



Gender gaps in early wage expectations[☆]

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ARTICLE INFO

Keywords:

Wage expectations
Gender gap
College enrollment

ABSTRACT

Using detailed data from a unique survey of high school graduates in Germany, we document a gender gap in expected full-time earnings of more than 15%. We decompose this early gender gap and find that especially differences in coefficients help explain different expectations. In particular, the effects of having time for family as career motive and being first-generation college student are associated with large penalties in female wage expectations exclusively. This is especially true for higher expected career paths. Resulting expected returns to education are associated with college enrollment of women and could thus entrench subsequent gaps in realized earnings.

1. Introduction

The literature on gender pay gaps continues to grow rapidly in parallel with a lively public debate (see [Blau & Kahn, 2017](#), for an overview). Many studies show that gender gaps are not only prevalent in actual earnings, but that already in college, women hold lower wage expectations than men (see e.g. [Blau & Ferber, 1991](#); [Reuben et al., 2017](#)). However, less is known about the determinants of gender gaps in wage expectations before postsecondary enrollment. Such *early* wage expectations can influence later human capital investment and career decisions. Thus, a better understanding of early gender gaps in expected wages can also provide insights into the formation of later disparities.

Gender gaps in expected wages prior to labor market entry may become self-fulfilling as they can entrench actual wage inequalities through at least two channels. First, lower expected earnings reduce the incentives to invest in higher education (see e.g. [Ferber & McMahon, 1979](#); [McMahon & Wagner, 1981](#)). Recent evidence shows that expected wages are a significant predictor for the choice which level of education to pursue, as well as for college major choice.¹ Second, wage expectations might affect starting wages through the formation of reservation wages ([Brown & Taylor, 2013](#)). If, in turn, lower reservation wages result in lower starting salaries, they are likely to have a persistent effect on actual wage trajectories.² [Caliendo et al. \(2017\)](#) show that gender differences in reservation wages can indeed account

[☆] We thank Teodora Boneva, Gabriella Conti, Thomas Dohmen, Bernd Fitzenberger, Henning Hermes, Hannah Schildberg-Hörisch, Jonas Jessen, Victor Lavy, Anna Maria Mayda, Markus Nagler, Jürg Schweri, Felix Weinhardt and all participants of the annual meeting of the German Economic Association 2021, the meeting of its standing field committee in Education Economics 2022, the 1st Berlin Workshop on Empirical Public Economics 2022, the 21st journées LAGV 2022, the 2022 meeting of the SEHO and the CIDER-LERN conference 2022 for valuable comments and suggestions. We are grateful to the editor and thank two anonymous referees for providing helpful feedback. We also thank Vaishali Zambre for her initial work on wage expectations in the *Berliner-Studienberechtigten-Panel*. Frauke Peter and C. Katharina Spiess gratefully acknowledge funding from the Einstein Foundation Berlin, Germany (A-2010-025 (FU)). Andreas Leibing, Frauke Peter, Sevrin Waights and C. Katharina Spiess further acknowledge funding from the German Research Foundation (SP 1091/2-1). Sevrin Waights also acknowledges funding from an SAW project on regional inequality (Leibniz Association grant number: K258/2019). The usual disclaimer applies.

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¹ See e.g. [Arcidiacono et al. \(2012\)](#), [Attanasio and Kaufmann \(2014, 2017\)](#), [Belfield et al. \(2020\)](#) and [Favara et al. \(2021\)](#) for high school and college enrollment and [Boneva et al. \(2021\)](#) for postgraduate enrollment. For college major choice see [Arcidiacono et al. \(2020\)](#), [Ruder and Noy \(2017\)](#), [Wiswall and Zafar \(2018\)](#) and [Zafar \(2013\)](#).

² Evidence on the adverse effect of lower starting wages is provided by [Oreopoulos et al. \(2012\)](#). The authors show that entering the labor market during a recession has potentially long lasting *scarring effects* on wages.

for a large share of the subsequent gender gap in realized wages. This is exacerbated by gender differences in negotiation styles and outcomes, which are larger for inexperienced negotiators (see [Mazei et al., 2015](#), for an overview) and thus matter especially for starting wages.

Our study asks: what factors drive the gender gap in expected wages among high school students? Our analysis draws on data from a unique survey among high school graduates in Germany, in which we asked individual students for their expected full-time earnings range at age 35 years in three different scenarios: (i) if they enrolled for a vocational degree, (ii) if they enrolled for a bachelor's degree or (iii) if they enrolled for a master's degree. We examine the determinants of the expected gender gap using a regression-compatible Oaxaca–Blinder (OB) decomposition ([Blinder, 1973](#); [Fortin, 2008](#); [Oaxaca, 1973](#)) and place a particular focus on differences in coefficients (*unexplained part*) as opposed to differences in endowments (*explained part*), giving a detailed overview of components attributable to socio-demographic factors, intended college major choice, career motives and both cognitive and noncognitive abilities.

