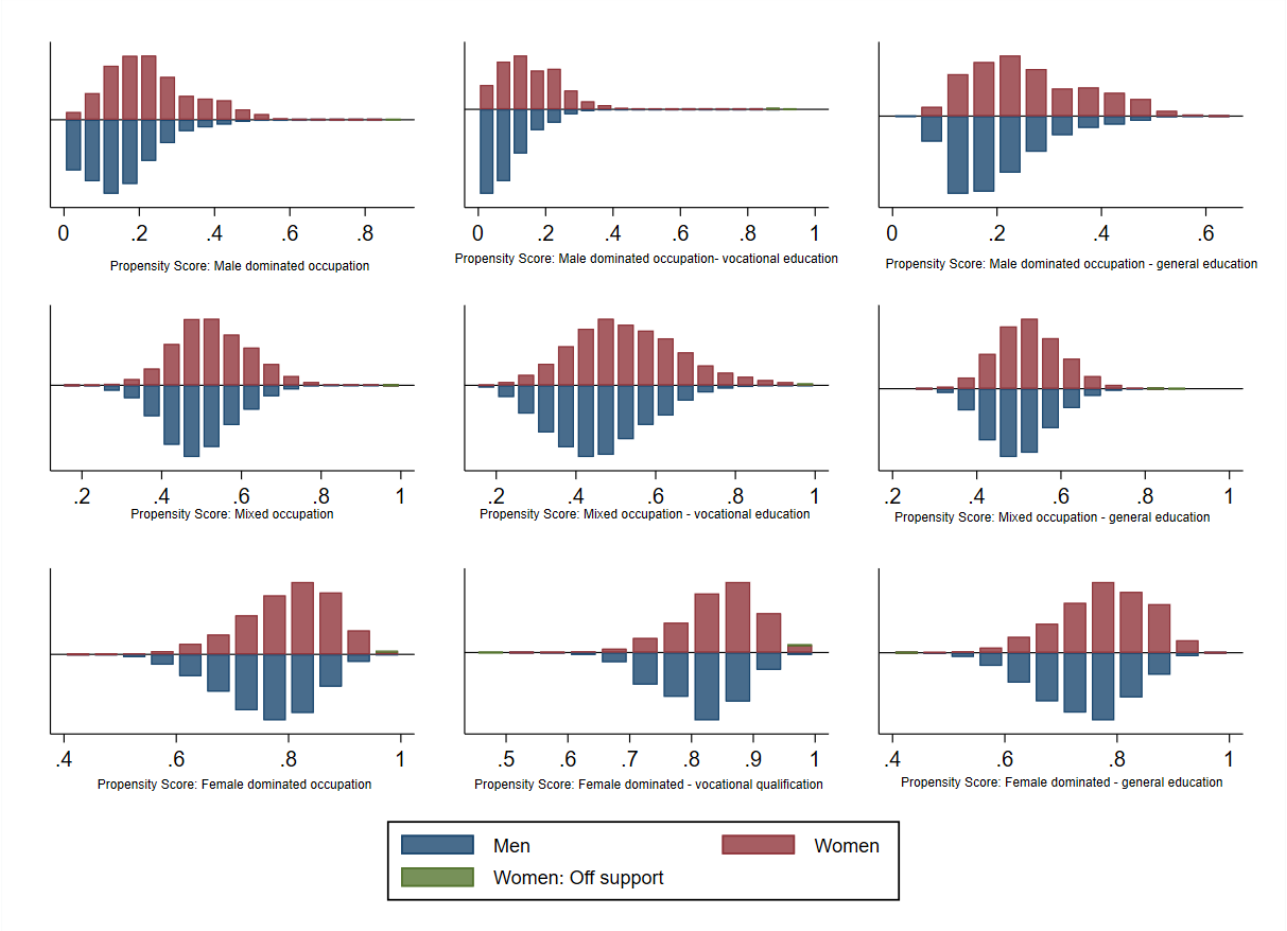

Figure 4.15 Common support by occupation and education
Note: LFS 2014-2019. Working-age population (18-65) only.

- Subject of the highest qualification achieved

The results reported in Table 4.3 are extended in Table 4.4 which adds to the baseline model the subject area of the highest qualification achieved across different occupations as one of the main explanatory variables. The aim is to understand whether having the appropriate qualification, in the required subject field, helps women to do better in terms of relative wages across different occupations and whether the impact changes according to the type of the highest educational qualification held by the individual (vocational or general). For this reason, an interaction term between the highest degree achieved (vocational or a general) and an indicator of whether the

individual has secured employment in the "appropriate" occupation[51] for the degree held is generated. The coefficient on the interaction term shows the additional return to the highest vocational degree from securing employment in a pertinent occupation relative to individuals with a general qualification as the highest qualification in the same occupation. The results show that women with a vocational background, working as Health Professionals (SOC22) or as Corporate managers and directors (SOC11), would benefit from getting a qualification mainly focused respectively on medicine and medical-related subjects or in management.

The coefficient on the "Matched Subject" variable instead defines the additional return to the highest general qualification in a relevant subject for that occupation. In other words, getting a qualification in the relevant subject could help women working in SOC61 "Caring personal and service occupation", in SOC22 "Health professionals", in SOC24 "Business, media, and public service professionals", and in SOC35 "Business and public service associate professionals" to reach a better position in the male wage distribution. Given that the sum of the base effect and the interaction term represents the total return to the vocational qualification in the relevant occupation, the same conclusion can be drawn for vocationally qualified women, since in no cases is there a significant negative interaction coefficient to offset this base effect.

[51] This study considers as appropriate those qualifications that allow individuals to gain the required experience, skills, or attributes, on average, to enter a particular occupation. Hence, this study identifies:

- Qualifications in medicine and medical related as appropriate qualifications when working as health professionals (SOC22)
- Qualifications in physical science, maths, computing, engineering, technology and biology as appropriate when working as science, research, engineering, and technology professionals (SOC21)
- Secretarial and hotel and catering qualifications as appropriate when working in administrative occupations (SOC41)
- Caring, personal service, and medical-related qualifications when working in caring personal service occupations (SOC61)
- Retail training/qualifications when working in sales occupations (SOC71)
- Education, literature, and art qualifications when working as teaching and educational professionals (SOC23)
- Engineering and management qualifications when working as corporate managers and directors (SOC11)
- Business, law and economics, and architecture when working as business, media, and public service professionals (SOC24)
- Business, social service, and law qualifications when working as business and public service associate professionals (SOC35)

Table 4.4 Determinants of women's position in the male wage distribution for given occupations

	Health	Science	Administrative	Caring	Sales	Teaching	Corporate	Business Media	Business PublicServ
VET	-0.156***	-0.095***	-0.107***	-0.046***	-0.050***	-0.247***	-0.168***	-0.156***	-0.167***
	(0.013)	(0.019)	(0.008)	(0.009)	(0.012)	(0.018)	(0.015)	(0.018)	(0.011)
MatchedSubject	**0.026*** **	**0.028***	**-0.092***	**0.048*** **	**-0.129***	**0.008**	**0.003**	**0.049*** **	**0.023***
	(0.007)	(0.015)	(0.039)	(0.014)	(0.062)	(0.007)	(0.012)	(0.010)	(0.010)
VET#MatchedSubject	0.046**	0.034	0.081	-0.014	0.098	-0.031	0.060*	-0.025	0.005
	(0.016)	(0.062)	(0.043)	(0.016)	(0.066)	(0.035)	(0.023)	(0.028)	(0.018)
Age	0.034***	0.046***	0.037***	0.022***	0.029***	0.044***	0.044***	0.053***	0.054***
	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)
Age squared	-0.032***	-0.042***	-0.039***	-0.024***	-0.033***	-0.043***	-0.045***	-0.055***	-0.058***
	(0.003)	(0.007)	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
Public	0.022**	-0.093***	-0.005	0.125***	0.071	0.052***	-0.007	-0.090***	-0.064***
	(0.008)	(0.013)	(0.008)	(0.007)	(0.042)	(0.009)	(0.012)	(0.009)	(0.009)
Married	-0.009*	-0.001	-0.000	-0.007	-0.004	-0.005	0.007	0.004	-0.000
	(0.004)	(0.008)	(0.004)	(0.004)	(0.007)	(0.004)	(0.006)	(0.005)	(0.005)
1 Child	0.003	0.026	-0.028**	-0.061***	-0.0318*	0.006	-0.009	-0.003	-0.013
	(0.008)	(0.017)	(0.010)	(0.009)	(0.015)	(0.010)	(0.014)	(0.012)	(0.011)
2 Children	0.032***	0.014	-0.047***	-0.079***	-0.029	0.004	0.000	0.017	-0.006
	(0.009)	(0.018)	(0.011)	(0.009)	(0.017)	(0.010)	(0.014)	(0.012)	(0.01)
3 Children	0.014	-0.018	-0.028	-0.115***	-0.0618*	-0.039*	-0.019	-0.059**	-0.028
	(0.014)	(0.038)	(0.019)	(0.014)	(0.026)	(0.016)	(0.027)	(0.023)	(0.023)
4+Children	-0.018	0.077	-0.058	-0.088***	-0.037	-0.039	-0.003	-0.143*	-0.048
	(0.027)	(0.089)	(0.043)	(0.024)	(0.047)	(0.034)	(0.061)	(0.056)	(0.048)
Size:1-25	0.014	-0.105***	-0.062***	-0.019*	-0.040**	-0.104***	-0.183***	-0.128***	-0.089***
	(0.008)	(0.017)	(0.008)	(0.008)	(0.012)	(0.010)	(0.012)	(0.011)	(0.009)
Size: 25-49	0.005	-0.089***	-0.061***	-0.066***	-0.009	-0.044***	-0.081***	-0.09***	-0.053***
	(0.009)	(0.022)	(0.011)	(0.008)	(0.018)	(0.008)	(0.017)	(0.015)	(0.013)
Black	-0.094***	-0.058	-0.062*	0.033*	-0.058	-0.029	-0.120***	-0.064**	-0.100**
	(0.015)	(0.047)	(0.024)	(0.017)	(0.037)	(0.029)	(0.034)	(0.024)	(0.032)
Asian	0.034*	-0.040	-0.013	-0.027	-0.030	-0.040	0.001	-0.017	-0.029
	(0.014)	(0.027)	(0.021)	(0.017)	(0.029)	(0.021)	(0.029)	(0.021)	(0.020)
Chinese	0.039	0.100*	-0.027	-0.014	-0.069	-0.063	0.072	-0.050	-0.046
	(0.039)	(0.042)	(0.050)	(0.066)	(0.064)	(0.062)	(0.065)	(0.051)	(0.044)
Other	0.023	-0.073	-0.065*	-0.024	0.034	-0.043	-0.017	-0.015	-0.054
	(0.022)	(0.041)	(0.029)	(0.026)	(0.039)	(0.026)	(0.039)	(0.027)	(0.029)
London	0.085***	0.127***	0.211***	0.090***	0.096***	0.069***	0.163***	0.116***	0.153***
	(0.012)	(0.022)	(0.015)	(0.014)	(0.024)	(0.012)	(0.014)	(0.013)	(0.013)
Bad health	-0.029**	0.014	-0.068***	-0.0182	-0.053**	-0.025	-0.068**	-0.039*	-0.030*
	(0.011)	(0.025)	(0.012)	(0.010)	(0.017)	(0.013)	(0.021)	(0.017)	(0.015)
Constant	-0.475***	-0.624***	-0.269***	0.0128	-0.046	-0.631***	-0.460***	-0.690***	-0.708***
	(0.049)	(0.103)	(0.048)	(0.041)	(0.058)	(0.059)	(0.092)	(0.072)	(0.059)
N	4932	1363	4813	6948	2048	5182	2206	2867	3662
adj. R^2	0.176	0.255	0.165	0.119	0.064	0.204	0.278	0.235	0.252

*Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.*

The variable “VET” represents instead the difference in relative wages between a woman with a vocational qualification as the highest qualification and one with a general qualification holding other factors constant. The latter acquires always a negative value for all the specifications, meaning that women with a vocational background are worse off than those with a general background in terms of relative wage.

- **Weekly working hours**

Given the narrowing path of the gender wage gap, mainly due to women’s improvement of their labour market characteristics and given the vertical and horizontal segregation extensively shown in this chapter, it could be useful to understand the reason behind women’s labour market choices: why do women keep self-selecting themselves into female-dominated occupations even though they end up facing the tougher glass ceiling effect? As suggested by Goldin (2014) in her prominent work, the most important amenity for women, who are still perceived from society’s perspective as the caregiver of their families, is time flexibility. The latter pushes women, and in particular family-oriented women, to look for jobs that allow them to reach a work-family balance, commonly defined as family-friendly jobs which, on average, end up being categorized as female-dominated occupations.

Table D.12 shows how the distribution of hours worked on weekly basis across wages in decile groups for both women and men across occupation types and within every single occupation. The first clear element revealed by the table is that women in female-dominated occupations show the lowest average in terms of usual weekly working hours across every single decile. Besides, the highest gap in terms of monthly working hours within the highest percentile is shown between women and men working in female-dominated occupations.

These results might provide a piece of evidence that those women who are more family-oriented and who self-select themselves into female-dominated occupations are those who attach greater importance to family time and consequently, value work flexibility the most. Subsequently, men in female-dominated occupations end up doing better than women in female-dominated occupations

given that their weekly working hours do not vary greatly between occupation types. The above mentioned might be one possible reason behind much of the gender wage gap and the significant glass ceiling effect in female-dominated occupations observed in the previous section. This hypothesis is endorsed by the fact that women in mixed occupations are concentrated in those occupations that show on average lower working hours.

