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Review

Wage Growth across Fields of Study among Young College Graduates: Is There a Gender Gap?

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Abstract

We use the Flexible Professional in the Knowledge Society data set to learn about gender gaps during the early career of college graduates in Europe. We document substantial heterogeneity across fields of education in the gender wage gap at the entrance to the labour market. We find that the gap evolves against women over the five years after graduation in Social Science and in Economics, Business, and Law. Finally, we estimate a significant female wage growth penalty after we control for observable characteristics only within the Economics, Business, and Law category. Within this field, we estimate a female annual wage growth penalty of 1.1 percentage points among individuals who remained childless and 2.5 percentage points among individuals who became parents. A small fraction of the wage growth gap disappears after we control for variables capturing individual differences in job mobility or in labour market attachment during the early career. (JEL codes: J16, J24, J31)

Key words: gender wage growth gap, college field of education, human capital, early career

1. Introduction

In spite of the substantial decline in gender differences in labour market outcomes that we have observed over the last few decades in developed countries, substantial gender gaps remain. As discussed in Blau and Kahn (2017), nowadays gender gaps in terms of conventional human capital variables are small, in particular if we focus on highly educated individuals. However, a gender pay gap persists and it is more pronounced at the top of the wage distribution.

In this paper, we use the Flexible Professional in the Knowledge Society (REFLEX) data set to learn about the dynamics of the gender wage gap during the early career across fields of education of college graduates in Europe. In particular, we document gender gaps in entry wages and wage growth over the five-year period after their entrance to the labour market. Although there is a large literature documenting gender gaps in entry wages and wage trajectories for the US, evidence for the case of Europe is scarce.

Our analysis, that follows a similar approach to Bertrand et al. (2010), examines the dynamics of wages for a broad set of fields of college education and a wide set of European countries. There are several advantages of using the REFLEX data set. First, it is a homogeneous data set for various countries and it provides detailed information of the tertiary education completed by individuals (such as for instance, field of education or official and effective number of years to complete the programme) that are in general not available for a broad set of countries in individual surveys. Second, focusing on the early career is important because, as shown by Murphy and Welch (1990) for the US, two-thirds of the lifetime wage growth is accumulated during the first ten years of the working career. Finally, analysing the case of college graduates can provide new insights about the importance of different factors accounting for gender differences in wages at the top of the wage distribution.

Our main findings can be summarized as follows. First, there is substantial heterogeneity across fields of education in Europe in the raw gender wage gap at the entrance to the labour market (in the 'first job' after graduation). The initial raw gender wage gap is not significant in the Education, Humanities and Arts, and Social Science categories. In contrast, it is about 5 log points in Economics, Business and Law, about 8 log points in Health, and 12 log points in Science, Technology, Engineering and Maths (hereafter STEM). This gap becomes negligible in Economics, Business, and Law after we control by industry and occupation, but it is still very substantial in Health (6 log points) and in STEM (8 log points). Second, in the full sample, we document a significant female wage growth penalty among those who became parents during the period of analysis. However, there are striking differences across fields of study, with the largest penalty found in the Economics, Business, and Law category. In this field, and in line with what has been recently documented in the literature, women who became mothers during the period of analysis exhibit a wage growth penalty of 2.5 percentage points with respect to fathers, remarkably higher than the female wage growth penalty of 1.1 percentage points found among childless individuals. Only a small fraction of the wage growth gap disappears after we control for variables capturing individual differences in job mobility or in labour market attachment between the 'first job' and the 'current job'. This is not surprising since differences between men and women in these regards are small in our sample. In contrast, in other fields of study, the female wage growth gap is not significant or it becomes insignificant after we control for education subfields or industry and occupation.

We contribute to the literature that has looked at the evolution of the gender wage gap among college-graduated individuals in several countries. Bertrand et al. (2010) document male earnings advantage reaching almost 60 log points a decade after MBA completion from a top US business school. Goldin (2014) documents striking differences across fields of study among college graduates, with occupations exhibiting non-linear earnings with respect to hours presenting larger gaps (in particular, those related to Business and Law studies). More recently, Francesconi and Parey (2018) study gender gaps in college and labour market performance twelve to eighteen months after graduation in Germany. They find an adjusted gender gap of 5–10 log points. Albrecht et al. (2018) track for twenty years individuals who completed a university degree in Business or Economics in Sweden and show that although women and men had essentially identical wages and earnings at the start of their careers, their career paths diverge substantially as they age. They find that men experience both higher returns to job mobility and higher wage growth within firms than women. Finally, Bütikofer et al. (2018) find that in Norway, average earnings prior to childbirth are similar for men and women, but substantial pay gaps emerge as a result of career interruptions related to childbearing. They find larger pay gaps in professions with a non-linear wage structure, such as MBAs and lawyers. In contrast, they find that in STEM or medical degrees the motherhood penalty is lower.[1] Our findings for a broad set of European countries are consistent with this literature.

The paper is organized as follows. In Section 2, we offer a discussion of the related literature. In Section 3, we describe the data set used for the analysis. We start in Section 4 by reporting the distribution of men and women across fields of education, industries, and occupations in the first job after graduation and then we show in Section 5 gender wage differences among college graduates at the entrance to the labour market. Section 6 documents gender differences in wages at the time they are interviewed and in wage growth. Finally, in Section 7 we present our conclusions.

2. Related Literature

Empirical evidence of a widening overall gender gap after several years in the labour market is found, among others, in Manning and Swaffield (2008) for the UK and Goldin (2014) and Erosa et al. (2016) for the US. Interestingly, similar findings are reported when focusing on a more homogenous sub-sample of the population such as college graduates, MBAs from top business schools or associate lawyers, see Goldin (2014), Goldin et al. (2017), Bertrand et al. (2010), and Azmat and Ferrer (2017). Furthermore, among college graduates, Goldin (2014) documents substantial heterogeneity across fields of study in the evolution of the gender gap, with occupations exhibiting non-linear earnings with respect to hours presenting larger gaps. According to Goldin (2014), the desire for time flexibility due to the arrival of children lies behind the growing divergence between men and women's wages over the life-cycle in occupations with non-linear wages. More recently, Angelov et al. (2016), for the case of Sweden, Kleven et al. (2018, 2019), for the case of Denmark, and De Quinto et al. (2020) for the case of Spain use an event study approach to show that most of the gender inequality in earnings is due to the arrival of children. Similar findings are reported for the case of highly educated individuals by Bütikofer et al. (2018), for the case of Norway, and by Albrecht et al. (2018), for the case of Sweden.