We find that the gender gap in average wage expectations after high school graduation amounts to over 15%. Our decomposition results indicate that endowments explain some of the difference in future wages: around a quarter of the total gap. In particular, intentions to choose a major in Science, Technology, Engineering, and Mathematics (STEM) and a high academic self-efficacy³ are more prevalent in men and on average associated with higher expected wages. However, it is the differences in coefficients rather than differences in endowments that play a bigger role. Being potential first generation at college, intending to study business or management and expressing *time for family* as a career motive all have significantly more negative impacts on female expected wages than on male expected wages. Some further factors, such as having *good health and safety conditions* as a career motive, also have relatively more positive impacts on female expectations. The fact that these coefficient effects offset each other, explains the relatively low share of the gender gap in wage expectations explained by differences in coefficients.

We investigate the decomposition not just for mean expected wages pooled over educational scenarios, but also for minimum and maximum expected wages, as well as bachelor and master scenarios separately, to shed light on underlying heterogeneity. Certain factors, e.g. *time for family*, are associated with the largest contribution via the unexplained part for the maximum expected wages and the master scenario, implying the differential impacts are exacerbated for the highest career tracks. This result suggests that women anticipate having to give up higher career paths and leadership positions in order to have more flexible work arrangements.⁴ Recent evidence by [Wiswall and Zafar \(2021\)](#) stresses the close link between human capital investments, including major choice, and expectations about career and family.

In our findings, having a very high preference for *time for family* as a career motive is the largest single and most consistent driver of the gender gap in wage expectations. Although time for family could cover many family related issues, as caring for parents, partners, or siblings in need, it is very often related to childcare. Our analysis suggests that *family penalties*, one of the most central factors in explaining inequalities in earnings, are already reflected in the expectations of high school students. Finally, to assess possible pathways of how the gender gap in wage expectations might translate into actual earnings, we examine the association between expected returns to college and

³ Academic self-efficacy refers to individuals' convictions that they can successfully perform given academic tasks at designated levels ([Bong & Skaalvik, 2003](#)). See Section 2 for details.

⁴ The phenomenon of such *glass ceilings* is well reflected in the relatively low share of women in leading positions in firms (see e.g. [Bertrand and Hallock \(2001\)](#) for the U.S. and [Kirsch and Wrohlich \(2020\)](#) for Germany) but also in academia ([Ceci & Williams, 2011](#)).

college enrollment. We find strong heterogeneities across gender and socioeconomic background.

The majority of existing studies on earnings expectations focus on averages, asking students for point estimates of their future wages (for overviews, see e.g. [Brunello et al., 2004](#); [Giustinelli, 2022](#); [Manski, 2004](#)). By eliciting the minimum and maximum expected wages of high school students, we are able to give a more comprehensive picture and are able to assess drivers of wage expectations at different margins. Many studies in this strand of the literature compare expected wages of students to actual wages of different reference groups and focus predominantly on college students (e.g. [Alonso-Borrego & Romero-Medina, 2016](#); [Betts, 1996](#); [Carvajal et al., 2000](#); [Huntington-Klein, 2015](#); [Manski, 1993](#); [Wolter, 2000](#); [Wolter & Zbinden, 2002](#)). By eliciting wage expectations for different degree types, we can compare wage expectations to actual earnings of a wider range of reference groups. Other studies investigate the *accuracy* of college students' expectations and compare them to later realized wages by following students into the labor market (e.g. [Filippin & Ichino, 2005](#); [Jerrim, 2011, 2015](#); [Webbink & Hartog, 2004](#)).

Our study is not the first to elicit the wage expectations of pre-college students. However, it is one of only a few studies that aims to explain the gender gap in expectations at this early age. Many studies of the wage expectations of pre-college students do not specifically estimate gender gaps (e.g. [Attanasio & Kaufmann, 2014](#); [Dominitz & Manski, 1996](#); [Hastings et al., 2016, 2015](#); [Schweri & Hartog, 2017](#); [Wolter, 2000](#)) whereas several others estimate the gender gap only in passing while summarizing the data (e.g. [Belfield et al., 2020](#); [Boneva & Rauh, 2020](#); [Mazza & Hartog, 2011](#)). Only three previous studies place a specific focus on estimating and explaining the gender gap in wage expectations, [Eliophotou-Menon \(1997a, 1997b\)](#) for secondary school students in Cyprus, [Attanasio and Kaufmann \(2017\)](#) for high school graduates in Mexico, and [Boneva et al. \(2022\)](#) for secondary school students Germany. All three studies regress explanatory factors on wage expectations for the girls and boys groups separately, but none carries out a decomposition analysis to assess the determinants of gender gaps in early wage expectations.