4.7. Conclusion

Using UK Labour Force Survey microdata this chapter provides empirical evidence of the persistent existence of vertical and horizontal segregation still considered one of the main drivers of the ongoing phenomenon of the gender wage gap.

The raw data show that women self-select themselves mainly into female-dominated occupations and in some specific mixed occupations, usually characterized by a lower average hourly wage. Some evident differences emerge when comparing the distributions of qualifications between women and men across occupation types. While women register higher educational achievements in male-dominated occupations, men appear to be more educated in female-dominated occupations if compared with individuals of the opposite sex in the same occupation type. Moreover, the raw data reveals that only a small percentage of women specializes in highly remunerative disciplines (e.g., STEM), while, on the contrary, men show a higher likelihood if compared to women to be specialized in STEM fields.

The chapter then implements a relative distribution comparison to explore the evolution over the wage distribution of the gender pay gap. When enabling comparison across occupation types it seems clear that, surprisingly, women in female-dominated and mixed occupations end up facing the toughest glass ceiling effect leading to the conclusion that women who can secure employment in male-dominated occupations perform on average as well as men. However, when the educational background is taken into consideration, the findings show a quite different underlying story for women with vocational qualifications as the highest qualification compared to women with a general

qualification. Indeed, while women with a vocational qualification face the wider wage gap in the upper part of the wage distribution in male-dominated and mixed occupations; women with a general background are the ones facing their lowest glass ceiling effect in male-dominated occupations. Those preliminary findings indicate that policies that aim to address the problem of occupational segregation should be implemented concomitantly with those policies aiming at overcoming the problem of gender educational segregation, paying also attention to the different effects of vocational versus general backgrounds.

The chapter concludes with the implementation of a grade of transformation approach to examine the impact of background, family and job characteristics, and educational attainments on the dimension of the wage gap over the pay distribution. While the coefficients associated with human capital measures suggest that highly educated women do perform better in terms of the relative wage distribution, explaining in this way the well-acknowledged narrowing pattern of the gender wage gap over time, family characteristics such as the number of children and relationship status still stand out as drivers for the different magnitude of female and male wages.

If the above mentioned is then combined with the findings on the occupations into which women self-select themselves, whereby female-dominated occupations and some specific occupations of the mixed type show the lowest number of weekly working hours across wage deciles, then the underlying story behind much of the gender wage gap starts to become clearer: women who are still facing social expectations and gender stereotyping, struggle to reach a work-family balance, hence they opt-out from jobs that require more work commitment and self-select themselves in those jobs characterized by lower working loads, giving up the chance of performing in well-paid jobs.

In light of the fact that well-paid jobs are usually characterized by a high elasticity of annual income with respect to weekly working hours (Goldin, 2014), a much-needed approach to wear down gender differences in the wage distribution could involve changes in the labour market which should aim to guarantee workers greater flexibility. Most importantly, the use of flexible work should not be penalized and should not be granted at a cost of holding back women's careers but, on the contrary,

policymakers should use these tools with the intention to achieve greater linearity of earnings in terms of working hours. If flexibility at work is granted as a prized benefit, then women will never have the chance to overcome gender inequalities.

Appendix D

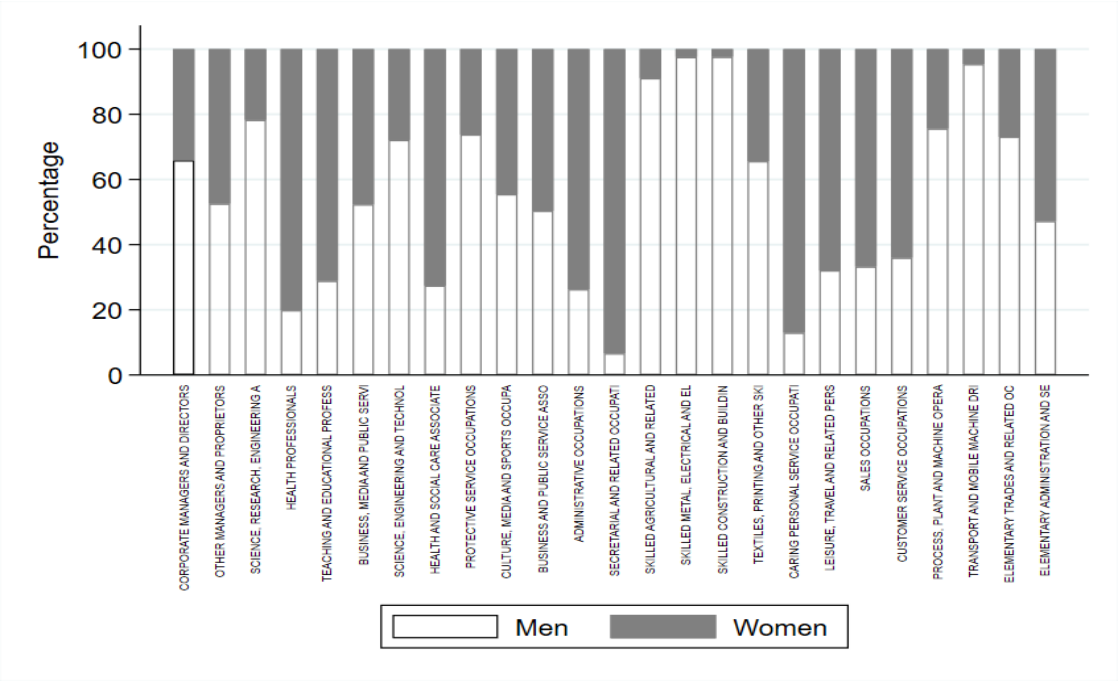

Figure D. 1 Occupations

Notes: Labour Force Survey data 2014-2019. Working-age adults only.

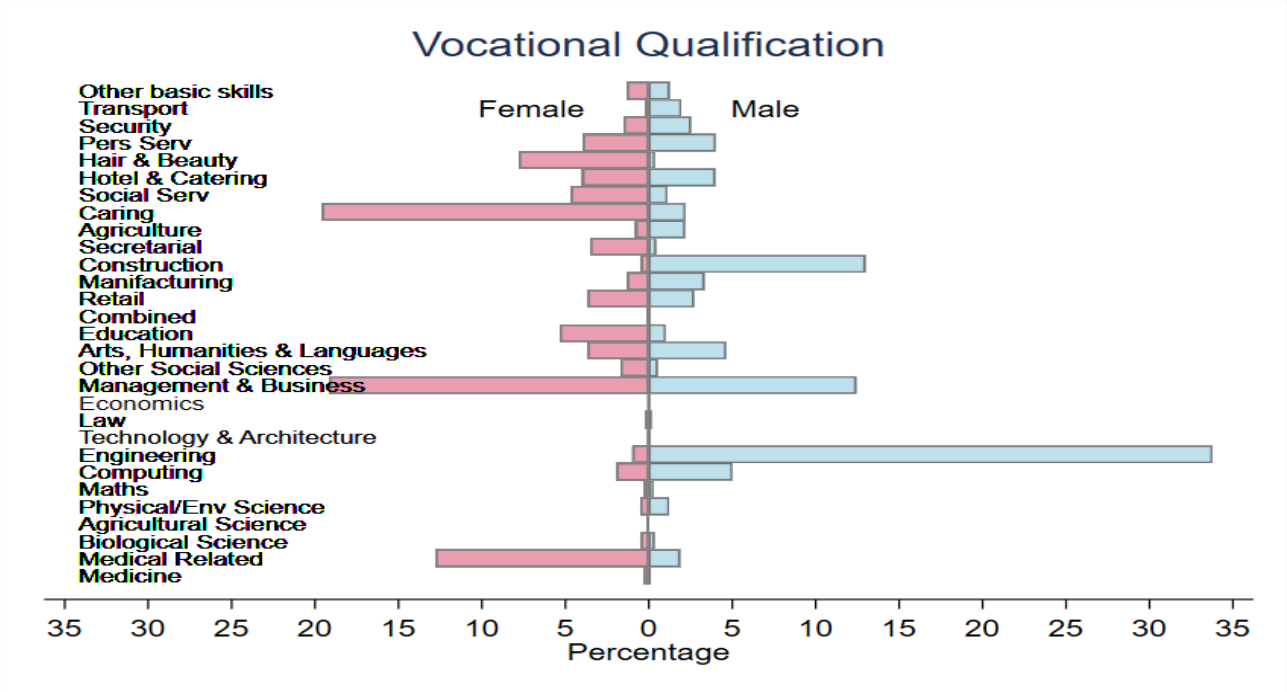

Figure D. 2 Distribution of qualifications by field of specialization among men and women with a vocational background

Notes: Labour Force Survey data 2014-2019. Working-age adults only.

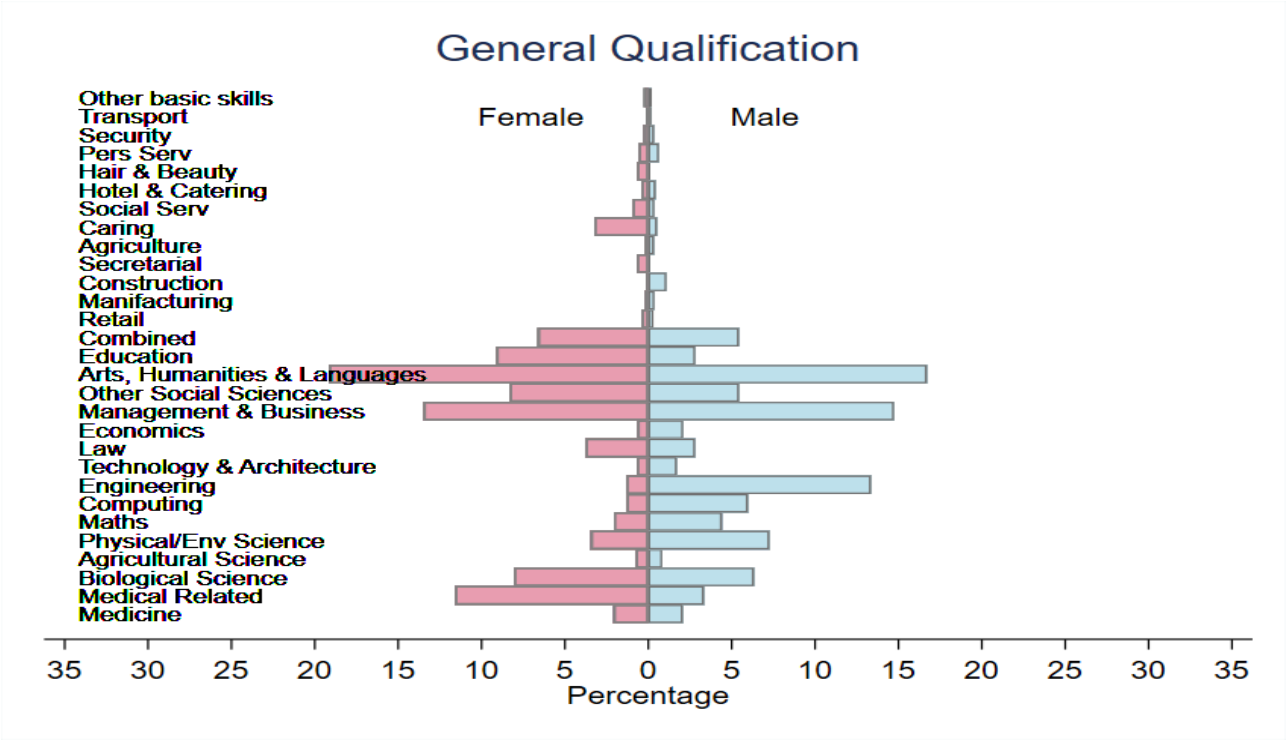

Figure D. 3 Distribution of qualifications by field of specialization among men and women with a general background

Notes: Labour Force Survey data 2014-2019. Working-age adults only.