There are several channels through which children may affect gender differences in wages over a worker's life-cycle. First, the human capital theory pioneered by Mincer (1974) and Becker (1993) has clear implications for the gender pay gap as originally shown, for instance, in Mincer and Polachek (1974) or Mincer and Ofek (1982). If the burden of raising children is borne primarily by mothers, women may be less attached to the labour market than men, which may be reflected in more frequent labour market interruptions or in a smaller number of hours worked. As a consequence, women accumulate less labour market experience, which erodes their future wages. For the case of the UK, Manning and Swaffield (2008) find that the human capital hypothesis can account for about half of the

1 Other papers have studied the evolution of wages for a wider group of workers: Manning and Swaffield (2008) for the UK, Loprest (1992) for the case of Italy, Hospido (2009) for the case of Spain, Napari (2009) for the case of Finland and Reshid (2017) for the case of Sweden.

gender pay gap that emerges ten years after joining the labour market. More recently, focusing on college workers in the US, Gicheva (2013) finds that wage growth increases with working hours when hours are high.[2] Related to this, Goldin (2014) argues that due to the production structure or work organization in some occupations, the number of hours worked per month has a large effect on earnings, indicating a strongly convex earnings structure. As a result, in these occupations, working long and particular hours has a large increase in compensation for workers. This may have a negative effect on female wages relative to male wages, in particular, in a context in which prevailing social norms about what is appropriate for men to do is different to what is appropriate for women to do after child arrival. Akerlof and Kranton (2000) provide theoretical grounds for gender identity to lie behind the allocation of housework tasks between spouses and empirical evidence in Fortin (2005, 2015) supports that the gender identity model can help to explain female labour market outcomes. Second, according to Topel and Ward (1992), job mobility is responsible for one-third of the wage growth in the first ten years after labour market entry among US men. Several papers have found that either women are more constrained than men in their opportunities to change jobs[3] or the returns to job mobility are different for men and women,[4] widening the gender wage gap over the life-cycle. Finally, women may self-select into jobs with lower average wage growth, which offer, however, other non-pecuniary amenities. This is related to Fortin (2008) who finds that gender differences in non-cognitive factors such as the importance of money/work and the importance of people/family have a significant role in accounting for the gender wage gap among young adults in the mid-eighties in the United States.[5] There is evidence of other interesting self-selection patterns that help to account for the gender wage gap. Card et al. (2016) find evidence that women are less likely to work at firms that pay higher firm-specific premiums. Adda et al. (2017) find evidence for Germany that occupational choices based on expectations of future fertility have a substantial effect on women's future wages. Finally, Erosa et al. (2017) find that women are more likely to self-select into occupations that do not reward longer hours.

Furthermore, individual attitudes such as willingness to compete, risk preference and negotiation behaviour may be responsible for gender differences in the evolution of wages. As pointed by Bowles et al. (2005), an individual's wage growth may depend on her ability to negotiate higher wages as her productivity increases within the firm. Laboratory evidence and field studies provide evidence of systematic gender differences in risk aversion and

2 In particular, between 14% and 48% of the gender difference in wage growth could be accounted for depending on the size of the labour supply gap. The importance of hours worked to determine wage growth is consistent with findings in Bertrand et al. (2010).

3 See for instance Fitzenberger and Kunze (2005) for the case of Germany, Barth et al. (2017) for the case of the US and Manning (2003) for the case of the UK. Pavan (2011) finds that career changes account for an average increase of 0.05 in log wages during the first ten years of work, while employer changes account for 0.12 in the US.

4 See for instance Loprest (1992), Del Bono and Vuri (2011) for the case of Italy, Hospido (2009) for the case of Spain, Napari (2009) for the case of Finland and Reshid (2017) for the case of Sweden.

5 Related to this, Zafar (2013) finds that gender differences in college major choice is determined to a large extent by the preferences regarding the workplace, with males caring more about the pecuniary outcomes and females about the non-pecuniary outcomes. Evidence in Daymont and Andrisani (1984) is also consistent with this.

negotiation behaviour. For instance, Niederle and Vesterlund (2007) present experimental evidence that women shy away from competition and men embrace it. In a study of graduating professional school students, Babcock and Laschever (2003) find that only 7% of female students attempted to negotiate their initial compensation offers, as compared to 57% of men. This is consistent with the findings in Babcock et al. (2006) that, among MBA students, more than half of the male students negotiated their job offer, compared to only about 10% of the female students. In spite of this evidence, it is still an open question the extent to which psychological perspectives on gender can account for gender gaps in the labour market, see Bertrand (2011) and Goldin (2014). A recent contribution in this respect is Card et al. (2016) who found that the combination of sorting and bargaining effects explain about one-fifth of the cross-sectional gender wage gap in Portugal.

Finally, discrimination may be behind gender differences in wages. According to the taste-based discrimination theory pioneered by Becker (1957), these differences can emerge if employers have a distaste for hiring members of a minority group. Alternatively, according to the statistical discrimination theory formulated by Arrow (1973) and Phelps (1972), they may be the result of a signal extraction problem, with differential treatment of members of a minority group due to imperfect information. As explained by Guryan and Charles (2013), concerns about the limited ability of regression-based methods to isolate the portion of disparities in economic outcomes that might be due to discrimination led to alternative methods of analysis, in particular, audit and correspondence studies. However, according to Bertrand and Duflo (2017), there is not conclusive evidence about how much of the differences in wages between men and women is due to discrimination as compared with other factors. Given the importance of child arrival for the evolution of wages that we summarized above, it is important to know the extent to which a bias exists against women with children, or against young women who may have children in the future. Petit (2007) finds evidence of discrimination against women for young workers in higher skilled positions in the French finance industry, but not among prime-age workers. More research along these lines is certainly needed.

3. Data

We use the Flexible Professional in the Knowledge Society (REFLEX) data set. REFLEX is a retrospective data set that collects the results of a survey of graduates from education level ISCED 5A who are interviewed approximately five years after their graduation in 1999/2000.[6] In this survey, data are available for a total of 14 countries, most of them in Europe. For our analysis, we select European countries with similar levels of development: Austria, Belgium (only Flanders), Finland, France, Germany, Italy, the Netherlands, Spain, the UK, Portugal, and Norway.[7] The database is representative of the sampled cohort across countries.[8]

6 Other papers using this data set to analyse different aspects of the labour market are McGuinness and Sloane (2011), Meroni and Vera-Toscano (2017), Verhaest et al. (2017) and Blázquez et al. (2018).

7 Our sample covers around 70% of the database. Excluded countries are Japan, Estonia, and the Czech Republic.

8 According to Little and Tang (2008), the achieved sample (i.e., those responding to the survey) is broadly representative of the graduating population. However, there is a potential risk of self-

Individuals are asked about several aspects related to the study programme they graduated from and to their transition from study to work. In particular, the database is rich in variables describing the type of education and skills acquired by the individuals and there is also detailed information on the characteristics of the 'first job' they had after graduation, their employment history in the subsequent years and the characteristics of the job at the time of the interview, 'current job'. For both the 'first' and the 'current job', there is detailed information about industry and occupation choices. Regarding the 'current job', individuals are also asked about work organization, the level of competencies required at work and how they value different aspects at the workplace. The data set also offers several socio-demographic characteristics of the individuals.

We restrict our sample to individuals younger than 35 who are interviewed between three and seven years after graduation. Individuals older than 35 represent around 8% of the original sample. Keeping those interviewed between three and seven years after graduation, we lose less than 1% of the sample. In order to avoid the contamination of our analysis by extreme values of wages, observations with the wage below 1/5 or above 5 times the median wage in each country, which represent less than 4% of the sample, are trimmed. Finally, we restrict the sample to those individuals for whom we have information on all the variables we use in our analysis. Our final sample is composed of 7429 individuals.