[Eliophotou-Menon \(1997a, 1997b\)](#) elicits wage expectations of secondary school students in Cyprus finding a gap in wage expectations and finding that factors such as family background and perceived ability affected the wage expectations of girls and boys differently. [Attanasio and Kaufmann \(2017\)](#) document a gap in wage expectations for high school graduates in Mexico also findings differences between boys and girls in the relationship between expectations and personal characteristics. Their study also analyzes later college enrollment, but places a focus on marriage market returns. [Boneva et al. \(2022\)](#) elicit the gender gap in competitiveness of adolescents from lower socio-economic backgrounds in Germany by looking at earnings expectations. Their focus is on the development of gender differences in competitiveness and the role of the social environment in this process. Additionally, the authors show that also earnings expectations of girls and boys already differ significantly at around fourteen years of age. Their findings suggest that the gender gap in wage expectations emerges already at the beginning of adolescence and is larger for children from lower socio-economic backgrounds.

A small number of studies decomposes the gender gap in wage expectations, but only for college students, i.e. when the decision to invest in higher education is already made.⁵ [Delaney et al. \(2010\)](#) decompose the gender gap in expected earnings of college students, using data from the Irish Universities Study. As one of only a few studies, they also consider career motives and noncognitive abilities as determinants of wage expectations. Their findings attribute a large share of the gender

⁵ A further related literature decomposes the gender gap for realized earnings in Germany (see [Francesconi and Pary \(2018\)](#) for college graduates and [Collischon \(2019\)](#) for the working population).

gap to risk preferences, but also indicate that family considerations can play a significant role. [Kiessling et al. \(2019\)](#) use data from the online survey *Fachkraft 2030* that elicits wage expectations of college students in Germany.⁶ Their findings attribute a larger role in explaining the gender gap in expected wages to occupational sorting and negotiation styles. Surprisingly, prospective child-related labor force interruptions have a relatively small effect in their framework, which focuses primarily on endowment effects. [Fernandes et al. \(2021\)](#) use data on wage expectations of students majoring in business at two Swiss colleges. Their findings confirm the importance of both fertility considerations and career preferences in explaining the gender gap in wage expectations, but focus mostly on endowment effects. Consistent with our results, they also find that both males and females overestimate their wages compared to actual ones. Furthermore, males respond in an overconfident manner to information about realized wages. [Briel et al. \(2022\)](#) decompose the gender gap in wage expectations for German university applicants. With an average age of 21 year these prospective students are older than those in our study and have already decided whether to invest in higher education. The authors carry out quantile regressions finding larger gaps at the bottom of the distribution. They find an important role of *biased beliefs*: men tend to overestimate both the average salary in their fields as well as their own likelihood to earn above this average. In a decomposition, these factors all help explain the gender gaps in expectations, leaving most other factors seemingly irrelevant.

Lastly, related studies by e.g. [Reuben et al. \(2017\)](#) and [Wiswall and Zafar \(2018\)](#) investigate the relationship between career motives, major choice and wage expectations among college students, using data from high-ability undergraduate students at New York University. [Wiswall and Zafar \(2018\)](#) confronts these students with multiple hypothetical job choice scenarios that vary in expected wages and other job characteristics. Their results show that, among others, women have a significantly higher willingness to pay (in terms of expected wages) for flexible working hours and more secure jobs than men. Since *time for family* can be interpreted as a form of higher flexibility in working hours, our findings are roughly in line with these results. However, we cannot confirm women's high willingness to pay for secure jobs.⁷ [Reuben et al. \(2017\)](#) also investigates the role of preferences in explaining gender differences in wage expectations. Based on the same survey among New York University undergraduates they document a large gender gap in expected wages. While part of the gap is due to gender differences in college major choice, the gap in wage expectations within a college major still amounts to around 20%. They further show that gender differences in preferences such as overconfidence, competitiveness and risk aversion, explain 18% of the gender gap in expectations.

Our study stands out from the related literature on wage expectations as it combines central aspects of the before-mentioned studies. To the best of our knowledge, this paper is the first to analyze determinants of the gender gap in earnings expectations of individuals before their decision to invest in higher education by explicitly carrying out detailed decompositions at different margins. Moreover, our panel data allows to track students over time and assess the association of wage expectations with college enrollment. Lastly, and unlike most other studies, we consider different noncognitive abilities and career motives, such as *time for family*, as potential drivers of the gender gap. Our study therefore contributes to a better understanding of gender gaps in wage

⁶ The data was collected among participants of largest job board *job-mensa.de* in Germany. [Ehrmantraut et al. \(2020\)](#) use the same data to study the expected signaling value of completing higher education, using college dropout as counterfactual.

⁷ A likely explanation is the fact that the German labor market is much more regulated than the American labor market. For example, *at-will employment* is not possible in Germany.

expectations and the interplay between educational investments and family and career considerations that take place already at a relatively early and crucial age.