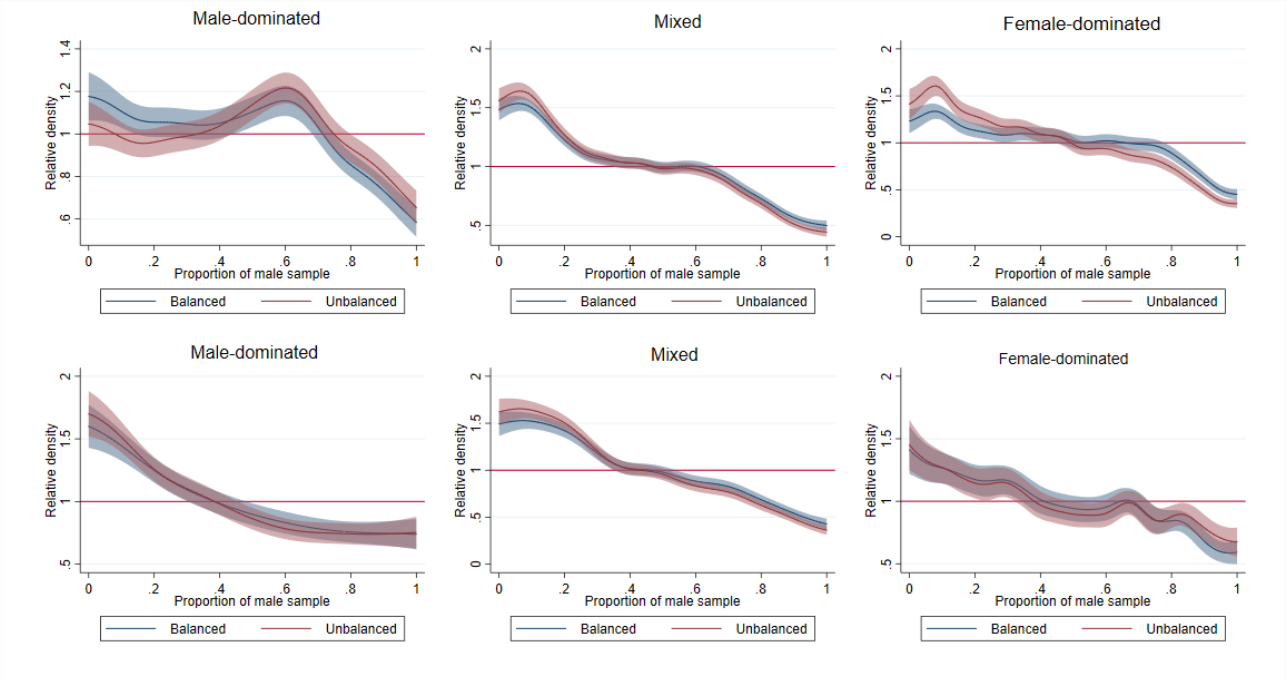

Figure D. 4 Relative density balanced versus unbalanced data by education and occupation types

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

Table D. 1 Covariates - common support: Male-dominated occupations

Variable	Comparison	Reference	% Bias	P value
Age	40.362	40.158	1.8	0.350
Public	0.288	0.284	1	0.663
Married	1.9098	1.8432	7.3	0.000
Children	0.672	0.648	2.5	0.171
Level 1 Vocational	0.089	0.089	-0.1	0.972
Level 2 Vocational	0.038	0.040	-0.7	0.685
Level 3 Vocational	0.063	0.060	0.9	0.538
Level 4 Vocational	0.004	0.003	3.7	0.095
Level 5 Vocational	0.040	0.033	3.2	0.059
Level 6 Vocational	0.006	0.004	2.6	0.115
Level 7 Vocational	0.002	0.002	0	1.000
Level 1 General	0.019	0.019	-0.1	0.943
Level 2 General	0.133	0.133	-0.1	0.954
Level 3 General	0.074	0.072	1	0.622
Level 4 General	0.000	0.000	0	1.000
Level 5 General	0.032	0.027	3	0.144
Level 6 General	0.256	0.264	-1.8	0.393
Level 7 General	0.170	0.179	-2.6	0.264
Size 1-25	0.181	0.174	1.7	0.353
Size 25-49	0.096	0.090	2	0.293
Black	0.016	0.011	3.8	0.035
Asian	0.069	0.066	1.1	0.610
Chinese	0.008	0.007	1.8	0.429
Other	0.026	0.024	1.2	0.571
London	0.083	0.075	3.1	0.124
Bad Health	0.089	0.068	7.5	0.000

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. Total observations: 30787: 25638 Male, 5149 Women. Off support: 3.

Table D. 2 Covariates - common support: Mixed dominated occupations

Variable	Comparison	Reference	% Bias	P Value
Age	40.623	40.271	2.8	0.000
Public	0.200	0.195	1.3	0.084
Married	1.9154	1.8788	4.1	0.000
Children	0.736	0.676	6	0.000
Level 1 Vocational	0.054	0.049	2.5	0.001
Level 2 Vocational	0.064	0.061	1.2	0.180
Level 3 Vocational	0.097	0.097	0	0.989
Level 4 Vocational	0.006	0.006	0	0.959
Level 5 Vocational	0.029	0.025	1.7	0.012
Level 6 Vocational	0.011	0 .0088	2.3	0.008
Level 7 Vocational	0.006	0.006	1	0.289
Level 1 General	0.027	0.026	0.6	0.468
Level 2 General	0.173	0.182	-2.5	0.004
Level 3 General	0.106	0.109	-1.1	0.200
Level 4 General	0.000	0.000	0.7	0.225
Level 5 General	0.034	0.032	1.1	0.182
Level 6 General	0.230	0.235	-1.3	0.118
Level 7 General	0.089	0.088	0.3	0.690
Size 1-25	0.374	0.371	0.6	0.451
Size 25-49	0.126	0.116	3	0.000
Black	0.023	0.018	2.9	0.000
Asian	0.042	0.035	3	0.000
Chinese	0.006	0.005	1.1	0.189
Other	0.022	0.017	3.2	0.000
London	0.107	0.093	4.7	0.000
Bad Health	0.104	0.096	2.8	0.001

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. Total observations: 59658: 29189 Male, 30469Women. Off support: 1.

Table D. 3 Covariates – common support: Female-dominated occupations

Variable	Comparison	Reference	% Bias	P Value
Age	42.174	42.28	-0.9	0.221
Public	0.506	0.514	-1.9	0.025
Married	1.9839	1.9914	-0.8	0.291
Children	0.817	0.758	5.8	0.000
Level 1 Vocational	0.030	0.024	2.8	0.000
Level 2 Vocational	0.066	0.064	0.8	0.290
Level 3 Vocational	0.143	0.145	-0.7	0.343
Level 4 Vocational	0.041	0.037	3.4	0.006
Level 5 Vocational	0.028	0.026	1.1	0.057
Level 6 Vocational	0.012	0.010	2.2	0.006
Level 7 Vocational	0.004	0.003	2	0.002
Level 1 General	0.015	0.012	1.9	0.000
Level 2 General	0.142	0.157	-4.3	0.000
Level 3 General	0.072	0.065	2.5	0.000
Level 4 General	0.001	0.000	0.4	0.612
Level 5 General	0.049	0.043	3.2	0.000
Level 6 General	0.236	0.243	-1.7	0.021
Level 7 General	0.135	0.140	-1.7	0.038
Size 1-25	0.321	0.321	0	0.988
Size 25-49	0.174	0.179	-1.4	0.087
Black	0.031	0.025	4.1	0.000
Asian	0.042	0.039	1.4	0.023
Chinese	0.003	0.003	0.9	0.104
Other	0.019	0.016	2	0.002
London	0.088	0.079	2.9	0.000
Bad Health	0.098	0.093	1.6	0.028

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. Total observations: 48276: 10151 Male, 38130 Women. Off support: 5.

Table D. 4 Definition of 2-Digit SOC2010 Occupational Classification

Sub-Major Group	Minor Group	Occupations
SOC11		**CORPORATE MANAGERS AND DIRECTORS**
	111	Chief Executives and Senior Officials
	112	Production Managers and Directors
	113	Functional Managers and Directors
	115	Financial Institution Managers and Directors
	116	Managers and Directors in Transport and Logistics
	117	Senior Officers in Protective Services
	118	Health and Social Services Managers and Directors
	119	Managers and Directors in Retail and Wholesale
SOC12		**OTHER MANAGERS AND PROPRIETORS**
	121	Managers and Proprietors in Agriculture Related Services
	122	Managers and Proprietors in Hospitality and Leisure Services
	124	Managers and Proprietors in Health and Care Services
	125	Managers and Proprietors in Other Services
SOC21		**SCIENCE, RESEARCH, ENGINEERING AND TECHNOLOGY PROFESSIONALS**
	211	Natural and Social Science Professionals
	212	Engineering Professionals
	213	Information Technology and Telecommunications Professionals
	214	Conservation and Environment Professionals
	215	Research and Development Managers
SOC22		**HEALTH PROFESSIONALS**
	221	Health Professionals
	222	Therapy Professionals
	223	Nursing and Midwifery Professionals
SOC23		**TEACHING AND EDUCATIONAL PROFESSIONALS**
	231	Teaching and Educational Professionals
SOC24		**BUSINESS, MEDIA AND PUBLIC SERVICE PROFESSIONALS**
	241	Legal Professionals
	242	Business, Research and Administrative Professionals
	243	Architects, Town Planners and Surveyors
	244	Welfare Professionals
	245	Librarians and Related Professionals
	246	Quality and Regulatory Professionals
	247	Media Professionals
SOC31		**SCIENCE, ENGINEERING AND TECHNOLOGY ASSOCIATE PROFESSIONALS**
	311	Science, Engineering and Production Technicians
	312	Draughtspersons and Related Architectural Technicians
	313	Information Technology Technicians
SOC32		**HEALTH AND SOCIAL CARE ASSOCIATE PROFESSIONALS**
	321	Health Associate Professionals
	323	Welfare and Housing Associate Professionals
SOC33		**PROTECTIVE SERVICE OCCUPATIONS**

	331	Protective Service Occupations
SOC34		**CULTURE, MEDIA AND SPORTS OCCUPATIONS**
	341	Artistic, Literary and Media Occupations
	342	Design Occupations
	344	Sports and Fitness Occupations
SOC35		**BUSINESS AND PUBLIC SERVICE ASSOCIATE PROFESSIONALS**
	351	Transport Associate Professionals
	352	Legal Associate Professionals
	353	Business, Finance and Related Associate Professionals
	354	Sales, Marketing and Related Associate Professionals
	355	Conservation and Environmental Associate Professionals
	356	Public Services and Other Associate Professionals
SOC41		**ADMINISTRATIVE OCCUPATIONS**
	411	Administrative Occupations: Government and Related Organisations
	412	Administrative Occupations: Finance
	413	Administrative Occupations: Records
	415	Other Administrative Occupations
	416	Administrative Occupations: Office Managers and Supervisors
SOC42		**SECRETARIAL AND RELATED OCCUPATIONS**
	421	Secretarial and Related Occupations
SOC51		**SKILLED AGRICULTURAL AND RELATED TRADES**
	511	Agricultural and Related Trades
SOC52		**SKILLED METAL, ELECTRICAL AND ELECTRONIC TRADES**
	521	Metal Forming, Welding and Related Trades
	522	Metal Machining, Fitting and Instrument Making Trades
	523	Vehicle Trades
	524	Electrical and Electronic Trades
	525	Skilled Metal, Electrical and Electronic Trades Supervisors
SOC53		**SKILLED CONSTRUCTION AND BUILDING TRADES**
	531	Construction and Building Trades
	532	Building Finishing Trades
	533	Construction and Building Trades Supervisors
SOC54		**TEXTILES, PRINTING AND OTHER SKILLED TRADES**
	541	Textiles and Garments Trades
	542	Printing Trades
	543	Food Preparation and Hospitality Trades
	544	Other Skilled Trades
SOC61		**CARING PERSONAL SERVICE OCCUPATIONS**
	612	Childcare and Related Personal Services
	613	Animal Care and Control Services
	614	Caring Personal Services
SOC62		**LEISURE, TRAVEL AND RELATED PERSONAL SERVICE OCCUPATIONS**
	621	Leisure and Travel Services
	622	Hairdressers and Related Services
	623	Housekeeping and Related Services

	624	Cleaning and Housekeeping Managers and Supervisors
SOC71		**SALES OCCUPATIONS**
	711	Sales Assistants and Retail Cashiers
	712	Sales Related Occupations
	713	Sales Supervisors
SOC72		**CUSTOMER SERVICE OCCUPATIONS**
	721	Customer Service Occupations
	722	Customer Service Managers and Supervisors
SOC81		**PROCESS, PLANT AND MACHINE OPERATIVES**
	811	Process Operatives
	812	Plant and Machine Operatives
	813	Assemblers and Routine Operatives
	814	Construction Operatives
SOC82		**TRANSPORT AND MOBILE MACHINE DRIVERS AND OPERATIVES**
	821	Road Transport Drivers
	822	Mobile Machine Drivers and Operatives
	823	Other Drivers and Transport Operatives
SOC91		**ELEMENTARY TRADES AND RELATED OCCUPATIONS**
	911	Elementary Agricultural Occupations
	912	Elementary Construction Occupations
	913	Elementary Process Plant Occupations
SOC92		**ELEMENTARY ADMINISTRATION AND SERVICE OCCUPATIONS**
	921	Elementary Administration Occupations
	923	Elementary Cleaning Occupations
	924	Elementary Security Occupations
	925	Elementary Sales Occupations
	926	Elementary Storage Occupations
	927	Other Elementary Services Occupations

Table D. 5 Number of vocational and general qualification holders - highest qualification achieved

	Full sample	Female	Male
Postgraduate	16392	8862	7530
Degree	40173	22029	18144
Higher Education	8102	5756	2346
General level 3	10574	5528	5046
General level 2	16530	9337	7193
General level 1	2925	1340	1585
Nvq level 5	465	257	208
Nvq level 4	1239	731	508
Nvq level 3	8480	5338	3142
Nvq level 2	2799	1751	1048
Nvq level 1	344	187	157
Gnvq level 1	8	3	5
Btec level 4	6138	2314	3824
Btec level 3	3317	1578	1739
Btec level 2	138	69	69
Btec level 1	31	15	16
Rsa level 4	84	83	1
Rsa level 3	267	259	8
Rsa level 2	38	33	5
Rsa level 1	91	89	2
Gnvq level 3	476	252	224
Gnvq level 2	59	31	28
Gnvq level 1	8	3	5
City & Guilds level3	2030	275	1755
City & Guilds level2	277	76	201
City & Guilds level1	118	38	80
Apprentice	3156	650	2506
Other qualification Level 3	3478	1878	1600
Other qualification Level 2	11967	6539	5428
Other qualification	5962	2473	3489
No qualification	9625	4462	5163
N	155283	82233	73050

Note: Labour Force Survey data 2014-2019. Working age population (18-65) only.

Table D. 6 Definition of the variables used in the analysis.