In principle, non-random selection of men and women into tertiary education and/or into the labour market may bias the results of our analysis. However, we think this is a minor issue in the case of our sample because, first, according to the OECD (2012), the fraction of qualifications awarded to women in tertiary-type A and advanced research programmes in 2000 was 0.55, with some variation across countries. The lowest rate is found in Germany with 0.45 and the highest in Portugal with 0.65. Second, the overall employment rate at the time of the interview is high in our sample, with 92% of the individuals working.[9,10]

In Table 1, we offer descriptive statistics of individual and job characteristics for males and females. The percentage of females in the sample is 59%. The average duration of the study programme for our college graduates is four years for both gender, ranging from three to seven years. We have information on how much time the individual took to complete the programme, so we can measure the ratio between the number of effective years to the number of official years, which can be seen as a measure of ability. The average ratio is slightly lower for females, and for the 90% of observations in the central part of the distribution it ranges from 0.75 to 1.75. Only 21% of the individuals in the sample have children at the time of the interview (the figure is only 3.4% when the individual was in her 'first job', 3.1% for females, and 3.9% for males). The data set has information on hourly wages,

selection among respondents since individuals who drop out of the labour force may choose not to answer. If self-selection patterns are different for men and women, this may affect our results. In particular, if there is positive self-selection into the labour market and its incidence is higher for women than for men, our estimates of the female penalties are probably downward biased. However, as we show below, labour market participation is very high among college graduates.

9 Although there is some variation across countries, there is a small overall gap of 5 percentage points between men and women. The largest gap of 12 percentage points is found in Finland, followed by Portugal and Austria with 7, Italy, the UK, Norway, Spain, and Germany with between 3 and 6, France, the Netherlands, and Belgium with a gap below 2 percentage points.

10 Nevertheless, we have checked the potential existence of sample selection bias in the models estimated in the subsequent sections, finding no evidence of it.

Table 1. Summary statistics by gender

	Female	Male
Years of the study programme	4.0 (1.0)	4.2 (1.0)
Years to complete programme/Years of the programme	1.16 (0.3)	1.18 (0.4)
Kids (=1 if individual has children) at the time of the interview	0.21 (0.4)	0.21 (0.4)
First job hourly wage	9.5 (4.7)	10.8 (5.1)
Current job hourly wage	12.7 (5.7)	14.8 (6.6)
First job weekly working hours	35.4 (9.0)	38.3 (8.0)
Current job weekly working hours	35.5 (7.8)	38.7 (6.7)
Number of months employed since graduation	55.1 (11.3)	57.0 (9.9)
Number of jobs	2.5 (2.3)	2.3 (2.4)
Industry change (=1 if individual has changed industry)	0.29 (0.5)	0.31 (0.5)
Occupation change (=1 if individual has changed occupation)	0.39 (0.5)	0.36 0.5)
Job tenure (months in current job)	37.6 (22.0)	39.0 (21.9)

Note: Average values reported. Standard deviations in parentheses. Sample size is 7429 observations.

both at the entrance to the labour market and at the time of the interview: the average wage is 9.5 euros for females and 10.8 euros for males in the 'first job'. This difference is more pronounced in the 'current job', 12.7 for females and 14.8 for males. The number of weekly hours worked is around 35 for females and 38 for males in both the first and the current job. On average, individuals have almost five years of work experience, being for males two months more than for females. Although some individuals remain in their first job at the time of the interview,[11] the average number of jobs during the period of analysis is 2, slightly higher for females. Around 30% have changed industry. Interestingly, changing occupations has been more frequent for females, 39% vs. 36% for males. On average, individuals have spent about three years (a little bit more for males) in their 'current job'.

4. Gender Segregation in Field of Education, Industry, and Occupation

In this section, we provide a descriptive analysis of gender differences in the distribution across fields of education, industries and occupations. We consider a set of five broad categories including: (i) Education, Humanities, and Arts, (ii) STEM, (iii) Economics, Business, and Law, (iv) Health, and (v) Social Sciences.[12] In our sample, the distribution of men and women across fields of education is reported in Table 2. The figures reflect substantial segregation. There is a higher percentage of women who have graduated in the fields of Education, Humanities, and Arts, about 27% in contrast to 9% of men. There are also more women in Health, 17% of women graduated in this field, in contrast to 8% of men. The same happens in Social Science, with 13% of women and 5% of men graduated from this field. The fraction of women who graduated in Economics, Business, and Law is quite similar to that of men. However, only 18% of women graduated in STEM, whereas the figure is 50% in the case of men.

11 This is the case of 33% individuals in our sample.

12 See more detailed information on education fields in Appendix A.

Table 2. Gender distribution across fields of education

	#Obs.	Female (%)	Male (%)
Education/Humanities/Arts	1373	26.51	9.32
STEM	2222	18.30	50.09
Economics/Business/Law	1838	24.63	27.92
Health	937	17.10	7.78
Social Sciences	702	13.46	4.90

Self-selection of women into different fields of education is a well-documented phenomenon and the underlying reasons for this may be related to different competitive advantages, to differences in preferences or to different beliefs. Zafar (2013) offers a deep discussion of the literature related to this and estimates a choice model of college major with uncertainty (among others, about realizations of outcomes related to the choice of major) using data on subjective expectations from 161 Northwestern University sophomores. He finds that the most important factors in the choice of major are enjoying coursework, enjoying work at potential jobs, and gaining the approval of parents. Although males and females have similar preferences while in college, they differ in their preferences regarding the workplace. Non-pecuniary outcomes explain the choices in half of the cases for males, and, in more than three-quarters of the cases for females.

In addition to gender segregation in the field of education, there may be segregation across industries and occupations. In Table 3, based on the two-digit codes from the ISIC (International Standard Industrial Classification), we observe that gender differences are substantial.[13] The presence of women is higher in health and social work, with 23% of them in this category, in contrast to 9% of men. There are also more women present in education, 21% as opposed to 13% of men. However, manufacturing is dominated by men, with 18% working in this industry, in contrast to 9% of women. The same happens in the real estate and renting industries, where 27% of men work, but only 19% of women do. For other industries, the differences are less pronounced.

Finally, regarding occupations, we show in Table 4 that gender differences are also substantial.[14] This is based on the two-digit codes from the ISCO (International Standard Classification of Occupations). We find that the fraction of women working as clerks is 12%, almost twice the fraction of men. Differences are huge regarding physical, mathematical and engineering science (associate) professional occupations, where the fraction of men is around three times that of women, 29% in contrast to 9% (11% in contrast to 4%). The opposite happens with education and health occupations. The fraction of women in the teaching professionals' category is 14%, almost twice the fraction of men and the fraction of women in life science and health associate professionals' category is 10% in contrast to 3% of men. For the other occupations, differences are smaller.

13 We only report those categories with 100 or more observations, which represent more than 98% of the sample. This classification is based on industry reported in the first job.

14 We only report those categories with 100 or more observations, which represent more than 95% of the sample. This classification is based on occupation reported in the first job.