The paper is organized as follows. Section 2 introduces the data, provides detailed information on the measurement of wage expectations and presents descriptive statistics. Section 3 introduces the OB decomposition method. Section 4 presents the decomposition results, examining the role of different factors in explaining the gender gap in wage expectations. Section 5 shows associations of wage expectations with subsequent college enrollment. Section 6 concludes.

2. Data and descriptive statistics

The data that we use in our empirical analysis are based on a survey of high school students at different institutions in the German capital city of Berlin. They include detailed information on student characteristics, educational aspirations and eventual educational choices. All of these aspects were surveyed as part of a larger research project, the *Berliner-Studienberechtigten-Panel* (Best Up), which aims to study educational paths of high school students (see [Ehlert, Peter et al., 2017](#), for details).

The survey aimed at obtaining a sample of students who were predominantly from lower socioeconomic backgrounds. Thus, the 27 selected schools are located in districts with a high share of individuals without college degree and cover 20% of all upper-secondary schools in Berlin. The survey followed all students from the end of their penultimate year in high school through two years after graduating from high school. All students were surveyed five times over that period. Except for the first paper and pencil survey conducted in schools, the subsequent surveys were administered online.⁸ Of the 1578 students surveyed in the first wave, 1105 participated in the second and 1033 in the third wave, where wage expectations were surveyed (see Appendix Figure F.1).

Wage expectations in this context have first been studied by [Zambre \(2018\)](#). Other elements of the Best Up project consisted in separate randomized controlled trials. First: an information intervention, in the form of a workshop, on the returns to tertiary education to study effects on college enrollment intentions ([Peter & Zambre, 2017](#)), college applications ([Ehlert, Finger et al., 2017](#)) and actual enrollment ([Peter et al., 2021](#)). Second: a financial intervention in form of a temporary monthly subsidy for students without enrollment intentions to study the effect on college applications, which remained ineffective ([Peter et al., 2017](#)). Even though these interventions are not the focus of our analysis, they might still affect wage expectations differently for both genders and thus also the gender gap in expectations (see Appendix Figure F.2 for the information treatment). Therefore, we include indicator variables accounting for school-level assignment to each intervention throughout this study. Those participants who decided to enroll at college were surveyed in subsequent waves to study the transition into postgraduate education. This so called PostGrad-Best Up project thus focused only on students, who were enrolled in college in 2017 (see [Berkes et al. \(2022\)](#) and Appendix Figure F.1).

2.1. Wage expectations

In the expected earnings module of the survey in summer 2014, students were asked to state the minimum and maximum net wage that they might expect to earn at the age of 35 conditional on working full

⁸ In the first wave, students were invited to fill out a paper based questionnaire at school during their classes and were possibly more motivated to participate in the survey. This could explain the large attrition rates in comparison to later waves, where the survey was administered online and there were e.g. less peer-effects at work.

time.⁹ Following Attanasio and Kaufmann (2014, 2017) and Guiso et al. (2002), students were then asked what they think is the probability they will earn more than the midpoint of the range between their stated minimum and maximum and we assume a single triangular distribution between the minimum and maximum expected wage, scaling each half of the triangle such the area of the right half matches the reported probability p to earn above the midpoint (see Appendix Figure B.1). As such the average expected wage is then computed as $E(y) = \frac{1-p}{3}(2 \cdot y_{min} + y_{max}) + \frac{p}{3}(y_{min} + 2 \cdot y_{max})$.

We asked each individual for three pieces of information for three different hypothetical educational scenarios, in which they have earned: (i) a vocational degree, (ii) a bachelor's degree, or (iii) a master's degree. Respondents could either state their expectations or leave open the question. In our main analysis, we pool individual expectations on bachelor's and master's degrees and discard information on wage expectations with a vocational degree.¹⁰ Hence, in our analysis we can only consider individuals who gave full information (i.e. min , max and p) for at least one degree (bachelor's or master's). Of the 1033 individuals who participated in wave three, 376 (36.4%) did not give any information on either their minimum or maximum wage expectations on any of the two degrees. Another 36 individuals (3.5%) gave only either their minimum or maximum wage expectations for both degrees. We also exclude students whose responses were not logically consistent: 13 individuals (1.3%) stated equal minimum and maximum expectations and another 8 individuals (1%) gave no, or invalid, information (i.e. $p = 1$ or $p = 0$) on their expected probability to earn above the midpoint. We further exclude 9 students (1%) with average wage expectations either above the highest or below the lowest percentile of the cross-sectional distribution of expected wages for each education degree. Further, we drop 78 students (8%) who did not provide complete information on all covariates and could thus not be used in the decomposition. The final sample for the decomposition analysis consists of 513 students, of whom 205 are male and 308 are female.¹¹