Variable	Category	Description
Age	Background characteristics	Continuous-variable in years
London	Background characteristics	Dummy variable (0, 1). 1 if the individual is resident in London; 0 otherwise.
Female	Background characteristics	Dummy variable (0, 1). 1 if the individual is female; 0 otherwise
White	Background characteristics	Dummy variable (0, 1). 1 if the individual is white; 0 otherwise.
Black	Background characteristics	Dummy variable (0, 1). 1 if the individual is black; 0 otherwise.
Asian	Background characteristics	Dummy variable (0, 1). 1 if the individual is Asian; 0 otherwise.
Chinese	Background characteristics	Dummy variable (0, 1). 1 if the individual is Chinese; 0 otherwise.
Other	Background characteristics	Dummy variable (0, 1). 1 if the individual has any other ethnic background; 0 otherwise.
Bad health	Background characteristics	Dummy variable (0, 1). 1 if the individual has a bad health status; 0 otherwise.
No child	Background characteristics	Dummy variable (0, 1). 1 if the individual has no children; 0 otherwise.
1 Child	Background characteristics	Dummy variable (0, 1). 1 if the individual has a child; 0 otherwise.
2 Children	Background characteristics	Dummy variable (0, 1). 1 if the individual has two children; 0 otherwise.
3 Children	Background characteristics	Dummy variable (0, 1). 1 if the individual has three children; 0 otherwise.
4 or more Children	Background characteristics	Dummy variable (0, 1). 1 if the individual has four or more children; 0 otherwise.
Married	Relationship status	Dummy variable (0, 1). 1 if the reference person has a partner; 0 otherwise
Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has any vocational qualification as highest qualification achieved; 0 otherwise
Level 1 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 1 vocational qualification as highest qualification achieved; 0 otherwise
Level 1 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 1 general qualification as highest qualification achieved; 0 otherwise
Level 2 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 2 vocational qualification as highest qualification achieved; 0 otherwise

Level 2 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 2 general qualification as highest qualification achieved; 0 otherwise
Level 3 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 3 vocational qualification as highest qualification achieved; 0 otherwise
Level 3 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 3 general qualification as highest qualification achieved; 0 otherwise
Level 4 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 4 vocational qualification as highest qualification achieved; 0 otherwise
Level 4 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 4 general qualification as highest qualification achieved; 0 otherwise
Level 5 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 5 vocational qualification as highest qualification achieved; 0 otherwise
Level 5 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 5 general qualification as highest qualification achieved; 0 otherwise
Level 6 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 6 vocational qualification as highest qualification achieved; 0 otherwise
Level 6 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 6 general qualification as highest qualification achieved; 0 otherwise
Level 7 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 7 vocational qualification as highest qualification achieved; 0 otherwise
Level 7 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 7 general qualification as highest qualification achieved; 0 otherwise
Level 8 Vocational	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 8 vocational qualification as highest qualification achieved; 0 otherwise
Level 8 General	Educational background	Dummy variable (0, 1). 1 if the respondent has a level 8 general qualification as highest qualification achieved; 0 otherwise
Employed	Job characteristics	Dummy variable (0, 1). 1 if the individual is employed; 0 otherwise
Hourly earnings	Job characteristics	Continuous variable, in pounds
Male-dominated	Job characteristics	Dummy variable (0, 1). 1 if the individual works in a male-dominated occupation; 0 otherwise
Mixed	Job characteristics	Dummy variable (0, 1). 1 if the individual works in a mixed occupation; 0 otherwise

Female dominated	Job characteristics	Dummy variable (0, 1). 1 if the individual works in a female-dominated occupation; 0 otherwise
Corporate Managers and Directors	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as a manager or professional; 0 otherwise
Other managers and proprietors	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as managers or proprietors; 0 otherwise
Business, media, and public service professionals	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as a business, media and public service professional; 0 otherwise
Culture media and sports occupations	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in culture media and sports occupations; 0 otherwise
Business and public service associate professionals	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as a business and public service associate professional; 0 otherwise
Textiles, printing, and other skilled trades	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in textile, printing and other skilled trades; 0 otherwise
Sales occupations	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in sales occupations; 0 otherwise
Customer service occupations	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in customer service occupations; 0 otherwise
Elementary administration and service occupations	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in elementary administration and service occupations; 0 otherwise
Science, engineering, and technology associate professionals	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as a science, engineering, and technology associate professional; 0 otherwise
Protective service occupations	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in protective service occupations; 0 otherwise
Skilled agricultural and related trades	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in skilled agricultural and related trades; 0 otherwise
Skilled metal electrical and electronic trades	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in skilled metal electrical and electronic trades; 0 otherwise
Skilled construction and building trades	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in skilled construction and building trades; 0 otherwise
Science, research, engineering, and technology professionals	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as a science, research, engineering, and technology professional; 0 otherwise
Teaching and other educational Professionals	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as a teaching and other educational professional; 0 otherwise
Health and social care associate professionals	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as a health and social care associate professional; 0 otherwise
Administrative occupations	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in administrative occupations; 0 otherwise
Secretarial and related occupations	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in secretarial and related occupations; 0 otherwise

Caring personal service occupations	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in caring personal service occupations; 0 otherwise
Leisure, travel, and related personal service occupations	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in leisure, travel and related personal service occupations; 0 otherwise
Health professionals	Job characteristics	Dummy variable (0, 1). 1 if the respondent works as a health professional; 0 otherwise
Size 1_25	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in a firm with less than 25 employees; 0 otherwise
Size 25_49	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in a firm with 25-49 employees; 0 otherwise
Size 50_more	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in a firm with more than 50 employees; 0 otherwise
Full-time	Job characteristics	Dummy variable (0, 1). 1 if the respondent works full-time; 0 otherwise
Public-Sector	Job characteristics	Dummy variable (0, 1). 1 if the respondent works in a public sector; 0 otherwise

Table D. 7 Descriptive statistics: female subsample

	Male-dominated			Mixed			Female-dominated		
Variable	N	Mean	SD	N	Mean	SD	N	Mean	SD
Log hourly wage	5281	2.479	0.49	31249	2.364	0.529	39048	2.39	0.44
Age	6655	40.41	11.4	39968	40.39	12.62	49023	42.05	12.09
Public	6643	0.269	0.44	39757	0.19	0.392	48974	0.49	0.5
Married	6655	0.487	0.5	39968	0.459	0.498	49023	0.532	0.499
No child	6655	0.586	0.49	39968	0.564	0.496	49023	0.536	0.499
1 Child	6655	0.21	0.41	39968	0.21	0.407	49023	0.206	0.405
2 Children	6655	0.166	0.37	39968	0.172	0.377	49023	0.197	0.398
3 Children	6655	0.031	0.17	39968	0.042	0.2	49023	0.049	0.215
4 Children	6655	0.007	0.08	39968	0.013	0.111	49023	0.012	0.11
Black	6651	0.019	0.14	39942	0.026	0.158	48994	0.035	0.183
Asian	6651	0.073	0.26	39942	0.048	0.213	48994	0.047	0.212
Chinese	6651	0.008	0.09	39942	0.006	0.08	48994	0.004	0.061
White	6651	0.874	0.33	39942	0.898	0.303	48994	0.895	0.307
Other	6651	0.026	0.16	39942	0.022	0.148	48994	0.02	0.139
London	6614	0.086	0.28	39757	0.113	0.317	48680	0.094	0.292
Bad Health	6655	0.089	0.29	39968	0.103	0.304	49023	0.096	0.294
size_1_25	6581	0.197	0.4	39349	0.388	0.487	48411	0.336	0.472
size_25_49	6581	0.094	0.29	39349	0.124	0.33	48411	0.17	0.375
size_50_more	6581	0.709	0.45	39349	0.487	0.5	48411	0.494	0.5
Managers	6655			39703	0.117	0.322	49023		
Other managers	6655			39703	0.05	0.218	49023		
Business and public service associate professionals	6655			39703	0.114	0.318	49023		
Culture media and sports occupations	6655			39703	0.023	0.149	49023		
Business, media, and public service professionals	6655			39703	0.178	0.383	49023		
Textiles, printing, and other skilled trades	6655			39703	0.034	0.18	49023		
Sales occupations	6655			39703	0.191	0.393	49023		
Customer service occupations	6655			39703	0.066	0.249	49023		
Elementary administration and service occupations	6655			39703	0.227	0.419	49023		
Science, engineering, and technology	6655	0.152	0.36	39703			49023		
Protective service occupations	6655	0.1	0.3	39703			49023		
Skilled agricultural and related trades	6655	0.012	0.11	39703			49023		
Skilled metal electrical and electronic trades	6655	0.025	0.16	39703			49023		
Skilled construction and building trades	6655	0.011	0.1	39703			49023		
Science, research, engineering, and technology prof	6655	0.34	0.47	39703			49023		
Teaching and other educational Professionals	6655			39703			49023	0.146	0.353
Health and social care associate professionals	6655			39703			49023	0.042	0.201
Administrative occupations	6655			39703			49023	0.26	0.439
Secretarial and related occupations	6655			39703			49023	0.089	0.285
Caring personal service occupations	6655			39703			49023	0.273	0.446
Leisure, travel, and related personal service occupations	6655			39703			49023	0.044	0.205
Health professionals	6655			39703			49023	0.145	0.352

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

Table D. 8 Descriptive statistics: male subsample

	Male-dominated			Mixed			Female-dominated		
Variable	N	Mean	SD	N	Mean	SD	N	Mean	SD
Log hourly wage	26550	2.544	0.47	30010	2.586	0.577	10406	2.556	0.488
Age	35152	41.47	12.3	40762	40.88	12.48	13323	41.23	12.46
Public	35109	0.123	0.33	40481	0.115	0.319	13311	0.492	0.5
Married	35152	0.539	0.5	40762	0.543	0.498	13323	0.538	0.499
No child	35152	0.576	0.49	40762	0.558	0.497	13323	0.579	0.494
1 Child	35152	0.186	0.39	40762	0.183	0.387	13323	0.18	0.384
2 Children	35152	0.177	0.38	40762	0.189	0.392	13323	0.174	0.379
3 Children	35152	0.046	0.21	40762	0.053	0.223	13323	0.049	0.217
4 Children	35152	0.016	0.13	40762	0.017	0.129	13323	0.017	0.13
Black	35131	0.018	0.13	40728	0.025	0.156	13314	0.043	0.202
Asian	35131	0.047	0.21	40728	0.068	0.252	13314	0.081	0.273
Chinese	35131	0.003	0.05	40728	0.006	0.074	13314	0.005	0.073
White	35131	0.915	0.28	40728	0.877	0.328	13314	0.84	0.367
Other	35131	0.017	0.13	40728	0.024	0.153	13314	0.031	0.173
London	34919	0.071	0.26	40567	0.127	0.333	13231	0.11	0.313
Bad Health	35152	0.081	0.27	40762	0.081	0.272	13323	0.089	0.285
size_1_25	34433	0.299	0.46	39856	0.356	0.479	13114	0.256	0.437
size_25_49	34433	0.113	0.32	39856	0.122	0.328	13114	0.126	0.332
size_50_more	34433	0.588	0.49	39856	0.521	0.5	13114	0.618	0.486
Managers	35152			40339	0.223	0.416	13323		
Other managers	35152			40339	0.055	0.227	13323		
Business and public service associate professionals	35152			40339	0.123	0.329	13323		
Culture media and sports occupations	35152			40339	0.028	0.165	13323		
Business, media, and public service professionals	35152			40339	0.178	0.383	13323		
Textiles, printing, and other skilled trades	35152			40339	0.063	0.243	13323		
Sales occupations	35152			40339	0.093	0.291	13323		
Customer service occupations	35152			40339	0.037	0.188	13323		
Elementary administration and service occupations	35152			40339	0.2	0.4	13323		
Science, engineering, and technology	35152	0.074	0.26	40339			13323		
Protective service occupations	35152	0.053	0.22	40339			13323		
Skilled agricultural and related trades	35152	0.023	0.15	40339			13323		
Skilled metal electrical and electronic trades	35152	0.189	0.39	40339			13323		
Skilled construction and building trades	35152	0.084	0.28	40339			13323		
Science, research, engineering, and technology prof	35152	0.232	0.42	40339			13323		
Teaching and other educational Professionals	35152			40339			13323	0.218	0.413
Health and social care associate professionals	35152			40339			13323	0.059	0.235
Administrative occupations	35152			40339			13323	0.341	0.474
Secretarial and related occupations	35152			40339			13323	0.023	0.151
Caring personal service occupations	35152			40339			13323	0.15	0.357
Leisure, travel, and related personal service occupations	35152			40339			13323	0.077	0.266
Health professionals	35152			40339			13323	0.132	0.339

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

Table D. 9 Descriptive analysis of the hourly wage by education type and across occupation type

Male-Dominated			
Vocational	Male	Female	Difference
	2.486	2.295	0.191***
General	Male	Female	Difference
	2.645	2.593	0.052***
Difference	-0.156***	-0.298***	
Mixed			
Vocational	Male	Female	Difference
	2.453	2.211	0.241***
General	Male	Female	Difference
	2.681	2.468	0.213***
Difference	-0.228***	-0.257***	
Female Dominated			
Vocational	Male	Female	Difference
	2.316	2.222	0.094***
General	Male	Female	Difference
	2.646	2.486	0.160***
Difference	-0.330***	-0.264***	

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. Significance level: * p < 0.10, ** p < 0.05, *** p < 0.01.

Table D. 10 Location and Shape effect

Log Hourly wage	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95% Conf. Interval]**	
Location	61.01918	2.390137	25.53	0	56.3346	65.70377
Shape	38.98082	2.390137	16.31	0	34.29623	43.6654

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only. The test implemented is based on the comparison of the entropy (Kullback-Leibler divergence) of the unadjusted and adjusted relative distributions (Bernhardt et al, 1999).