Table 3. Gender distribution across industries

	# Obs.	Female (%)	Male (%)
Agriculture, hunting, forestry, mining, and fishing	118	1.14	2.28
Manufacturing	918	9.03	17.57
Construction, electricity, gas, and water supply	258	1.98	5.72
Wholesale and retail trade	352	4.95	4.63
Transport, storage, and communication	338	3.59	6.09
Financial intermediation	396	5.02	5.99
Real estate, renting, and business activities	1608	18.60	26.84
Public administration and defence	472	6.44	6.49
Education	1278	20.91	12.64
Health and social work	1283	23.45	9.20
Other community, social and personal service activities	287	4.90	2.55

Table 4. Gender distribution across occupations

	# Obs.	Female (%)	Male (%)
Corporate managers	296	3.34	5.34
Physical, mathematical, and engineering science professionals	1226	8.88	29.22
Life science and health professionals	599	9.22	7.29
Teaching professionals	830	14.47	7.66
Other professionals	1212	18.06	15.60
Physical and engineering science associate professionals	464	3.65	10.64
Life science and health associate professionals	497	9.63	3.22
Teaching associate professionals	278	5.37	1.81
Other associate professionals	903	13.57	11.46
Office clerks	480	8.22	4.65
Customer service clerks	222	3.80	2.16
Models, salespersons, and demonstrators	103	1.79	0.96

5. The Gender Wage Gap in the 'First Job'

In this section, we look at the gender wage gap in the 'first job' after graduation. This information is rarely available in data sets and we think it is interesting because wages at that point are not affected by differences in previous labour market attachment.[15] In the first column of Table 5, Panel A, we report the raw gender difference in wages. This is the coefficient of the female dummy in the following regression model:

$$\ln(w_i^{fj}) = \beta_0 + \beta_1 F_i + \beta_2 \, yrs_{p_i} + \beta_3 \, yrs_{c_i} + \sum_{j=1}^{J} \lambda_j \, country_{ji} + u_i \qquad (1)$$

where the dependent variable is the 'first job' wage w^{fj} in logs and the set of explanatory variables includes a female dummy (F), the number of years of the study programme

15 Of course, there could potentially be gender differences in labour market experience up to the age of graduation, but we do not have information of this in our sample.

Table 5. Female coefficient of log wage regression

	Raw	Education	Industry	Occupation
Panel A: First job				
Full sample	−0.083***	−0.056***	−0.051***	−0.043***
$N = 7429$	(0.009)	(0.010)	(0.010)	(0.010)
Education, Humanities and Arts	−0.023	−0.035	−0.039	−0.030
$N = 1373$	(0.031)	(0.031)	(0.030)	(0.030)
STEM	−0.121***	−0.078***	−0.071***	−0.075***
$N = 2222$	(0.017)	(0.017)	(0.017)	(0.017)
Economics, Business and Law	−0.047**	−0.025	−0.018	−0.008
$N = 1838$	(0.018)	(0.018)	(0.018)	(0.019)
Health	−0.083***	−0.086***	−0.081***	−0.059*
$N = 937$	(0.029)	(0.029)	(0.030)	(0.030)
Social Science	0.013	0.013	−0.010	−0.035
$N = 702$	(0.039)	(0.039)	(0.042)	(0.046)
Panel B: Current job				
Full sample	−0.115***	−0.085***	−0.082***	−0.066***
$N = 7429$	(0.008)	(0.009)	(0.009)	(0.009)
Education, Humanities and Arts	−0.022	−0.032	−0.032	−0.019
$N = 1373$	(0.026)	(0.026)	(0.025)	(0.025)
STEM	−0.096***	−0.059***	−0.054***	−0.048***
$N = 2222$	(0.015)	(0.015)	(0.015)	(0.015)
Economics, Business and Law	−0.119***	−0.107***	−0.104***	−0.089***
$N = 1838$	(0.016)	(0.016)	(0.016)	(0.016)
Health	−0.084***	−0.084***	−0.084***	−0.075**
$N = 937$	(0.028)	(0.028)	(0.028)	(0.030)
Social Science	−0.067**	−0.065**	−0.069**	−0.080**
$N = 702$	(0.032)	(0.032)	(0.034)	(0.033)
Education dummies	No	Yes	Yes	Yes
Industry dummies	No	No	Yes	Yes
Occupation dummies	No	No	No	Yes

Notes: The dependent variable is $\ln(w^{fj})$ in Panel A and $\ln(w^{cj})$ in Panel B.
All models include country dummies, number of years of the study programme and the ratio of the effective number of years to complete the programme relative to the official number of years. Robust standard errors in parentheses. ***, **, *: significant at 1%, 5%, and 10%, respectively.

(*yrs_p*), the effective number of years to complete college relative to the official number of years (*yrs_c*) that may be an indicator of unobserved heterogeneity in ability, and a set of country dummies. There is a significant raw gender difference in wages for the full sample of individuals of 8 log points. This is a substantial gap if we take into account that our sample is made up of college graduates at the entrance to the labour market.

Gender differences in the distribution across fields of education that we documented in Section 4 may underlie gender differences in wages in the first job. However, it is striking that the raw gender wage gap across fields of education is very heterogeneous. It varies from 12 log points in STEM to a non-significant gap in Education, Humanities and Arts and Social Science. Within this range, we find a gap of 8 log points in Health and of 5 log points in Economics, Business, and Law. Of course, the five categories of fields that we consider are broad, and in the second column of Panel A we report the coefficient of the female dummy after we control for a more disaggregated classification of fields of education. By doing so, the gap decreases from 8 to 6 log points in the full sample. Within the STEM category, the gap goes from 12 to 8 log points and in the Economics, Business, and Law the gap becomes non-significant. Finally, the gap in Health is not affected.

In order to assess the importance of labour market segregation for the gender differences in wages at the entrance to the labour market, we include industry dummies as additional controls in the third column and we further include occupation dummies in the fourth column in Panel A of Table 5. There are several aspects to highlight. First, the overall gap goes down to 4 log points after all these controls are included. Second, there is substantial heterogeneity across fields of education in the adjusted gap. As previously stated, only in STEM and Health the gender wage gap is significant after subfields of education are controlled for. Adding industry and occupation dummies as controls leaves the gender gap almost unchanged in STEM, but it is reduced from 8 to 6 log points in Health. The fact that the largest gender gap is found in the STEM category is surprising. Given that the fraction of women in that field of education is relatively small and assuming positive self-selection of women into this field, we would expect them to have an average higher productivity than men.

6. The Dynamics of Gender Differences

The aim of this section is to document how gender differences in wages evolve after the 'first job' and to explore the potential drivers. First, we document the gender wage gap in the 'current job', that on average is observed after five years of graduation. The comparison with gender differences in the 'first job' provides a preliminary glance of the evolution of gender differences during early career. Second, we turn our attention to gender differences in individual annual wage growth during the early career, that is the main focus of our paper.

6.1. The gender wage gap in the 'current job'

In Table 5, Panel B, we report gender differences in wages in the *current job*. The dependent variable is the current job wage w_i^{cj} in logs. The raw gap, reported in the first column (with the same explanatory variables than in Equation(1)), is about 12 log points in the full sample, 4 log points higher than in the 'first job' reported in Panel A. Once we control for disaggregated fields of education, second column, the gap in the 'current job' goes down to 9 log points. We further include industry dummies and occupation dummies at the current job in the third and fourth columns, respectively. With these additional controls, the coefficient of the female dummy goes down to 7 log points. Therefore, the adjusted gender wage gap in the 'current job' is 3 log points higher than in the adjusted gender wage gap in the 'first job' (7 vs. 4 log points).