Individual average expected wages, pooled over degrees are presented in Fig. 1. In line with previous findings in the literature we find a large gender gap. Even before entering the labor market women expect to earn considerably less than their male counterparts. While men expect to earn on average around 3192 EUR per month, women expect to earn 2691 EUR. This difference implies a gender gap in wage expectations of 15.7%. Several other observations are noteworthy: First, average expected wages increase with the level of the education scenario, indicating that students are aware of the monetary returns to higher levels of education. Second, the higher the educational degree, the more dispersed the distribution. This shows that expected wage risk is increasing for higher levels of education, which is in line with the findings on actual labor market data (Koerselman & Uusitalo, 2014). In Appendix Section C we also present descriptive statistics by gender

⁹ Given that we condition on full time employment, biases arising from different labor supply expectations are ruled out by construction. The original question suggested a regular earned income arising from an employment agreement and we therefore use the terms *wage* and *earnings* interchangeably. It was formulated as follows: "Now assume that you earned a vocational or university degree and work full-time, meaning that you are economically active for about 39 h per week. What do you expect your monthly minimum net earnings and monthly maximum net earnings (i.e. the minimum/maximum amount of money that is transferred directly on your bank account) at the age of 35 to be if you ... [have earned a vocational/Bachelor/Master degree]".

¹⁰ We use expectations conditional on vocational degrees as reference when computing the expected returns to a college degree that we use to analyze college enrollment in Section 5.

¹¹ We explore item non-response for the wage expectation question and the full set of covariates in Appendix Section A. While non-response is related to certain characteristics such as academic performance, the selection is similar between men and women, which is central to our study.

for the minimum and maximum expected wages. Differences in the average are driven by both male students reporting higher maximums and female students reporting lower minimums, although this depends somewhat on the hypothetical degree. Appendix Table D.3 shows detailed decomposition results for the implied individual range in wage expectations as a measure for wage risk.

Third, both male and female wage distributions are right-skewed, just as is actual earnings distributions. Appendix Table C.2 further compares average wage expectations to actual earnings by gender. Interestingly, both genders overestimate the returns to higher degrees, but females overestimate more often and to a higher degree than men. Finally, in all education scenarios the distribution of men is shifted to the right and exhibits a thicker right tail, implying that men expect higher wages than women on average and are more likely to expect exceptionally high wages. A Kolmogorov–Smirnov test confirms that the distributions of cross-sectional average expected wages differ significantly by gender in each education scenario. More detailed descriptive statistics can be found in Table C.1.

2.2. Sample characteristics

The data include detailed information on characteristics potentially related to wage expectations. We outline those variables below and report means by gender in Table 1.

(I) **Baseline characteristics** comprise socio-demographic factors such as migration background, parental educational background, and attended high school type (academic high school, integrated high school, and vocational high school). Men and women do not differ significantly in these characteristics, with the exception of attended high school type. We also report whether students attended an *information intervention school* or a *financial intervention school* of the Best Up project.

(II) **Cognitive abilities** comprise students' final high school GPA as well as test scores on a verbal and figural cognition test.¹² We would expect higher performing students to anticipate that their higher ability (or signal thereof) is rewarded in the labor market. Surprisingly, women score lower on the verbal cognition test by around one point. Following Fortin (2008), we use standardized values for all cognitive abilities in the decomposition.

(III) **Intended college major** accounts for the well-documented wage differences between college majors as well as differences in college major choice by gender. The intended college major should proxy the type of occupation and/or industry individuals aspire to work in and should thus reflect differences in wage expectations due to sorting (Arcidiacono et al., 2020; Montmarquette et al., 2002). Based on the classification of the German Statistical Office (Destatis, 2012), the different majors are grouped into ten fields of study, as listed in Table 1.¹³ Women are significantly more likely to express intentions to enroll in medical studies and teaching and are less likely to report intentions for a major in STEM.

(IV) **Career motives** capture the importance of different job attributes that students assign to their future job choice. Similar to the intended college major, wage expectations are likely to be affected by the career plans that students hold, which in turn are likely to differ by

¹² Note that final high school GPA traditionally ranges from one (best) to four (worst) in Germany. However, we reverse this score such that a higher GPA corresponds to higher performance. The cognition tests were conducted in the first wave 1 of the *Berliner-Studienberechtigten-Panel*. Higher scores on the cognitive tests indicate higher skills as well.

¹³ The information on students intended major is derived from different waves of the survey. Firstly, if students already applied to university or reported to plan on applying in the third wave, we have information on which majors they applied for. If students apply for more than one major, we use the major that students rank as their first choice. Secondly, students who reported during high school that they intend to enroll in university, were also asked about the major that they would like to enroll in.