Table D. 11 Shares of men and women in male-dominated, mixed and female-dominated occupations

FEMALE					**FEMALE shares**				
	MD	**M**	**FD**	**TOTAL**		**MD**	**M**	**FD**	**TOTAL**
general	4080	28163	29209	61452	**general**	5%	32%	33%	70%
vocational	1328	10064	15553	26945	**vocational**	2%	11%	18%	30%
TOTAL	5408	38227	44762	88397	**TOTAL**	6%	43%	51%	100%

MALE					**MALE shares**				
	MD	**M**	**FD**	**TOTAL**		**MD**	**M**	**FD**	**TOTAL**
general	19573	24998	7956	52527	**general**	24%	31%	10%	65%
vocational	15785	9660	2709	28154	**vocational**	20%	12%	3%	35%
TOTAL	35358	34658	10665	80681	**TOTAL**	44%	43%	13%	100%

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

Table D. 12 Weekly working hours by occupations in each wage percentile

MALE-DOMINATED				MIXED				FEMALE-DOMINATED			
Occupation	Wage Groups	Female	Male	*Occupation*	Wage Groups	Female	Male	*Occupation*	Wage Groups	Female	Male
	0-10	37.27	42.50		0-10	37.63	46.99		0-10	37.45	43.46
	10-20	37.78	42.13		10-20	38.17	45.81	*SOC22*	10-20	36.93	41.67
SOC21	20-30	37.33	41.27	*SOC11*	20-30	37.94	45.54		20-30	36.31	39.95
	30-40	38.24	41.07		30-40	39.14	45.51		30-40	35.38	42.18
	40-50	37.46	41.09		40-50	38.91	45.52		40-50	34.63	42.15
	50-60	37.76	41.46		50-60	39.91	45.48		50-60	34.29	42.14
	60-70	36.95	41.51		60-70	40.27	45.66		60-70	33.87	43.29
	70-80	37.99	42.03		70-80	42.08	46.78		70-80	33.66	45.42
	80-90	38.61	42.10		80-90	42.09	47.39		80-90	34.70	47.51
	90-100	40.18	43.56		90-100	44.64	47.59		90-100	35.09	45.06
	0-10	34.37	41.31		0-10	39.33	45.37		0-10	33.70	40.65
	10-20	33.67	40.20	*SOC12*	10-20	37.32	43.59		10-20	39.10	45.21
SOC31	20-30	36.29	40.17		20-30	38.43	44.25	*SOC23*	20-30	42.41	44.40
	30-40	34.56	41.27		30-40	39.14	45.73		30-40	42.52	43.45
	40-50	36.12	41.15		40-50	38.91	44.17		40-50	40.76	44.04
	50-60	36.20	42.22		50-60	39.46	46.27		50-60	41.07	44.31
	60-70	35.69	41.03		60-70	38.99	44.60		60-70	40.43	46.05
	70-80	34.47	41.68		70-80	38.32	44.83		70-80	41.39	45.31
	80-90	35.57	40.82		80-90	40.52	44.01		80-90	41.11	44.91
	90-100	36.34	42.51		90-100	40.83	44.45		90-100	39.95	46.89
	0-10	43.69	52.63		0-10	35.66	43.11		0-10	30.94	38.05
	10-20	40.31	46.05		10-20	36.09	41.88		10-20	31.85	35.87
SOC33	20-30	39.24	45.48	*SOC24*	20-30	36.85	41.08	*SOC32*	20-30	30.69	37.72
	30-40	40.67	43.47		30-40	37.12	41.81		30-40	32.96	38.05
	40-50	39.23	43.14		40-50	37.04	41.34		40-50	33.81	38.11
	50-60	41.15	43.19		50-60	35.58	42.23		50-60	33.89	39.62
	60-70	40.64	44.21		60-70	37.32	42.45		60-70	34.45	37.90
	70-80	36.27	42.39		70-80	38.13	43.35		70-80	32.35	38.17
	80-90	39.55	42.39		80-90	39.25	44.34		80-90	34.34	37.79
	90-100	38.04	41.87		90-100	39.93	44.66		90-100	31.06	39.14
	0-10	49.71	51.20		0-10	31.03	34.32		0-10	29.79	36.29
	10-20	32.80	40.51		10-20	31.63	35.91		10-20	30.69	37.06
SOC51	20-30	27.49	36.98	*SOC34*	20-30	29.16	38.85	*SOC41*	20-30	31.89	38.79
	30-40	24.63	43.35		30-40	32.35	39.09		30-40	32.04	38.02
	40-50	34.78	40.11		40-50	31.97	37.09		40-50	31.44	38.83
	50-60	35.37	41.25		50-60	33.63	39.72		50-60	32.25	38.47
	60-70	27.37	40.70		60-70	31.90	40.79		60-70	32.59	38.87
	70-80	30.39	41.57		70-80	32.60	40.80		70-80	32.91	39.04
	80-90	32.16	42.07		80-90	32.54	39.48		80-90	32.87	39.17
	90-100	25.10	41.22		90-100	33.72	40.98		90-100	32.55	41.39
	0-10	39.09	42.48		0-10	31.75	39.87		0-10	28.95	32.54
	10-20	40.23	44.14		10-20	35.06	41.17		10-20	27.70	33.21
SOC52	20-30	36.74	44.81	*SOC35*	20-30	35.40	42.32	*SOC42*	20-30	28.50	35.91
	30-40	38.19	44.28		30-40	36.15	41.44		30-40	30.21	36.40
	40-50	35.31	43.66		40-50	37.02	41.90		40-50	30.25	40.79
	50-60	35.87	43.12		50-60	36.92	41.59		50-60	31.29	35.84

	60-70	37.19	43.33		60-70	36.65	42.92		60-70	31.61	37.88
	70-80	42.56	43.60		70-80	37.30	43.53		70-80	31.31	35.07
	80-90	38.39	43.43		80-90	38.41	44.75		80-90	32.47	35.32
	90-100	40.44	42.25		90-100	39.62	44.91		90-100	30.57	41.21
	0-10	33.96	42.22		0-10	33.39	39.24		0-10	33.00	42.68
	10-20	29.25	41.46		10-20	31.44	39.18		10-20	31.42	39.30
SOC53	20-30	39.71	43.26	***SOC54***	20-30	30.32	37.90	***SOC61***	20-30	30.38	37.78
	30-40	50.14	43.80		30-40	29.40	39.47		30-40	30.48	37.15
	40-50	39.79	43.81		40-50	30.21	41.70		40-50	30.60	38.52
	50-60	37.93	43.30		50-60	31.93	42.91		50-60	30.95	36.66
	60-70	40.25	43.34		60-70	33.63	43.53		60-70	31.25	37.98
	70-80	35.36	43.53		70-80	34.33	43.60		70-80	30.38	37.70
	80-90	38.07	43.21		80-90	34.90	41.67		80-90	30.49	35.14
	90-100	30.54	44.05		90-100	36.94	43.22		90-100	28.99	35.37
	0-10	37.02	41.88		0-10	24.86	27.19		0-10	30.10	34.04
	10-20	37.21	41.67	***SOC71***	10-20	24.00	28.75		10-20	27.78	34.97
SOC81	20-30	36.08	40.73		20-30	23.44	30.62	***SOC62***	20-30	27.98	30.77
	30-40	33.96	42.87		30-40	23.72	30.29		30-40	26.71	35.19
	40-50	36.27	43.22		40-50	23.10	31.88		40-50	27.34	33.88
	50-60	37.82	43.89		50-60	23.42	35.48		50-60	27.20	36.53
	60-70	36.63	43.80		60-70	25.91	34.25		60-70	29.43	37.25
	70-80	35.75	43.20		70-80	27.86	35.36		70-80	31.16	38.18
	80-90	36.73	42.96		80-90	27.28	38.17		80-90	31.75	41.86
	90-100	36.35	42.60		90-100	28.19	40.18		90-100	30.59	37.77
	0-10	32.36	40.49		0-10	31.29	33.55				
	10-20	27.20	41.93		10-20	29.88	37.01				
SOC82	20-30	32.62	43.01	***SOC72***	20-30	32.18	37.30				
	30-40	29.33	44.01		30-40	31.85	37.54				
	40-50	35.56	45.67		40-50	31.79	36.99				
	50-60	36.89	45.27		50-60	33.30	37.78				
	60-70	34.58	45.71		60-70	33.26	39.79				
	70-80	36.18	45.01		70-80	33.73	38.84				
	80-90	37.51	45.79		80-90	35.00	39.83				
	90-100	30.44	41.64		90-100	38.30	42.85				
	0-10	41.41	41.52		0-10	23.18	31.78				
	10-20	38.74	41.19		10-20	22.65	33.51				
SOC91	20-30	35.69	40.86	***SOC92***	20-30	22.82	34.54				
	30-40	36.61	39.11		30-40	22.38	34.65				
	40-50	35.61	41.57		40-50	22.55	36.36				
	50-60	35.50	41.73		50-60	22.47	37.27				
	60-70	35.72	41.10		60-70	23.25	38.03				
	70-80	35.19	43.06		70-80	23.76	38.80				
	80-90	34.57	42.50		80-90	25.23	38.26				
	90-100	33.22	42.79		90-100	24.55	37.00				

Note: Labour Force Survey data 2014-2019. Working-age population (18-65) only.

Chapter 5

5. Conclusion

5.1. Motivation and aims

Each study included in this thesis has shown robust empirical evidence from the use of large-scale datasets with the intention to enlighten on the posted research questions, in three related aspects of the gender wage gap, concerning, in particular, the identification of the key triggers behind gender differences in wages. To fill knowledge gaps in this literature, I have addressed relatively unexplored key research questions. This thesis adds to the previous literature from several viewpoints.

Considering the aims of this thesis in more detail, in Chapter 2 I examined the question concerning the impact of the nature of the highest qualification achieved and of the country's educational system on the gender wage gap. The study is implemented by using the first round – first cycle of PIAAC, a worldwide study developed by the OECD between August 2011 and March 2012. This cross-section dataset comprises not only an evaluation of three fundamental skills domains – literacy, numeracy, and problem-solving skills – but also a rich set of information on the individuals' backgrounds. Most importantly, among the latter, PIAAC provides information on the nature and the level of the highest qualification achieved by implementing a coding scheme closely related to the ISCED97, used in this study as one of the key variables to investigate the gender wage gap. The country's educational system is identified through the use of the statistics provided by the OECD's EAG 2008 and EAG 2013, which determine for each country the share of vocational and general education in the education system. In order to undertake the analysis, the chapter implements an interaction model to explores the different layers of intersectionality in which the gender wage gap may lie: at the individual level and at the country level. Moreover, in order to rule out the possibility that the results are driven by unobservable characteristics, the model controls for a rich set of covariates known by the literature to be good predictors of choice of education (Hanushek et al, 2016; Hampf and Woessmann, 2017)

Building on the previous results, Chapter 3 expands the gender wage gap analysis and includes an examination of heterogeneities of parenthood's effect on wages. The data used to implement the analysis comes from the GSOEP and considers employed women and men of fertile age between 2005 and 2015. The analysis focuses on Germany for two main reasons. First, Germany is one of the European countries with the highest shares of vocational programs in the country's educational system (as shown in Chapter 2). This means that individuals in Germany have the widest range of choices in terms of educational qualifications when it is time to embark on an educational path. Moreover, German legislation offers a legislative framework with extensive potential parental leave aimed at guaranteeing the return of individuals to their former workplace. In light of this, it is then possible for us to exploit the differential impact of a vocational or a general educational background on wages, found in Chapter 2, to define whether this might have an impact on the magnitudes of the motherhood and fatherhood wage gaps/premia. The model implemented consists of a two-way fixed effect approach that involves comparing treated individuals (mothers/fathers) who had a child in 2010, with childless individuals with similar background characteristics. To justify the results achieved, additional robustness checks, and a generalised fixed effect model are also implemented.

Finally, Chapter 4, uses data from the UK LFS to estimate the magnitude of the gender wage gap across the wage distribution by education and occupation type. Given the classification system (SOC2010) used in the LFS, the latter seems to be the most suitable database to obtain a straightforward categorization of the different occupations into occupation types, namely female, mixed and male-dominated occupations. Moreover, the LFS provides an extensive amount of information concerning the level and nature of each qualification held by each member of the participating household which allows us to identify the individual's highest qualification achieved and to classify it as either a vocational or general qualification type. By applying a grade of transformation approach together with a relative distribution analysis, the Chapter implements a strongly comparative approach to examine, between and within occupation and education types, the change in the gender wage gap over the wage distribution. The aim is to produce new evidence on

the gender wage gap by exploiting the way in which gender occupational and educational segregation affect the gender wage gap across the wage distribution, exploiting once again the differential impact of vocational and general qualifications on skills acquired, employability rates and wages level over the life cycle.

5.2. Summary of results

Firstly, results from Chapter 2 contribute to the literature of the Economics of Education by providing evidence of the differential impact of vocational versus general education in terms of labour market outcomes across 19 countries. Results confirm that having a vocational qualification leads to better income opportunities at the early-stage career than having a general qualification. However, this pattern seems to turn around later on, with individuals with a general qualification catching up and then moving increasingly towards a higher level of wages. The difference in age-wage pattern over the life cycle between the two education types considered is then exploited to examine its impact on gender differences in an age-wage perspective. Results confirm that while negligible differences are found in the age-wage pattern for women of different education types, men with a general background show a steeper profile compared to men with a vocational qualification as their highest qualification. Consequently, this has an effect on gender differences in wages over the lifecycle with a significant difference in the age-wage pattern registered, on average, between women and men with a general background. When the analysis finally introduces the last key variable in the analysis, which is the country's orientation of the education system, the underlying story changes again. On one side, not statistically significant gender differences in terms of age-wage perspective are shown among women and men with a vocational background in general-oriented countries and a difference of only 0.1 percentage point is registered, instead, in vocational-oriented countries. On the other hand, women with a general background report, instead, a steeper age-wage profile, in vocational rather than general-oriented countries if compared to men with the same educational background. The pattern of the results is even more pronounced when countries are disaggregated by the intensity of the

treatment, when we distinguish between general, school-based, no school-based, and apprenticeship countries.