Again, looking within each field of education provides interesting facts. First, the raw gap in the 'current job' is similar or larger than in the 'first job' in all categories except in STEM, in which a reduction from 12 to 10 log points is observed. Over time, an increase in gender differences is also found in the case of the adjusted gender wage gap, with a remarkable increase from 0 to 8–9 log points in Economics, Business and Law and in Social

Science. All in all, the adjusted gap after five years of graduation is between 8 to 9 log points in all categories, except in Education, Humanities, and Arts, where there is not a significant gap and in the STEM category, where it is about 5 log points. Similarly to what Goldin (2014) finds for the US, in Europe the gender wage gap in business occupations is among the largest.

There are other potential drivers of differences between men an women in the 'current job' wage that we are able to explore with our data set.[16] Women may have jobs with certain lower paid attributes within a particular industry and occupation. If so, including those attributes in the regression of the 'current job' wage would reduce the unexplained gender wage gap at the time of the interview. We use information on workers' responsibility in setting goals in the firm, on their autonomy in introducing innovations regarding products, technology, or knowledge, on the degree to which they supervise other workers within the firm and on the extent to which their own mistakes or bad performance may be damaging for the organization. We pay special attention to those variables in which we observe a gender gap. However, we find that they are not able to account for the unexplained gender wage gap in the 'current job' reported in Panel B of Table 5.

Finally, we find that self-reported differences in preferences for jobs offering career prospects, high earnings as well as for the opportunity to balance family and work have a negligible effect in accounting for gender differences in the 'current job' wage in our sample.

6.2. The gender wage growth gap

As in Gicheva (2013), we define individual wage growth g_i as the annualized change in hourly wages between the 'first job' (w^{fj}) and the 'current job' (w^{cj}).[17] Therefore,

$$g_i = \frac{\ln(w_i^{cj}) - \ln(w_i^{fj})}{n_i} 100 \tag{2}$$

where n_i is the number of years elapsed between the 'first job' and the 'current job'. We multiply by 100 to have a percentage points rate of variation.

The average annual wage growth between the 'current job' and the 'first job' in our sample is 6.5% and the raw gender gap of this average annual growth is 0.7 percentage points.

In the first column of Table 6, we report the raw gender gap in annual wage growth (in percentage points). This is the female coefficient of the following regression:

$$g_i = \beta_0 + \beta_1 F_i + \beta_2 \, yrs_{p_i} + \beta_3 \, yrs_{c_i} + \sum_{j=1}^{J} \lambda_j \, country_{ji} + u_i \tag{3}$$

where the dependent variable is the annual wage growth as defined above (in percentage points). In this basic specification, the set of explanatory variables is the same than in Equation (1). The overall raw gender wage growth gap is 0.58 percentage points, however there is substantial heterogeneity across fields of study. The largest raw gender gaps is

16 All estimation results are available from the authors upon request.

17 We use the Harmonised Index of Consumer Prices for each country provided by Eurostat to generate price-adjusted wages for the 'current job'.

Table 6. Female penalty in annual wage growth (percentage points)

	Overall	Childless individuals	Parents
Full sample	−0.579***	−0.377	−1.221***
	(0.199)	(0.230)	(0.433)
Edu/Hum/Arts	0.096	0.464	−1.073
	(0.654)	(0.785)	(1.234)
STEM	0.599*	0.734*	0.106
	(0.356)	(0.407)	(0.817)
Eco/Busin/Law	−1.460***	−1.204***	−2.514**
	(0.405)	(0.453)	(0.993)
Health	−0.007	0.028	−0.202
	(0.667)	(0.802)	(1.206)
Soc Science	−1.536*	−1.554*	−1.927
	(0.782)	(0.884)	(2.029)

Notes: The dependent variable is the annual wage growth as defined in Equation (2).
All models include country dummies, number of years of the study programme and the ratio of the effective number of years to complete the programme relative to the official number of years. In the first column, same sample as in Table 5 (7429 obs in the full sample). In the second and third columns, we restrict the sample to those who were childless in the first job (7034 obs in the full sample).
Robust standard errors in parentheses; ***, **, *: significant at 1%, 5%, and 10%, respectively.

found in Social Science, 1.54 percentage points, followed by 1.46 percentage points in the Economics, Business, and Law category. The gender gap is non-significant in Education, Humanities and Arts and in Health. In the STEM category, the annual wage growth is 0.60 percentage points higher for women than for men.

Inspired by the recent literature on the wage dynamics of high-skilled men and women, we explore the extent to which the divergence in wages between men and women during the early career that we document is related to the arrival of children. For this purpose, we restrict our sample to individuals who were childless in the 'first job'[18] and we include in the regression a binary indicator of the individual becoming a parent between the 'first' and the 'current job' together with its interaction with the female dummy. In the second and third columns of Table 6, we report, respectively, the differential wage growth between men and women who remained childless and the differential wage growth between men and women who became parents. Of course, since we do not have exogenous variation of the parenthood status, our estimates are not measuring the causal effect of children on wage growth. Parenthood status is endogenous and individuals with lower current and expected earnings may be more likely to have children, what would bias our estimates. Unfortunately, our data set does not allow us to follow a similar strategy to recent papers by Kleven et al. (2018, 2019) and Bütikofer et al. (2018) who restrict their samples to individuals who are observed to become parents during the sample period. However, we believe our estimates provide suggestive descriptive evidence about the importance of children in the evolution of wages. According to our estimates, the gender wage growth gap in the full

18 Most of the individuals in our sample are childless when they enter the labour market and therefore with this sample restriction we only lose 3.4% observations. In addition, for 2% of the remaining sample the information on children is missing.

sample is related to women becoming mothers between the 'first' and the 'current job'. As a matter of fact, the estimated penalty for childless women is not significant, whereas a significant penalty of 1.2 percentage points is estimated for mothers.

We then inspect differences across educational categories. Within the STEM category, the relatively higher female wage growth in the overall seems to be driven by higher wage growth among women who remained childless. Both within the Economics, Business and Law and Social Science categories, that exhibit an overall female wage growth penalty, there is a significant penalty among childless women. However, only within the Economics, Business, and Law category the penalty is significant among women who became mothers and more than twice the estimated penalty for those who remained childless (2.5 percentage points and 1.2, respectively).

Our descriptive evidence for the European countries on the positive relationship between the gender wage growth gap and motherhood, on the substantial heterogeneity in the gender wage growth gap across fields of study and on the field of Economics, Business, and Law presenting the largest motherhood penalty is consistent with evidence reported for other countries elsewhere in the literature, see for instance Goldin (2014) and Bütikofer et al. (2018).

6.3. Job mobility and labour market attachment

The gender wage growth gap may reflect that either women have moved towards jobs with lower paid attributes within a particular industry and occupation, as suggested above, or that the dynamics of female wages are different, or both. Different dynamics of wages may be due to self-selection of women at the entrance to the labour market into industries and/or occupations with different wage growth or due to gender differences in labour market behaviour over time. As for the latter, the human capital theory pioneered by Mincer (1974) and Becker (1993) has clear implications for the gender pay gap as shown, for instance, in Mincer and Polachek (1974) or Mincer and Ofek (1982). Therefore, higher labour market attachment may result in higher productivity and hence higher future wages. In addition, as found by Topel and Ward (1992), individuals who are more prone to move from one job to another are more likely to enjoy wage increases. Note that, in principle, the presence of children or/and, as argued by Adda et al. (2017), the expectation of having children in the future may be behind gender differences in labour market attachment or in the motives for job mobility. Therefore, labour market attachment and mobility are transmission mechanisms of children to wages. In this section, we investigate gender differences in these regards as potential drivers of the observed increasing gender wage gap.