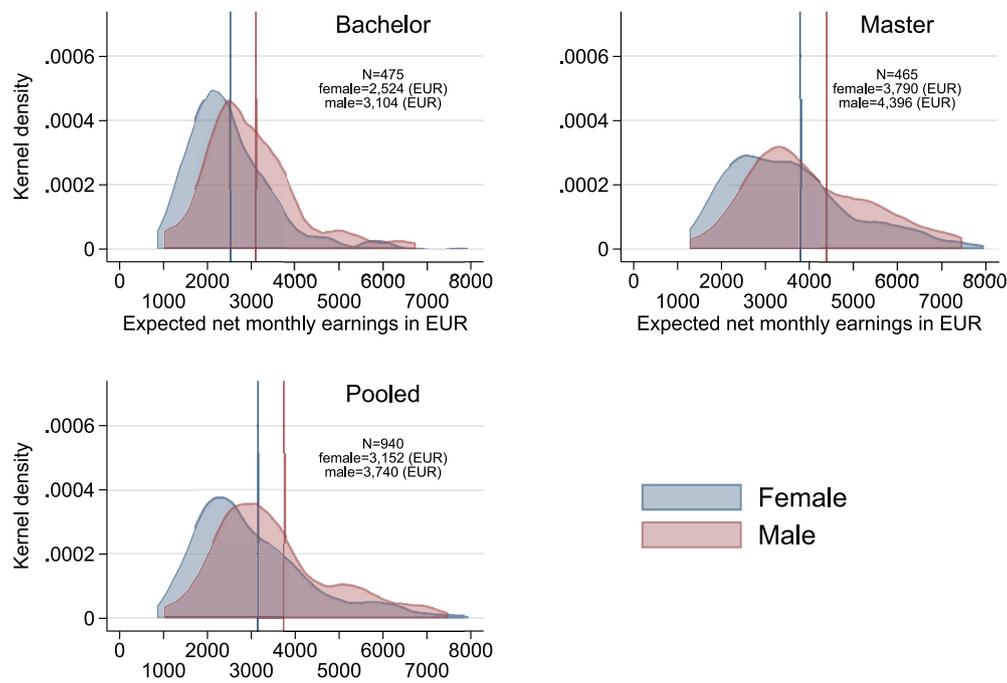


Fig. 1. Expected wages by education scenario and gender. *Notes:* This figure shows the cross-sectional distribution of expected average wages with different educational degrees for men (red) and women (blue). Observations above the highest and below the lowest percentile of the respective distributions are excluded. For illustration purposes wage expectations exceeding 8000 EUR per month are not depicted.

Source: Berliner-Studienberechtigten-Panel wave 3.

Table 1
 Sample characteristics.

	Male	Female		Male	Female
Baseline characteristics:			Career motives:		
Information intervention school	0.327	0.357	High income	3.229	3.175
Financial intervention school	0.405	0.344	Promotion possibilities	3.176	3.162
Migration background	0.420	0.477	Recognition	2.795	2.942*
First generation at college	0.595	0.597	Interesting job	3.498	3.630**
Academic high school	0.254	0.331*	Independent working	2.946	3.062
Integrated high school	0.405	0.341	Social interaction	2.688	3.055***
Vocational high school	0.341	0.328	Important for society	2.615	2.747*
Fast track option	0.034	0.052	Help others	2.561	2.981***
Cognitive abilities:			Spare time	2.756	2.805
Final high school GPA	2.508	2.567	Health/safety conditions	3.239	3.545***
Verbal cognitive skills	10.917	9.808***	Time for family	3.093	3.351***
Figural cognitive skills	11.024	11.244	Noncognitive abilities:		
Intended college major:			Extraversion	4.849	4.880
Arts & Humanities	0.063	0.091	Openness	4.970	5.136*
Social Sciences & Economics	0.024	0.036	Conscientiousness	4.698	5.028***
Business & Management	0.093	0.130	Neuroticism	3.611	4.633***
STEM	0.332	0.153***	Agreeableness	5.029	5.389***
Teaching	0.054	0.107**	Locus of control (int.)	5.027	4.879**
Law	0.039	0.032	Academic self-efficacy	3.220	3.062***
Health & Medicine	0.107	0.192**	Self-confidence	5.200	4.727***
Other	0.063	0.032*			
No college aspiration	0.220	0.195			
Missing information	0.005	0.032**			
N	205	308		205	308

Notes: This table shows means of individual characteristics for men and women. Significance stars signal mean differences based on a two-sided t-test. Source: Berliner-Studienberechtigten-Panel waves 1–2. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

gender (Daymont & Andrisani, 1984). In particular, one might expect that women anticipate future career breaks, e.g. due to care duties related to children or other relatives, which may explain their lower wage expectations compared to men (Chevalier, 2007). Although we do not have direct information on e.g. child bearing plans, the survey includes eleven items that capture the importance of different career aspects for students’ future job choice, on a four-point Likert scale that

ranges from one “not important at all” to four “very important”. This includes the preference to have a job that leaves sufficient time for family commitments. In the decomposition, following Fortin (2008), we use binary indicators that signals if an individual considers a factor very important.

Career motives differ significantly between genders. Overall, women have higher preferences for all intrinsically, socially, and work-life-

balance motivated factors. Although there are no significant differences for extrinsically motivated (or monetary) factors, such as preferences for a high income and good promotion possibilities, it is unclear what men and women assume to be good promotion possibilities and a high income. Gender differences in wage expectations suggest that men and women indeed have a fundamentally different understanding of the latter.