The findings of the second study, described in Chapter 3, suggest heterogeneous effects of parenthood on wages and provide evidence of significant wage penalties for motherhood. On the contrary, no significant effect has been found on men's wages. The main factor contributing to the detected gender inequality in parenthood wage effects appears to be the differential trend in terms of working hours exhibited by women and men after the birth of the child, with women experiencing a drastic reduction of their weekly working hours. Based on the assumption that differences in vocational and general paths may lead individuals to face different career opportunities and to benefit from different sets of skills, the chapter aims to contribute to the literature by exploiting, for the first time in this topic area, the differential impact of vocational and general qualifications on wages over the lifecycle and investigates any possible correlation between the educational background and the parenthood wage effect. While findings uncover no significant differences in terms of parenthood wage effects for men with both a general and vocational background, the underlying story differs for women. Indeed, women with a vocational background register a wider motherhood wage gap compared to those women having a general background, and the results achieved are confirmed even after various robustness tests are performed.

The results from Chapter 4 provide clear evidence of the effect of occupational segregation and the impact of the glass ceiling effect on women's relative wage distribution, with women being overrepresented at the bottom and underrepresented at the top of the wage distribution when compared with men's wage distribution. Once the occupational type is taken into account, results indicate that the majority of women tend to self-select themselves into female-dominated occupations on average associated with lower hourly wages. The latter, apparently, does not seem to be the best choice for women. Indeed, when implementing a comparison in terms of women's and men's wage distributions the data show that women tend to be overrepresented and underrepresented, respectively, in the bottom and the top decile of the wage distribution in mixed and female-dominated

occupation while a relative density close to one is registered across most of the wage distribution if the comparison is made within male-dominated occupations. The analysis takes a step further and investigates the potential impact of education on gender wage differences over the distribution. Firstly, some evident differences emerge when comparing the distributions of qualifications between women and men across occupation types. While women register higher educational levels in male-dominated occupations, men appear to be more educated in female-dominated occupations if compared with individuals of the opposite sex in the same occupation type. When taking into consideration the differential impact of vocational versus general education on wages, the analysis clearly shows that while women with vocational qualifications face a tougher glass ceiling in male-dominated and mixed occupations, those women with a general background have their least restrictive glass ceiling effect in male-dominated occupations. As expected, the factors that seem to play a crucial role in defining the different magnitude of gender differences in terms of relative wages are educational achievements, relationship status and the number of children. Finally, the analysis considers the effect of having an appropriate qualification, in terms of the subject area, for the occupation held. Results show that holding a qualification in the relevant subject could help women, having either a general or vocational background, to reach a better position in terms of the male wage distribution.

5.3. Policy implications

The analysis carried out in this thesis aims to derive robust empirical evidence to provide new light on gender inequalities with the intention to inform policymakers on the main determinants of gender differences in wages to guide through the development of policies aiming to provide equal gender opportunities in the labour market.

Results from Chapter 2 indicate that there is a strong impact of the education type on wages over the lifecycle with individuals with a vocational qualification showing higher income at the early stage of their career if compared to individuals with a general background. This could be associated with the

fact that vocational qualifications provide individuals with ready-to-use skills and with more job experience which consequently helps to smooth the entrance of individuals into the labour market. However, the skills acquired through vocational paths are firm-specific and, consequently, less transferable, less adaptable, and characterized by a higher depreciation rate. Whilst increasing the chance of being employed and encouraging a smooth school-to-work transaction are currently forefront of the political discourse, it is important for the policymaker to focus on employment sustainability and career progression as well. The potential trade-off generated from the comparison of the two education types should enter into policy debate in order to enhance the reliability of vocational programs. In this view, the latter should aim to be more inclusive and not substitute programs that aim to provide strong general skills which enable individuals to adapt to the current changes of the modern economy. The extent to which the selection of women in different education types may contribute to increased gender discrepancies in wages should be considered and reassessed in public policies discussion. Although the chapter claims no causality of these findings, the fact that differences in age-wage patterns do seem to depend on the educational background and the country's educational system confirm also the need for differentiated analysis by country and qualification level/type given the important heterogeneity detected.

The findings from Chapter 3 indicate that policies to decrease the gender wage gap should take into account the crucial impact of motherhood on women's careers. In particular, the fact that mothers show a drastic decrease in terms of weekly working hours suggests that a much-needed step to be taken by the policymaker is to support mothers and families by updating and implementing family-friendly and gender-neutral paid parental leave policies. On the other hand, even though the German system appears to be aiming at reaching gender equality by entitling not only women to fourteen weeks' maternity leave but also granting mothers and fathers the option to take an extended parental leave, still the latter has not been taken up by many men. In this setting, one of the possible reasons behind gender differences in parental leave uptake could lie within the different expectations in terms of women's and men's social roles in Germany (Lamberti, 2018, OECD, 2019) confirming the urgent

need to actively work towards addressing those social norms that restrict women with childcare-related issues. Raw data have also shown the higher propensity of mothers to work part-time rather than full-time. In light of this, the public debate should discuss alternative choices rather than making part-time work the most feasible option available to women. Indeed, part-time work could easily be seen more as a double-edged sword, given that on the one hand it promotes employment and helps women to cope with family responsibilities but on the other hand, it also risks limiting the professional growth and career aspirations of female workers. Boosting strategies such as flexible working hours, job sharing, and remote working could potentially help women to meet family-work responsibilities. Results from the third Chapter have also provided evidence of the key role played by educational choices. In this regard, having a vocational background rather than a general background has straightforward consequences on women's wages. The Chapter relied on the hypothesis that not only do those two different educational paths lead to different career choices but also lead to the acquisition of a different set of skills that may depreciate at a different rate. In terms of policy direction, the implementation of specific policies aimed at facilitating the participation of women on maternity leave on professional training courses, as well as in retraining courses for career progression, should also be considered to overcome the problem of skills depreciation. Finally, an effort should be made to statistically identify this link between skill depreciation and wages. In this regard, it could be useful to further expand Chapter 3, with the estimation of occupation-specific depreciation rates to provide stronger conclusions on the relationship between the motherhood wage gap and skills depreciation by occupation and education types.

The results from Chapter 4 have demonstrated the persistent occupational segregation in the UK labour market. In this view, important policy conclusions can be reached. First of all, market forces alone are not able to address occupational segregation. It is quite evident from our results that women self-select into female-dominated occupations. This is probably because female-dominated occupations are usually more family-friendly and offer more flexible jobs. Findings show that female-dominated occupations are characterized by the lowest average usual weekly working hours. This

might lead one to suspect that one of the possible explanations behind the polarization of women in female-dominated occupations relies on the fact that women opt-out from jobs that require more work commitment and self-select into those jobs that help them to meet social expectations and to overcome the trade-off between family responsibility and career aspirations at a cost of lower salaries. Consequently, gender occupational segregation is certainly another important factor that should be taken into account when examining the phenomenon of the gender wage gap.

One of the possible policy implications that could be derived from Chapter 4 coincides with what was already stated by Goldin (2014) who argues that in order to overcome the problem of the gender wage gap, policy should aim to make jobs more flexible. The increase in remote and hybrid work could lead to having positive effects as well as greater flexibility in terms of working hours. Most importantly, the use of flexible work should not be penalized and should not be granted at a cost of holding back women's careers but, on the contrary, policymakers should use these tools with the intention to achieve greater linearity of earnings in terms of working hours. Moreover, an intervention of the "reconciliation between family and working life" type, which reduces the cost for women of choosing to pursue their career aspirations, could also be beneficial. For example, it is in this situation that low-cost nurseries, home care for the elderly, corporate vouchers for nursing services etc, may also be particularly useful.

Given the important role of education, policy discussion should aim to address the problem of occupational segregation concomitantly with the problem of gender educational segregation. The level and the type of qualification achieved does certainly play an important role in defining individuals' career choices. In this regard, previous studies have amply demonstrated significant gender differences with regards to the field of specialization (Chevalier, 2002, Gemici and Wiswall, 2014, Bertrand, 2017, Vaarmets, 2018). Behind the low propensity of women to take an interest in STEM disciplines, known as fields of study associated with the higher earnings, there could be cultural legacies translated in women's expectation of being the main caregiver of their children and of facing important career breaks due to birth-related leave, making, consequently, the investment in

human capital less profitable and making women only able to access certain types of occupations. Increasing the number of female students in these disciplines would have a very important effect on the gender wage gap, giving women the chance to enter sectors with greater job opportunities, with medium-high salaries and in companies that have a strong influence on the next generation. This hypothesis is reinforced by the fact that those highly educated women who were able to secure a job in male-dominated occupations are found to do, on average, as well as men in those occupations.

In summary, each chapter of this thesis has aimed to advance the understanding of the gender wage gap by exploring the main factors behind this phenomenon and contributing to various strands of the literature such as Labour Economics, Gender Economics and Economics of Education. The findings of this thesis support that profound coordinated efforts should be made with the intention to support women by implementing synergetic policies aiming at dealing with educational segregation, occupational segregation and parenthood wage effects simultaneously, as closely interlinked key drivers of the differences in wages between women and men. The analysis on the gender wage gap provided in this thesis would certainly benefit from further expansion which will only be feasible with the availability of more complex and complete databases that could potentially allow capturing the possible effect of pure discrimination, family policy issues and taste/preferences of the individuals, all elements not captured in this thesis.

References

Adler, M. A. & Brayfield, A. 1996. East-West differences in attitudes about employment and family in Germany. *The Sociological Quarterly,* 37**,** 245-260.

Albrecht, J., Björklund, A. & Vroman, S. 2003. Is there a glass ceiling in Sweden? *Journal of Labor economics,* 21**,** 145-177.

Alon, T., Doepke, M., Olmstead-Rumsey, J. & Tertilt, M. 2020. The impact of COVID-19 on gender equality. *National Bureau of economic research.*

Altonji, J. G. & Williams, N. 1997. Do Wages Rise with Seniority? A Reassessment, *NBER Working Paper,* No. 6010.

Amuedo-Dorantes, C. & Kimmel, J. 2008. New evidence on the motherhood wage gap. *IZA Discussion Paper,* No.3662

Anderson, C. D. & Tomaskovic-Devey, D. 1995. Patriarchal pressures: An exploration of organizational processes that exacerbate and erode gender earnings inequality. *Work and Occupations,* 22**,** 328-356.

Anderson, D. J., Binder, M. & Krause, K. 2003. The motherhood wage penalty revisited: Experience, heterogeneity, work effort, and work-schedule flexibility. *ILR Review,* 56**,** 273-294.

Angle, J. & Wissmann, D. A. 1981. Gender, college major, and earnings. *Sociology of Education***,** 25-33.

Anker, R. 1998. *Gender and jobs: Sex segregation of occupations in the world,* International Labour Organization.

Arulampalam, W., Booth, A. L. & Bryan, M. L. 2007. Is there a glass ceiling over Europe? Exploring the gender pay gap across the wage distribution. *Ilr Review,* 60**,** 163-186.

Averett, S. L. & Burton, M. L. 1996. College attendance and the college wage premium: Differences by gender. *Economics of Education Review,* 15**,** 37-49.

Babcock, L., Laschever, S., Gelfand, M. & Small, D. 2003. Nice girls don't ask. *Harvard Business Review,* 81**,** 14-14.

Bailey, M. J. 2006. More power to the pill: The impact of contraceptive freedom on women's life cycle labor supply. *The quarterly journal of economics,* 121**,** 289-320.

Bailey, M. J., Hershbein, B. & Miller, A. R. 2012. The opt-in revolution? Contraception and the gender gap in wages. *American Economic Journal: Applied Economics,* 4**,** 225-54.

Bandara, A. 2015. The economic cost of gender gaps in effective labor: Africa's missing growth reserve. *Feminist Economics,* 21**,** 162-186.

Barg, K. & Beblo, M. 2009. Does marriage pay more than cohabitation? *Journal of Economic Studies,* 36**,** 552-570.

Barón, J. D. & Cobb-Clark, D. A. 2010. Occupational segregation and the gender wage gap in private- and public-sector employment: a distributional analysis. *Economic Record,* 86**,** 227-246.

Bayard, K., Hellerstein, J., Neumark, D. & Troske, K. 2003. New evidence on sex segregation and sex differences in wages from matched employee-employer data. *Journal of labor Economics,* 21**,** 887-922.

Becker, G. S. 1975a. Front matter, human capital: a theoretical and empirical analysis, with special reference to education. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, Second Edition.* NBER.

Becker, G. S. 1975b. Investment in human capital: effects on earnings. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, Second Edition.* NBER.

Becker, G. S. 1981. Altruism in the Family and Selfishness in the Market Place. *Economica,* 48**,** 1-15.

Bernhardt, A., Morris, M., Handcock, M. S. & Scott, M. A. 1999. Trends in job instability and wages for young adult men. *Journal of Labor Economics,* 17**,** S65-S90.

Bertrand, M. 2017. The glass ceiling. *Becker Friedman Institute for Research in Economics Working Paper*.