In Table 7, we show gender differences in terms of job mobility for the different fields of study as measured by the average number of jobs after graduation and the propensity of individuals to change industry and occupation from the 'first' to the 'current job'. Note, however, that job changes may be related to voluntary job-to-job transitions, which may be positively correlated with wage growth if the individual is searching for better pecuniary conditions, but may be negatively correlated if the individual is searching for other non-pecuniary job attributes. Furthermore, job changes may be the result of the individual being dismissed from a previous job, most probably having a negative effect on her wage growth. Unfortunately, we do not have information on the reasons for job mobility to further explore this issue. There are slight differences between men and women in these respects and

Table 7. Job mobility

	Number of jobs			Industry change[a]			Occupation change[a]		
	Female	Male	Pv[b]	Female	Male	pv[b]	Female	Male	pv[b]
Edu/Hum/Arts	2.6 (2.3)	3.0 (3.8)	0.168	0.26 (0.44)	0.25 (0.43)	0.764	0.44 (0.50)	0.40 (0.49)	0.244
STEM	2.4 (3.5)	2.0 (1.6)	0.005	0.31 (0.46)	0.28 (0.45)	0.137	0.35 (0.48)	0.31 (0.46)	0.046
Eco/Busin/Law	2.3 (1.9)	2.2 (3.0)	0.512	0.41 (0.49)	0.39 (0.49)	0.462	0.45 (0.50)	0.43 (0.50)	0.505
Health	2.5 (1.6)	2.6 (2.1)	0.400	0.09 (0.28)	0.12 (0.33)	0.156	0.23 (0.42)	0.24 (0.43)	0.699
Soc Sciences	2.8 (2.0)	2.6 (1.7)	0.359	0.33 (0.47)	0.41 (0.49)	0.076	0.45 (0.50)	0.47 (0.50)	0.650

Notes: Average values reported. Standard deviations in parentheses.
[a]Binary indicator.
[b]*p*-value of the mean difference test.

most of them are non-significant. The most remarkable difference is found in terms of the propensity to change the industry in the Social Science category. Interestingly, within the STEM category, propensity to change occupation is higher for women than for men.

In Table 8, we report the average number of hours worked in the 'first job' and in the 'current job', the average number of months worked since graduation and the number of months of job tenure. Gender differences are significant in the number of hours worked in both the 'first job' and the 'current job' in all fields. The same is observed, except within the Education, Humanities, and Arts category, for the number of months employed. However, the gender gap in terms of job tenure is only significant in STEM. All in all, we find evidence of significant gender gaps in these labour market attachment variables, but they are quantitatively small and quite similar across fields of education.

In spite of the small gender differences we observe in terms of labour market attachment and job mobility, we study the ability of these individual characteristics to account for the gender differences in the evolution of wages. In what follows, we try to disentangle the importance of these driving forces in accounting for the female wage growth gaps. Unfortunately, we do not have exogenous variation for the different variables that we consider, therefore, we interpret our estimates as descriptive rather than as identifying causal effects, as for instance in Albrecht et al. (2018). We consider different specifications of a regression model for the full sample and for each field of study with wage growth as the dependent variable and several sets of control variables. The first set of controls includes the subfield of education, industry and occupation in the 'first job'. If women self-select into jobs with lower average wage growth we should expect that including these controls would reduce the gender wage growth gap.[19] Second, in order to test the possibility that job mobility accounts to some extent for the gender wage growth gap, we include two different variables: the number of jobs the individual reports since the entrance to the labour market and

19 Fortin (2008) finds that gender differences in non-cognitive factors such as the importance of money/work and the importance of people/family have a significant role in accounting for the gender wage gap among young adults in the mid-eighties in the United States. More recently, Zafar (2013) finds that gender differences in college major choice is determined to a large extent by the preferences regarding the workplace, with males caring more about the pecuniary outcomes and females about the non-pecuniary outcomes.

Table 8. Labour market attachment

	Hours worked (first job)			Hours worked (current job)		
	Female	Male	pv[a]	Female	Male	pv[a]
Edu/Hum/Arts	31.2 (10.3)	32.8 (10.7)	0.032	33.1 (8.7)	35.5 (9.4)	0.000
STEM	37.6 (7.3)	38.9 (7.1)	0.000	37.0 (7.0)	39.1 (5.4)	0.000
Eco/Busin/Law	37.4 (6.6)	39.1 (6.5)	0.000	37.3 (6.1)	39.4 (5.9)	0.000
Health	37.3 (9.4)	40.0 (10.0)	0.000	35.4 (8.8)	38.6 (8.2)	0.000
Soc Sciences	34.1 (8.5)	36.6 (8.0)	0.001	35.1 (7.1)	37.5 (8.4)	0.002
	Months employed			**Job tenure (months)**		
	Female	Male	pv[a]	Female	Male	pv[a]
Edu/Hum/Arts	54.7 (11.7)	55.3 (10.4)	0.354	38.4 (22.0)	38.4 (21.4)	0.996
STEM	55.6 (10.3)	57.3 (9.9)	0.000	36.7 (22.1)	40.7 (21.7)	0.000
Eco/Busin/Law	55.7 (10.4)	56.9 (9.6)	0.009	37.3 (21.6)	37.7 (21.8)	0.714
Health	55.8 (12.0)	57.6 (10.4)	0.035	40.0 (23.0)	37.2 (23.6)	0.108
Soc Sciences	52.8 (12.0)	55.1 (9.9)	0.021	35.4 (20.7)	34.4 (20.6)	0.640

Notes: Average values reported. Standard deviations in parentheses.
[a]*p*-value of the mean difference test.

a dummy variable that takes on the value of 1 if the occupation changed from the ‘first’ to the ‘current job’. Finally, a third hypothesis is that gender differences in accumulated human capital through ‘learning-by-doing’ during the early career account for gender differences in wage growth. In order to explore this possibility, we include as regressors the number of hours worked in the ‘first job’, the number of months employed since graduation and the number of months working for the current employer (job tenure) as control variables. The regression model is as follows:

$$g_i = \beta_0 + \beta_1 F_i + \beta_2 \, yrs_{p_i} + \beta_3 \, yrs_{c_i} + \sum_{j=1}^{J} \lambda_j \, country_{ji} + \gamma' X_i + u_i \tag{4}$$

that is, the specification in Equation (3) but now including additional sets of control variables in the vector X_i.