(V) **Noncognitive abilities** cover personality traits, locus of control and confidence measures. A large strand of literature emphasizes the importance of such attributes in explaining educational choices and labor market outcomes (e.g. Heckman et al., 2006) and document gender differences with respect to these non-cognitive skills (see Bertrand, 2011, for an overview).¹⁴ In Section 3 we investigate how these differences are related to gender differences in expectations.

For personality traits, we use an adjusted version of the Five Factor Model that covers openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (Big Five) (McCrae & Costa, 1996). Each dimension is represented by three statements that are answered on a seven-point Likert scale ranging from one “does not apply at all” to seven “fully applies” (Dehne & Schupp, 2007). Unlike when measuring adults, measuring youth’ openness to experience is based on four questions as defined in Weinhardt and Schupp (2011). Based on this information, we generate summation scores for each personality dimension. Comparing personality traits, women are more open, more conscientious, more neurotic, and more agreeable than men. The extent of extraversion is the only dimension that does not differ significantly between gender.

The (internal) locus of control indicates how strongly an individual believes that what happens is a consequence of her own actions as opposed to external factors, e.g. luck or fate (Rotter, 1966).¹⁵ Women show a lower internal locus of control, indicating that they perceive their life to be more affected by circumstances outside their control than men.

Self-confidence accounts for gender differences in the assurance to succeed in the labor market that could result in higher expected wages. This (general) self-confidence is approximated by the extent students agree with the following statement: “I am a person who has a positive attitude toward herself”. The extent of agreement is measured on a seven-point Likert scale. Additionally, students were asked how likely they think it is that they could successfully graduate from university, indicating their academic self-efficacy. Answers are given on a four-point Likert scale ranging from very low to very high. Table 1 shows that women have a considerably lower general self-confidence and lower academic self-efficacy when compared to men. Following Fortin (2008), we use standardized values for all noncognitive abilities in the decomposition.

3. Methodology

In order to investigate the determinants of the gender gap in wage expectations, we rely on the regression-compatible adaption of the standard Oaxaca–Blinder (OB) decomposition (Blinder, 1973; Oaxaca, 1973) as proposed by Fortin (2008).¹⁶ We start by regressing expected log wages y of each individual i associated with each degree d separately for females f (males m) in a simple multivariate setting:

$$\ln(y_{id}^j) = \beta_{0f} + X_i' \beta_f + \varepsilon_{id}, \tag{1}$$

¹⁴ For example, Grove et al. (2011) find that the inclusion of measures on non-cognitive skills and work preferences significantly increases the explained part of the gender pay gap for a sample of individuals with a master’s degree in the U.S.

¹⁵ This measure is based on eight different items, capturing the extent to which individuals agree (on a seven-point Likert scale) with statements such as “The possibilities we have in life are dependent on social circumstances”.

¹⁶ For a detailed discussion of different decomposition methods see Fortin et al. (2011).

$$\ln(y_{id}^j) = \beta_{0m} + X_i' \beta_m + \varepsilon_{id}, \tag{2}$$

which gives estimates of the expected wage structure β of each group (male and female) multiplied with the set of corresponding control variables in X . These comprise baseline characteristics, intended college major choice, career motives, as well as cognitive and noncognitive abilities as described in Section 2. Superscript j indicates the different outcomes y_{min} , y_{max} and $E(y)$. In a second step, we estimate the corresponding reference wage structure γ in a similar regression, pooled over males and females:

$$\ln(y_{id}^j) = \gamma_0 + \gamma_{0f} \cdot F_i + \gamma_{0m} \cdot M_i + X_i' \gamma + \nu_{id},$$

subject to $\gamma_{0f} + \gamma_{0m} = 0$. (3)

To account for group-membership effects, the pooled regression includes separate gender intercepts for males and females. This mitigates the problem that pooled coefficients overstate the effects of variables with large gender differences (Fortin, 2008). In each specification we account for clustering at the individual level.

After obtaining male, female and reference wage structure, gender gaps in expected wages can be decomposed into:

$$\overline{\ln(y_m^j)} - \overline{\ln(y_f^j)} = \Delta X \hat{\gamma} + [X_m' (\hat{\beta}_m - \hat{\gamma}) + (\hat{\beta}_{0m} - \hat{\gamma}_0)] - [X_f' (\hat{\beta}_f - \hat{\gamma}) + (\hat{\beta}_{0f} - \hat{\gamma}_0)], \tag{4}$$

which is a reformulation of the traditional triple-difference OB decomposition (Cotton, 1988; Neumark, 1988; Oaxaca & Ransom, 1994). In this framework, gender gaps can be decomposed into an explained part ($\Delta X \hat{\gamma}$) that captures *differences in characteristics* and an unexplained part that captures *differences in coefficients*. The unexplained part itself can be decomposed into a part that reflects the male advantage ($X_m' (\hat{\beta}_m - \hat{\gamma}) + (\hat{\beta}_{0m} - \hat{\gamma}_0)$) and a part that reflects the female disadvantage ($X_f' (\hat{\beta}_f - \hat{\gamma}) + (\hat{\beta}_{0f} - \hat{\gamma}_0)$).