Bettio, F., Verashchagina, A., Mairhuber, I. & Kanjuo-Mrčela, A. 2009. *Gender segregation in the labour market: Root causes, implications and policy responses in the EU*, Publications Office of the European Union Luxembourg.
Bhatia, N. & Bhatia, S. 2021. Changes in gender stereotypes over time: A computational analysis. *Psychology of Women Quarterly,* 45**,** 106-125.
Blackburn, M. L. & Neumark, D. 1993. Are OLS estimates of the return to schooling biased downward? Another look. *National Bureau of Economic Research.*
Blakemore, A. E. & Low, S. A. 1984. Sex differences in occupational selection: The case of college majors. *The Review of Economics and Statistics***,** 157-163.
Blau, F. D., Ferber, M. A. & Winkler, A. E. 2013. *The economics of women, men and work*, Pearson Higher Ed.
Blau, F. D. & Kahn, L. M. 2000. Gender differences in pay. *Journal of Economic perspectives,* 14**,** 75-99.
Blau, F. D. & Kahn, L. M. 2003. Understanding international differences in the gender pay gap. *Journal of Labor economics,* 21**,** 106-144.
Blau, F. D. & Kahn, L. M. 2017. The gender wage gap: Extent, trends, and explanations. *Journal of economic literature,* 55**,** 789-865.
Borrowman, M. & Klasen, S. 2020. Drivers of gendered sectoral and occupational segregation in developing countries. *Feminist Economics,* 26**,** 62-94.
Branisa, B., Klasen, S. & Ziegler, M. 2013. Gender inequality in social institutions and gendered development outcomes. *World Development,* 45**,** 252-268.
Bratti, M. 2001. Life-Cycle Female Labour Force Participation and Fertility Decisions: Differences by Level of Education.
Brown, C. & Corcoran, M. 1997. Sex-based differences in school content and the male-female wage gap. *Journal of Labor Economics,* 15**,** 431-465.
Brunello, G. & Rocco, L. 2017. The labor market effects of academic and vocational education over the life cycle: Evidence based on a British cohort. *Journal of Human Capital,* 11**,** 106-166.
Brynin, M. 2017. The gender pay gap. *Equality and Human Rights Commission (EHRC)*
Budig, M. J. & England, P. 2001. The wage penalty for motherhood. *American sociological review***,** 204-225.
Budig, M. J. & Hodges, M. J. 2014. Statistical models and empirical evidence for differences in the motherhood penalty across the earnings distribution. *American Sociological Review,* 79**,** 358-364.
Budig, M. J., Misra, J. & Boeckmann, I. 2012. The motherhood penalty in cross-national perspective: The importance of work–family policies and cultural attitudes. *Social Politics,* 19**,** 163-193.
Buser, T., Niederle, M. & Oosterbeek, H. 2014. Gender, competitiveness, and career choices. *The quarterly journal of economics,* 129**,** 1409-1447.
Byrnes, J. P., Miller, D. C. & Schafer, W. D. 1999. Gender differences in risk taking: A meta-analysis. *Psychological Bulletin,* 125**,** 367.
Card, D. & Krueger, A. B. 1992. Does school quality matter? Returns to education and the characteristics of public schools in the United States. *Journal of political Economy,* 100**,** 1-40.
Carli, L. L. & Eagly, A. H. 2016. Women face a labyrinth: An examination of metaphors for women leaders. *Gender in Management: An International Journal*.
Casarico, A. & Profeta, P. A. 2009. Uguaglianza di genere e sistemi pensionistici: aspetti critici e prospettive per l'Italia. *Studi e note di Economia.*
Cavaglia, C., McNally, S. & Ventura, G. 2018. Do apprenticeships increase earnings? *LSE Business Review*.
Cavalcanti, T. & Tavares, J. 2016. The output cost of gender discrimination: A model-based macroeconomics estimate. *The Economic Journal,* 126**,** 109-134.
Cejka, M. A. & Eagly, A. H. 1999. Gender-stereotypic images of occupations correspond to the sex segregation of employment. *Personality and social psychology bulletin,* 25**,** 413-423.

Cerulli, G. 2015. *Econometric evaluation of socio-economic programs Theory and applications*, Springer.
Charles, M. & Bradley, K. 2009. Indulging our gendered selves? Sex segregation by field of study in 44 countries. *American journal of sociology,* 114**,** 924-976.
Chevalier, A. 2002. Education, motivation and pay of UK graduates: are they different for women? *European Journal of Education,* 37**,** 347-369.
Chevalier, A. 2007. Education, occupation and career expectations: determinants of the gender pay gap for UK graduates. *Oxford Bulletin of Economics and Statistics,* 69**,** 819-842.
Chzhen, Y. & Mumford, K. 2011. Gender gaps across the earnings distribution for full-time employees in Britain: Allowing for sample selection. *Labour Economics,* 18**,** 837-844.
Ciminelli, G., Schwellnus, C. & Stadler, B. 2021. Sticky floors or glass ceilings? The role of human capital, working time flexibility and discrimination in the gender wage gap. *OECD Economics Department Working Papers*, No. 1668, OECD Publishing
Cörvers, F., Heijke, H., Kriechel, B. & Pfeifer, H. 2011. High and steady or low and rising. *Life-cycle earnings patterns in vocational and general education*.
Cotter, D. A., Hermsen, J. M., Ovadia, S. & Vanneman, R. 2001. The glass ceiling effect. *Social forces,* 80**,** 655-681.
Cox, D. 1984. Panel estimates of the effects of career interruptions on the earnings of women. *Economic Inquiry,* 22**,** 386.
Cuberes, D. & Teignier, M. 2016. Aggregate effects of gender gaps in the labor market: A quantitative estimate. *Journal of Human Capital,* 10**,** 1-32.
Cukrowska-Torzewska, E. & Matysiak, A. 2020. The motherhood wage penalty: A meta-analysis. *Social science research,* 88**,** 102416.
Dang, H.-A. H. & Nguyen, C. V. 2021. Gender inequality during the COVID-19 pandemic: Income, expenditure, savings, and job loss. *World Development,* 140**,** 105296.
Das, S. & Kotikula, A. 2019. *Gender-based employment segregation: understanding causes and policy interventions*, World Bank.
Daymont, T. N. & Andrisani, P. J. 1984. Job preferences, college major, and the gender gap in earnings. *Journal of Human Resources***,** 408-428.
De la Rica, S., Dolado, J. J. & Llorens, V. 2008. Ceilings or floors? Gender wage gaps by education in Spain. *Journal of Population Economics,* 21**,** 751-776.
Dearden, L., McIntosh, S., Myck, M. & Vignoles, A. 2000. The returns to academic, vocational and basic skills in Britain. *DfEE Skills Task Force Research Paper,* 20.
Dearden, L., McIntosh, S., Myck, M. & Vignoles, A. 2002. The returns to academic and vocational qualifications in Britain. *Bulletin of economic research,* 54**,** 249-274.
Del Boca, D. & Locatelli, M. 2006. The determinants of motherhood and work status: A survey. *IZA Discussion Papers*, No. 2414
Desjardins, R., Thorn, W., Schleicher, A., Quintini, G., Pellizzari, M., Kis, V. & Chung, J. E. 2013. OECD skills outlook 2013: First results from the survey of adult skills. *Journal of Applied Econometrics,* 30**,** 1144-1168.
DiPrete, T. A. & Buchmann, C. 2006. Gender-specific trends in the value of education and the emerging gender gap in college completion. *Demography,* 43**,** 1-24.
DiPrete, T. A. & Buchmann, C. 2013. *The rise of women: The growing gender gap in education and what it means for American schools*, Russell Sage Foundation.
Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J. & Wagner, G. G. 2011. Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European economic association,* 9**,** 522-550.
Duflo, E. 2005. Gender equality in development. *BREAD Policy Paper,* 11.
Duncan, G. J. & Corcoran, M. 1984. Do women 'deserve' to earn less than men. *Year of poverty, years of plenty. Ann Arbor, Mich.: The University of Michigan*.
Dustmann, C. & Meghir, C. 2005. Wages, experience and seniority. *The Review of Economic Studies,* 72**,** 77-108.

Eagly, A. H., Nater, C., Miller, D. I., Kaufmann, M. & Sczesny, S. 2020. Gender stereotypes have changed: A cross-temporal meta-analysis of US public opinion polls from 1946 to 2018. *American psychologist,* 75**,** 301.

Eckel, C. C. & Grossman, P. J. 2008. Men, women and risk aversion: Experimental evidence. *Handbook of experimental economics results,* 1**,** 1061-1073.

Ellingsæter, A. L. 2013. Scandinavian welfare states and gender (de) segregation: Recent trends and processes. *Economic and Industrial Democracy,* 34**,** 501-518.

England, P., Reid, L. L. & Kilbourne, B. S. 1996. The effect of the sex composition of jobs on starting wages in an organization: Findings from the NLSY. *Demography,* 33**,** 511-521.

Esteve-Volart, B. 2004. Gender discrimination and growth: Theory and evidence from India.

European Commission, Directorate-General for Justice and Consumers, 2021. *2021 Report on gender equality in the EU,* Publications Office, 2021

Fainshmidt, S., Judge, W.Q., Aguilera, R.V. and Smith, A., 2018. Varieties of institutional systems: A contextual taxonomy of understudied countries. Journal of World Business, 53(3), pp.307-322.

Felfe, C. 2012. The motherhood wage gap: What about job amenities? *Labour Economics,* 19**,** 59-67.

Flory, J. A., Leibbrandt, A. & List, J. A. 2015. Do competitive workplaces deter female workers? A large-scale natural field experiment on job entry decisions. *The Review of Economic Studies,* 82**,** 122-155.

Frick, J.R. and Grabka, M., 2007. Item non-response and imputation of annual labor income in panel surveys from a cross-national perspective. Available at SSRN 1020605.

Gangl, M. & Ziefle, A. 2009. Motherhood, labor force behavior, and women's careers: An empirical assessment of the wage penalty for motherhood in Britain, Germany, and the United States. *Demography,* 46**,** 341-369.

Gemici, A. & Wiswall, M. 2014. Evolution of gender differences in post-secondary human capital investments: College majors. *International Economic Review,* 55**,** 23-56.

Gerhart, B. 1990. Gender differences in current and starting salaries: The role of performance, college major, and job title. *ILR Review,* 43**,** 418-433.

Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B. & Vermeersch, C. M. 2016. *Impact evaluation in practice,* World Bank Publications.

Glauber, R. 2008. Race and gender in families and at work: The fatherhood wage premium. *Gender & Society,* 22**,** 8-30.

Gneezy, U., Niederle, M. & Rustichini, A. 2003. Performance in competitive environments: Gender differences. *The quarterly journal of economics,* 118**,** 1049-1074.

Goldin, C. 1994. The U-shaped female labor force function in economic development and economic history. *National Bureau of Economic*. *University of Chicago Press* ; 1995. pp. 61-90.

Goldin, C. 1995. Career and family: College women look to the past. *National Bureau of Economic Research*.

Goldin, C. 2006. The quiet revolution that transformed women's employment, education, and family. *American economic review,* 96**,** 1-21.

Goldin, C. 2014. A grand gender convergence: Its last chapter. *American Economic Review,* 104**,** 1091-1119.

Goldin, C. & Katz, L. F. 2002. The power of the pill: Oral contraceptives and women's career and marriage decisions. *Journal of political Economy,* 110**,** 730-770.

Golsteyn, B. H. & Stenberg, A. 2017. Earnings over the life course: General versus vocational education. *Journal of Human Capital,* 11**,** 167-212.

Gornick, J. C., Meyers, M. K. & Ross, K. E. 1997. Supporting the employment of mothers: Policy variation across fourteen welfare states. *Journal of European social policy,* 7**,** 45-70.

Grimshaw, D., & Rubery, J. (2015). *The Motherhood Pay Gap: A Review of the Issues, Theory and International Evidence.* Conditions of Work and Employment Series. International Labour Organization.

Gronau, R. I974. Wage Comparison- A Selectivity Bias. *Journal of Political Economy,* 82**,** 1119-1164.
Grönlund, A. & Magnusson, C. 2013. Devaluation, crowding or skill specificity? Exploring the mechanisms behind the lower wages in female professions. *Social Science Research,* 42**,** 1006-1017.
Hakim, C. 2000. *Work-lifestyle choices in the 21st century: Preference theory*. Oxford: Oxford University Press
Hall, P.A. and Soskice, D., 2001. Varieties of Capitalism: the institutional. Oxford: Oxford University Press
Hampf, F. & Woessmann, L. 2017. Vocational vs. general education and employment over the life cycle: New evidence from PIAAC. *CESifo Economic Studies,* 63**,** 255-269.
Hampton-Alexander Review. 2018. *Improving gender balance - 5 year summary report.* FTSE Women Leaders.
Handcock, M. S. & Morris, M. 1998. Relative distribution methods. *Sociological Methodology,* 28**,** 53-97.
Handcock, M. S. & Morris, M. 2006. *Relative distribution methods in the social sciences,* Springer Science & Business Media.
Hanushek, E. A., Schwerdt, G., Wiederhold, S. & Woessmann, L. 2015. Returns to skills around the world: Evidence from PIAAC. *European Economic Review,* 73**,** 103-130.
Hanushek, E. A., Schwerdt, G., Woessmann, L. & Zhang, L. 2017. General education, vocational education, and labor-market outcomes over the lifecycle. *Journal of human resources,* 52**,** 48-87.
Hegewisch, A. & Hartmann, H. 2014. *Occupational segregation and the gender wage gap: A job half done.* Institute for Women's Policy Research
Hegewisch, A., Liepmann, H., Hayes, J. & Hartmann, H. 2010. Separate and not equal? Gender segregation in the labor market and the gender wage gap. *IWPR Briefing Paper,* 377**,** 1-16.
Heijke, H., Meng, C. & Ris, C. 2003. Fitting to the job: the role of generic and vocational competencies in adjustment and performance. *Labour economics,* 10**,** 215-229.
Hodges, M. J. & Budig, M. J. 2010. Who Gets the Daddy Bonus? *Gender & Society,* 24**,** 717-745.
Jacobs, J. A. 1989. *Revolving doors: Sex segregation and women's careers*, Stanford University Press.
Jacobs, J. A. 1996. Gender inequality and higher education. *Annual review of sociology,* 22**,** 153-185.
Jacobsen, J. P. & Levin, L. M. 1995. Effects of intermittent labor force attachment on women's earnings. *Monthly Lab. Rev.,* 118**,** 14.
Kahn, L. M. 2015. Wage compression and the gender pay gap. *IZA World of Labor*.
Kalist, D. E. 2008. Does motherhood affect productivity, relative performance, and earnings? *Journal of Labor Research,* 29**,** 219-235.
Kankaraš, M., Montt, G., Paccagnella, M., Quintini, G. & Thorn, W. 2016. Skills Matter: Further Results from the Survey of Adult Skills. OECD Skills Studies. *OECD Publishing*.
Kee, H. J. 2006. Glass ceiling or sticky floor? Exploring the Australian gender pay gap. *Economic Record,* 82**,** 408-427.
Kellokumpu, J. 2007. Baby and pay: The family gap in Finland. *Labour Institute for Economic Research (PT) Working Paper*.
Khandker, S. R., Koolwal, G. B. & Samad, H. A. 2009. *Handbook on impact evaluation: quantitative methods and practices,* World Bank Publications.
King, E., Klasen, S., Porter, M. & Lomborg, B. 2009. Gender and development. *Global Crises, Global Solutions. Cambridge University Press, Cambridge*.
Klasen, S. 2000. Does gender inequality reduce growth and development? Evidence from cross-country regressions. *Policy Research Report, Engendering Development, Working Paper* No. 7. World Bank, Washington, D.C
Klasen, S. 2016. Gender, institutions, and economic development: Findings and open research and policy issues. *Courant Research Centre: Poverty, Equity and Growth Discussion Papers* No. 211. Handle: RePEc:got:gotcrc:211