The estimation results under the different specifications are reported in Table 9 for the full sample. In the first column, we include the female indicator, the indicator of the arrival of children between the first and the current job and its interaction with the female indicator. We also include country dummies, the number of years of the study programme and the ratio of the effective number of years to complete college relative to the official number of years as controls. This is the regression that we use to calculate the raw gender wage growth gap. In the second column, we control for disaggregated fields of education, while in the third column we also include industry dummies and in the fourth column we further

Table 9. Annual wage growth (percentage points). Full sample regression

	Raw	Education	Industry	Occupation	Mobility	Human capital
Female	−0.377	−0.373	−0.363	−0.316	−0.327	−0.051
	(0.230)	(0.250)	(0.253)	(0.256)	(0.255)	(0.250)
Yrs programme	1.049***	0.904***	0.991***	0.768***	0.775***	0.673***
	(0.110)	(0.122)	(0.124)	(0.143)	(0.143)	(0.142)
Yrs to complete[a]	0.241	0.279	0.200	0.041	0.077	−0.073
	(0.337)	(0.340)	(0.342)	(0.345)	(0.345)	(0.340)
Kids	0.617	0.687*	0.860**	0.883**	0.810**	0.800**
	(0.382)	(0.378)	(0.383)	(0.386)	(0.386)	(0.381)
Kids × Female	−0.844*	−0.807*	−1.064**	−1.181**	−1.023**	−1.001**
	(0.488)	(0.483)	(0.485)	(0.491)	(0.490)	(0.483)
Number of jobs					−0.099**	−0.005
					(0.044)	(0.042)
Ind. change					0.468*	0.565**
					(0.268)	(0.275)
Occup. change					1.240***	1.500***
					(0.260)	(0.255)
Working hours (fj)						0.226***
						(0.019)
Job tenure						0.007
						(0.005)
Mths empl						0.038***
						(0.011)
Constant	−0.405	−1.114	−1.828	2.817	2.091	−11.94***
	(0.856)	(1.705)	(2.283)	(2.989)	(3.055)	(3.268)
Ctry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Edu field dummies	No	Yes	Yes	Yes	Yes	Yes
Ind dummies (fj)	No	No	Yes	Yes	Yes	Yes
Occup dummies (fj)	No	No	No	Yes	Yes	Yes
N	7034	7034	7034	7034	7034	7034
Adjusted R^2	0.043	0.056	0.069	0.080	0.085	0.127

Notes: The dependent variable is the annual wage growth as defined in Equation (2).
Robust standard errors in parentheses; ***, **, *: significant at 1%, 5%, and 10%, respectively.
[a]Ratio between number of years to complete the study programme and official number of years.

control for occupation. Both industry and occupation are referred to the 'first job'. The job mobility variables explained above have been included as additional controls in the fifth column. We find a strong positive correlation between occupational and industry changes from the 'first' to the 'current job' and the wage growth, but a negative correlation between the number of jobs the individual reports and the wage growth. Finally, in the sixth column we include as additional regressors variables related to the degree of labour market attachment after graduation. We estimate a positive correlation between wage growth and the number of working hours in the 'first' job or the number of months the individual has been employed, but, other things equal, the wage growth is uncorrelated with job tenure.

Based on these estimates, in Table 10 we report the differential wage growth between men and women who remained childless (Panel A) and the differential wage growth

Table 10. Female penalty in annual wage growth (percentage points)

Panel A: Childless individuals						
	Raw	Education	Industry	Occupation	Mobility	Human capital
Full sample	−0.377	−0.373	−0.363	−0.316	−0.327	−0.051
$N = 7043$	(0.230)	(0.250)	(0.253)	(0.256)	(0.255)	(0.250)
Edu/Hum/Arts	0.464	0.549	0.646	0.688	0.652	0.918
$N = 1280$	(0.785)	(0.792)	(0.781)	(0.841)	(0.842)	(0.800)
STEM	0.734*	0.561	0.622	0.662	0.653	0.779*
$N = 2113$	(0.407)	(0.422)	(0.433)	(0.449)	(0.450)	(0.445)
Eco/Business/Law	−1.204***	−1.422***	−1.454***	−1.438***	−1.532***	−1.119**
$N = 1771$	(0.453)	(0.454)	(0.463)	(0.476)	(0.472)	(0.461)
Health	0.028	0.043	−0.324	−0.570	−0.533	−0.295
$N = 868$	(0.802)	(0.802)	(0.821)	(0.833)	(0.833)	(0.844)
Social Science	−1.554*	−1.523*	−1.221	−1.302	−1.337	−1.308
$N = 668$	(0.884)	(0.883)	(0.971)	(1.057)	(1.035)	(1.013)
Panel B: Parents						
Full sample	−1.221***	−1.180***	−1.428***	−1.496***	−1.349***	−1.052**
$N = 7043$	(0.433)	(0.441)	(0.446)	(0.453)	(0.452)	(0.448)
Edu/Hum/Arts	−1.073	−1.008	−1.323	−1.321	−1.381	−1.114
$N = 1280$	(1.234)	(1.224)	(1.222)	(1.309)	(1.310)	(1.287)
STEM	0.106	−0.123	−0.522	−0.792	−0.562	−0.482
$N = 2113$	(0.817)	(0.818)	(0.840)	(0.882)	(0.877)	(0.866)
Eco/Business/Law	−2.514**	−2.860***	−2.898***	−2.850***	−2.501**	−2.471**
$N = 1771$	(0.993)	(0.993)	(1.009)	(1.059)	(1.028)	(1.004)
Health	−0.202	−0.101	0.181	0.304	0.303	0.523
$N = 868$	(1.206)	(1.204)	(1.258)	(1.315)	(1.319)	(1.363)
Social Science	−1.927	−1.959	−1.821	−1.215	−1.408	−0.844
$N = 668$	(2.029)	(2.005)	(2.301)	(2.511)	(2.540)	(2.437)

Notes: The dependent variable is the annual wage growth as defined in Equation (2).
Results based on the same specifications in the corresponding column of Table 9.
Robust standard errors in parentheses; ***, **, *: significant at 1%, 5%, and 10%, respectively.

between men and women who became parents (Panel B) for the full sample and for each of the educational categories and specifications. In the full sample, being a childless woman is uncorrelated with wage growth across all the specifications, however there is a significant motherhood penalty. This gender wage growth gap is slightly larger in the specifications in which we include industry and occupation dummies. Job mobility variables together with human capital variables account for 30% of the maternal wage growth gap that remains after controlling for industry and occupation. In particular, variables related to the accumulation of human capital have a much stronger impact on the estimated gap. However, a wage growth penalty of about 1 percentage point for women who became mothers (relative to fathers) remains unexplained in the full sample.