Korpi, W. 2000. Faces of inequality: Gender, class, and patterns of inequalities in different types of welfare states. *Social Politics: international studies in gender, state & society,* 7**,** 127-191.
Koslowski, A. S. 2010. Working Fathers in Europe: Earning and Caring. *European Sociological Review,* 27**,** 230-245.
Kumlin, J. 2007. The sex wage gap in Japan and Sweden: The role of human capital, workplace sex composition, and family responsibility. *European Sociological Review,* 23**,** 203-221.
Kunze, A. 2003. Gender differences in entry wages and early career wages. *Annales d'Economie et de Statistique***,** 245-265.
Kunze, A. 2005. The evolution of the gender wage gap. *Labour Economics,* 12**,** 73-97.
Lamberti, C. 2018. *Women in management and the issue of gender-based barriers: An empirical study of the business sector in Europe.* EIKV-Schriftenreihe zum Wissens-und Wertemanagement.
Leaker, D. 2008. The gender pay gap in the UK. *Economic & Labour Market Review,* 2**,** 19-24.
Leuze, K. & Strauß, S. 2016. Why do occupations dominated by women pay less? How 'female-typical'work tasks and working-time arrangements affect the gender wage gap among higher education graduates. *Work, employment and society,* 30**,** 802-820.
Levanon, A., England, P. & Allison, P. 2009. Occupational feminization and pay: Assessing causal dynamics using 1950–2000 US census data. *Social Forces,* 88**,** 865-891.
Lim, H., Kimm, H. & Song, I. H. 2015. The relationship between employment status and self-rated health among wage workers in South Korea: the moderating role of household income. *Health & social work,* 40**,** 26-33.
Little, R. J. A. & Su, H.-L. (1989):. Item Non-Response in Panel Surveys. In D. Kasprzyk, G. Duncan and M. P. Singh (Eds.), Panel Surveys. New York: John Wiley.
Loko, M. B. & Diouf, M. A. 2009. *Revisiting the Determinants of Productivity Growth-What's new?*, International Monetary Fund.
Lundberg, S. & Rose, E. 2000. Parenthood and the earnings of married men and women. *Labour Economics,* 7**,** 689-710.
Lundberg, S. & Rose, E. 2002. The effects of sons and daughters on men's labor supply and wages. *Review of Economics and Statistics,* 84**,** 251-268.
Machin, S. & Puhani, P. A. 2002. Subject of degree and the gender wage differential. *Retrieved January,* 15**,** 2013.
Machin, S. & Puhani, P. A. 2003. Subject of degree and the gender wage differential: evidence from the UK and Germany. *Economics Letters,* 79**,** 393-400.
Madgavkar, A., White, O., Krishnan, M., Mahajan, D. & Azcue, X. 2020. COVID-19 and gender equality: Countering the regressive effects. *McKinsey Global Institute,* 15.
McIntosh, S. & Morris, D. 2016. Labour market returns to vocational qualifications in the Labour Force Survey. *CVER Research Paper,* 6.
McNabb, R., Pal, S. & Sloane, P. 2002. Gender differences in educational attainment: The case of university students in England and Wales. *Economica,* 69**,** 481-503.
Melkas, H. & Anker, R. 1997. Occupational segregation by sex in Nordic countries: An empirical investigation. *Int'l Lab. Rev.,* 136**,** 341.
Meurs, D., Pailhé, A. & Ponthieux, S. 2010. Child-related career interruptions and the gender wage gap in France. *Annals of Economics and Statistics/Annales d'Économie et de Statistique***,** 15-46.
Meyersson Milgrom, E. M., Petersen, T. & Snartland, V. 2001. Equal pay for equal work? Evidence from Sweden and a comparison with Norway and the US. *Scandinavian Journal of Economics,* 103**,** 559-583.
Mincer, J. 1974. *Schooling, Experience, and Earnings*. Human Behavior & Social Institutions No. 2.
Mincer, J. & Polachek, S. 1974. Family investments in human capital: Earnings of women. *Journal of political Economy,* 82**,** S76-S108.
Montmarquette, C., Cannings, K. & Mahseredjian, S. 2002. How do young people choose college majors? *Economics of Education Review,* 21**,** 543-556.

Mumford, K. & Smith, P. N. 2008. What determines the part-time and gender earnings gaps in Britain: evidence from the workplace. *Oxford Economic Papers,* 61**,** i56-i75.
Munasinghe, L., Reif, T. & Henriques, A. 2008. Gender gap in wage returns to job tenure and experience. *Labour Economics,* 15**,** 1296-1316.
Murnane, R., Willett, J. B. & Levy, F. 1995. The growing importance of cognitive skills in wage determination. *Review of Economics and Statistics*, 77(2):251–266
Nestić, D. 2007. Differing characteristics or differing rewards: What is behind the gender wage gap in Croatia? *Radni materijali EIZ-a,* Vol(4), pp.5-42.
Nicoletti, C., Salvanes, K. G. & Tominey, E. 2018. The family peer effect on mothers' labor supply. *American Economic Journal: Applied Economics,* 10**,** 206-34.
Nicoletti, C., Salvanes, K. G. & Tominey, E. 2020. Mothers working during preschool years and child skills. Does income compensate? *IZA Discussion Papers*. No. 13079, Institute of Labor Economics
Niederle, M. & Vesterlund, L. 2007. Do women shy away from competition? Do men compete too much? *The quarterly journal of economics,* 122**,** 1067-1101.
Nielsen, H. S., Simonsen, M. & Verner, M. 2004. Does the gap in family-friendly policies drive the family gap? *Scandinavian Journal of Economics,* 106**,** 721-744.
Noland, M., Moran, T. & Kotschwar, B. R. 2016. Is gender diversity profitable? Evidence from a global survey. *Peterson Institute for International Economics Working Paper*.
OECD 1999. *Education at a glance 1999: OECD Indicators.* OECD Publishing.
OECD 2009. *Education at a glance 2009: OECD indicators.* OECD Publishing.
OECD 2010. *Education at a glance 2010: OECD indicators.* OECD Publishing.
OECD 2015. E*ducation at a glance 2015: OECD indicators*. OECD Publishing.
OECD 2019. *From promises to action: Addressing discriminatory social institutions to accelerate gender equality in G20 countries.*OECD, Paris
OECD 2021. *Education at a glance 2021: OECD indicators.* OECD Publishing.
OECD 2022a. *Educational attainment and labour-force status*. Available at: *https://stats.oecd.org/Index.aspx?datasetcode=EAG_NEAC* (Accessed: *24/02/2022*).
OECD 2022b. *Gender Wage Gap*. Available at: *https://data.oecd.org/earnwage/gender-wage-gap.htm* (Accessed: *24/02/2022*).
OECD 2022c. *LFS by sex and age - indicators.* Available at: *https://stats.oecd.org/viewhtml.aspx?datasetcode=LFS_SEXAGE_I_R&lang=en* (Accessed: *24/02/2022*).
Olivetti, C. & Petrongolo, B. 2008. Unequal pay or unequal employment? A cross-country analysis of gender gaps. *Journal of Labor Economics,* 26**,** 621-654.
Olsen, W. & Walby, S. 2004. Modelling gender pay gaps. *EOC Working Paper Series* 17, London: EOC
Ono, H. 2001. *On the Adjusted Rate of Return to Women's University Education: A Preliminary Study of OECD Countries.* Stockholm School of Economics.
ONS, 2022. Gender pay gap. Available at: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/annualsurveyofhoursandearningsashegenderpaygaptables (Accessed: 24/02/2022).
Pal, I. & Waldfogel, J. 2014. Re-visiting the family gap in pay in the United States. *Columbia Population Research Center (CPRC) working paper*. No. 14- 02. New York: Columbia University.
Polachek, S. W. 1981. Occupational self-selection: A human capital approach to sex differences in occupational structure. *The review of Economics and Statistics***,** 60-69.
Pollmann-Schult, M. 2011. Marriage and earnings: why do married men earn more than single men? *European Sociological Review*, 27**,** 147-163.
Presser, H. B. 1994. Employment schedules among dual-earner spouses and the division of household labor by gender. *American sociological review***,** 348-364.

Profeta, P. 2020. Gender equality and public policy during COVID-19. *CESifo Economic Studies,* 66**,** 365-375.
Redmond, P. & McGuinness, S. 2019. The gender wage gap in Europe: Job preferences, gender convergence and distributional effects. *Oxford Bulletin of Economics and Statistics,* 81**,** 564-587.
Rege, M. & Solli, I. F. 2013. The impact of paternity leave on fathers' future earnings. *Demography,* 50**,** 2255-2277.
Ryan, P. 2001. The school-to-work transition: a cross-national perspective. *Journal of economic literature,* 39**,** 34-92.
Sabatier, M. 2015. A women's boom in the boardroom: effects on performance? *Applied Economics,* 47**,** 2717-2727.
Schneider, S. L. 2018. Education in OECD's PIAAC Study: How Well do Different Harmonized Measures Predict Skills? *Methods, data, analyses (mda),* 12(1)**,** 151-176.
Simonsen, M. & Skipper, L. 2012. The family gap in wages: What wombmates reveal. *Labour Economics,* 19**,** 102-112.
Stiglitz, J. E. 1973. Approaches to the Economics of Discrimination. *The American Economic Review,* 63**,** 287-295.
Stohmeyer, R. 2007. Gender gap and segregation in self-employment: On the role of field of study and apprenticeship training. *German Council for Social and Economic Data (RatSWD) Research Note*.
Strain, M. R. & Webber, D. A. 2017. High school experiences, the gender wage gap, and the selection of occupation. *Applied Economics,* 49**,** 5040-5049.
Stromquist, N. P. 1989. Determinants of educational participation and achievement of women in the third world: A review of the evidence and a theoretical critique. *Review of educational research,* 59**,** 143-183.
Thomas, D. 1997. Incomes, expenditures, and health outcomes: Evidence on intrahousehold resource allocation. *Intrahousehold resource allocation in developing countries***,** 142-64.
Trappe, H. & Rosenfeld, R. A. 2000. How do children matter? A comparison of gender earnings inequality for young adults in the former East Germany and the former West Germany. *Journal of Marriage and Family,* 62**,** 489-507.
Triventi, M. 2013. The gender wage gap and its institutional context: a comparative analysis of European graduates. *Work, Employment and Society,* 27**,** 563-580.
Vaarmets, T. 2018. Gender, academic abilities and postsecondary educational choices. *Journal of Applied Research in Higher Education,* 380-398
Waldfogel, J. 1997. The effect of children on women's wages. *American sociological review***,** 209-217.
Weber, S. 2014. Human capital depreciation and education level. *International Journal of Manpower,* 35**,** 613-642.
Weichselbaumer, D. & Winter-Ebmer, R. 2005. A meta-analysis of the international gender wage gap. *Journal of Economic Surveys,* 19**,** 479-511.
Wilde, E. T., Batchelder, L. & Ellwood, D. T. 2010. The mommy track divides: The impact of childbearing on wages of women of differing skill levels. *National Bureau of Economic Research.Working paper*. No. 16582.
Woetzel, J. 2015. *The power of parity: How advancing women's equality can add $12 trillion to global growth.* McKinsey Global Institute, London
Wolter, S. C. & Ryan, P. 2011. Apprenticeship. *Handbook of the Economics of Education.* Elsevier.
World Bank, 2011. *World development report 2012: Gender equality and development.* The World Bank.
World Economic Forum. 2021. *Global Gender Gap Report 2021*.
Yavorsky, J. E. & Dill, J. 2020. Unemployment and men's entrance into female-dominated jobs. *Social science research,* 85**,** 102373.

Zhang, Y., Hannum, E. & Wang, M. 2008. Gender-based employment and income differences in urban China: Considering the contributions of marriage and parenthood. *Social Forces,* 86**,** 1529-1560.
Zimmerman, B. J. 2013. Theories of self-regulated learning and academic achievement: An overview and analysis. *Self-regulated learning and academic achievement***,** 10-45.