Interestingly, the picture is very different across fields of education. As we showed in Table 6, before including controls, there is a significant female wage growth penalty in Economics, Business, and Law (both among childless individuals and parents) and Social

Science (only among childless individuals), whereas in the STEM category being a childless female is positively correlated with wage growth. Within the Economics, Business, and Law category, the penalty is strikingly different for women who remained childless (with respect to childless men), 1.2 percentage points, and for women who became mothers (with respect to fathers), 2.5 percentage points. After controlling by subfield of education, these penalties increase from 1.2 to 1.4 and from 2.5 to 2.9 percentage points, respectively. The relatively higher presence of women in the Law subfield, that exhibits higher wage growth, can explain this outcome. The female wage growth penalty among childless individuals in the Social Science category remains unchanged after we control for subfields of education, but it disappears after including industry and occupation controls. Finally, the female wage growth premium in the STEM category disappears after we control by subfield of education.[20]

Within Economics, Business, and Law, estimated female penalties slightly change after including industry and occupation dummies. However, after we control for job mobility and human capital variables, about 22% of the penalty estimated for childless women and about 13% of the female penalty estimated for mothers disappear. The fact that gender differences in human capital only account for a modest fraction of the gender wage growth gap is not surprising if we take into account that differences in labour market attachment are small between men and women in our sample. This is consistent with evidence reported in Blau and Kahn (2017) who state that due to the reversal of the gender differences in education, as well as the substantial reduction in the gender experience gap, conventional human capital variables explain little of the gender wage gap in the aggregate.[21]

As discussed in Section 2, Bowles et al. (2005) argue that gender gaps in individual attitudes may be responsible for gender differences in the evolution of wages. Unfortunately, we cannot define proxies for the *ex ante* attitude towards negotiation in our sample, but we have information regarding the individual's self-reported ability to negotiate. In the full sample, the fraction of women who report to have a high or very high ability to negotiate is similar to men. However, if we look at the gap across the different field of study categories, we find that a significant gender gap of about 6 percentage points emerges in the Economics, Business, and Law category alone. Interestingly, this category is the one in which the gender wage growth gap is the largest. In spite of this, if we include the individual self-reported ability to negotiate as a covariate in the regression of the individual wage growth the unexplained gender gap is unaffected.

Our estimates of the female penalties are robust to an alternative specification in which we allow the coefficient of each control variable to differ by gender and parenthood status.[22] Under this specification, we find that the overall impact of each of the control variables is almost identical to our specification in Table 9, which supports the robustness of our results. Moreover, we do not find important differences across gender in the overall impact

20 Interestingly, within this category, after variables related to human capital accumulation are included, the female wage growth premium emerges again. As shown in Table 8, within this category, there is a gender gap in job tenure that apparently do not translate into lower wage growth for women.

21 The estimation results for Economics, Business, and Law with the specification that includes all controls are reported in Table A2 in Appendix B.

22 We thank an anonymous referee for this suggestion. Estimation results are available from the authors upon request.

of controls. However, among parents, we find some evidence of gender differences in the correlation between job mobility variables and wage growth.

All in all, we find that there is substantial heterogeneity in terms of the gender wage growth gap across fields of education in a broad group of European countries. A very substantial female penalty is found in the Economics, Business, and Law category, in contrast with other fields of education. The gap is significant both among individuals who remained childless and among individuals who became parents, but it is twice as large in the case of the latter. Bütikofer et al. (2018) also find that the child earnings penalty for mothers is larger among MBAs and lawyers than among STEM and Medicine graduates in Norway, in line with the evidence reported in Goldin (2014) for the case of the US. Finally, according to our analysis, only a small fraction of the gender wage growth gap can be attributed to gender differences in labour market attachment (or to the way they are priced in different fields) or to gender differences in job mobility. Therefore, most of the gender wage growth gap in Economics, Business, and Law remains unexplained. This is consistent with findings in Albrecht et al. (2018) for the group of high-skilled individuals in Sweden.

7. Conclusions

In this paper, we have studied early career dynamics of the gender wage gap among college graduates in a broad group of European countries using the Flexible Professional in the Knowledge Society (REFLEX) data set. This survey offers information on wages and other characteristics of the 'first job' and the 'current job' of college-graduated individuals interviewed around five years after their graduation in 1999/2000.

There are several important findings of our analysis. First, we find substantial heterogeneity across fields of education in Europe in terms of the gender wage gap at the entrance to the labour market. This gap is non-significant in Education, Humanities and Arts and in Social Science, but it reaches about 5 log points in Economics, Business, and Law, about 8 log points in Health and 12 log points in STEM. Second, we find an overall significant female wage growth penalty and striking differences across fields of study. In line with what has been recently documented in the literature, the largest penalty is found in the Economics, Business, and Law category. Moreover, differences in this regard between those who became parents during the period of analysis and those who did not are remarkable: there is a female annual wage growth penalty of 1.1 percentage points among individuals who remained childless and 2.5 percentage points among individuals who became parents. Only a small fraction of the wage growth gap disappears after we control for variables capturing individual differences in job mobility or in labour market attachment between the 'first job' and the 'current job'. This is not surprising since differences between men and women in these regards are small in our sample. In contrast, in other fields of study the female wage growth gap is not significant or it becomes insignificant after we control for education subfields or industry and occupation dummies.

Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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Appendix A

Table A1 offers the distribution of education fields. Panel A reports the one-digit classification into eight categories. As shown, the most frequent study programmes are those related to Social Sciences, Business and Law, around one-third of the sample; in Science, Maths, Technology and related fields we find around 29% of college individuals, 18% in Education, Humanities and Arts and around 16% have completed Health studies. Since we want to study the evolution of the gender wage growth gap across fields of education and in some of them the sample size is quite low, we have grouped them into five categories, that are shown in Panel B. The number of observations in Panel B is slightly lower than in Panel A because when looking at a more disaggregated education field (two-digits) to get more precise information to create our broad fields, it was not clear where they should be included.[23] Nevertheless, the classification in Panel B covers more than 95% of the sample.

A more detailed information of the studies included in each of these broad categories is provided by the two-digits and three-digits classifications. According to them, Education, Humanities and Arts field includes Education, Teacher training and education science, Arts and Humanities. STEM field includes Life science, Physical science, Mathematics and statistics, Computing, Engineering, Arquitecture and building, Agriculture, forestry and fishery

23 This was the case for categories like personal services, sports, food processing, among others.

Table A1. Education fields distribution

Panel A: 1-digit classification	# Obs.	Percent	Female (%)	Male (%)
Education	714	9.61	13.63	3.86
Humanities and Arts	659	8.87	11.55	5.04
Social Sciences, Business, Law	2389	32.16	33.01	30.95
Science, Mathematics, Computing	830	11.17	8.67	14.75
Engineering, Manufacturing, Construction	1310	17.63	8.10	31.27
Agriculture and Veterinary	167	2.25	1.67	3.07
Health and Welfare	1171	15.76	20.91	8.41
Services	189	2.54	2.47	2.65
Total	7429	100	100	100
Panel B: Broad fields				
Education, Humanities and Arts	1373	19.41	26.51	9.32
STEM	2222	31.42	18.30	50.09
Economics, Business and Law	1838	25.99	24.63	27.92
Health	937	13.25	17.10	7.78
Social Sciences	702	9.93	13.46	4.90

and Environmental Protection. Economics, Business and Law field includes these categories: Economics, Business and administration and Law. Health includes: Health, Medicine, Nursing and caring, Dental studies, Medical diagnostic, Therapy and rehabilitation, Pharmacy. Finally, Social Sciences field includes these categories: Social and behavioural science, Psychology, Sociology and cultural studies, Political science, Social services and Social work and counselling.

Appendix B

Regarding the results in Table A2, although the coefficient for the interaction *Kids* × *Female* is not significant, we find a significant female penalty not only for those with no kids but also for parents (see Table 10, last column). Other things equal, the female penalty for childless individuals is given by the coefficient of *Female*. For parents, it is given by the sum of the coefficient of *Female* and the coefficient of the interaction term *Kids* × *Female*. In our results, the estimated covariance between both estimators is –0.1952. Taking also into account the standard errors of both estimators (see Table A2) we get a significant motherhood wage growth penalty.