The explained part gives the share of the overall gender gap that can be explained by women having characteristics that are associated with higher expected wages on average (in both groups). The unexplained part, in contrast, gives the share of the remaining gap that can be explained by women having a different smaller association between certain characteristics and higher expected wages. Traditionally, the explained part reflects differences in *endowments*, i.e. differences in characteristics that capture an individuals productivity. The unexplained part could then be interpreted as discrimination, under the assumption that covariates fully capture productivity differences. In a decomposition of expected wages, the unexplained part reflects subjective beliefs on how different career choices or motives will affect later earnings. These subjective beliefs may themselves be subject to social norms, for example regarding care-giving roles during parenthood, or different role models of young men and women. If women implicitly expect having to give up higher career paths or earnings in order to undertake family duties, then this could also be interpreted as implicitly expected discrimination. Therefore, as both the explained and the unexplained part of the gap provide important information as to whether differential characteristics or differential subjective beliefs are the source of gender gaps in expectations, both have their own policy implications.

4. Decomposition results

4.1. Average wage expectations

Table 2 presents results of the OB decomposition for average expected wages pooled over master’s and bachelor’s degree. Column (1) shows the contribution of each covariate via the explained part and Column (2) gives the respective contribution via the unexplained part. Coefficients behind a covariate category (in bold) give the joint contribution of a set of factors, i.e. the sum of all individual coefficients in that category. The gender gap in expected wages (0.173 log

points) equals the sum of the explained and unexplained part plus the regression constant, which signals the share attributable to unobserved factors. The share attributable to differences in endowments (*explained part*) is positive and significant with 0.045 log points — about a quarter of the overall gap. The share attributable to coefficients (*unexplained part*) is smaller and sums up to 0.016 log points. However, coefficients of the unexplained part are considerably larger on average, but offset each other. Together, the differences in endowments and coefficients of observable characteristics account for about 60% of the overall gap. The remaining constant (0.111 log points) collects all unobserved factors that affect wage expectations.

The two most important categories of endowment (explained part) are intended college major and noncognitive abilities. Differences in intended college major explain about 0.017 log points (around 10% of the overall gender gap in expected wages) and operate mainly through STEM enrollment.¹⁷ The relatively small share explained by other fields of study suggests that much of the gender difference in expected average wages may occur within (intended) college majors, in line with findings by Reuben et al. (2017). An on average higher academic self-efficacy of men explains 0.012 log points, i.e. about 7% of the total gap. This coefficient reflects a higher confidence of male high school graduates in their ability to successfully graduate from college. General self-confidence plays virtually no role in explaining gender differences in expected earnings.¹⁸ The remaining coefficients are insignificant.

In terms of contributions via the unexplained part, several factors are statically significant. Being a first generation potential college students contributes 0.069 log points to the gender gap in expected wages. Fig. 2 shows that this factor has a marginally significant average effect on women, but not on men. This difference alone can explain almost 40% of the overall gap. Of similar sizes in magnitude (although in opposite directions) are the career motives *good health and safety conditions* (−0.081 log points) and *time for family* (0.068 log points). Finally, several intended college majors have differential expected earnings associations for men and women. Most notably, Business & Management is associated with 0.031 log points lower earnings for women than for men. Arts & Humanities and Law, however, are associated with somewhat higher earnings by women compared with men. The negative contribution of the covariate *Master* via the unexplained part shows, that the gender gap in wage expectations for a master's degree is 0.023 log points lower than the average.¹⁹

To provide further understanding of contributions via the explained and unexplained part, Fig. 2 plots selected coefficients from the separate regressions for men (Eq. (1)) and women (Eq. (2)). We see that intending to study a STEM field and a positive academic self-efficacy is associated with higher earnings for both men and women. Table 1 shows that these factors are more prevalent for men, resulting in positive endowment effects. On the other hand, very high preferences for *time for family* and being potential first generation at college have differential effects by gender; they are associated with lower earnings for women but not for men. The former association is large and significant for women. Having a very high preference for *time for family* reduces female wage expectations by 14.8%, while men are virtually unaffected. Similarly, studying Business & Management is associated with higher earnings for men but not for women. These are the differences that are captured by the unexplained part in Table 1.

¹⁷ Table 1 shows that women are less likely to enroll in STEM, which is on average associated with higher earnings.

¹⁸ While there are large gender differences for both measures of confidence (see Table 1), self-confidence is associated with higher expected earnings only for women.

¹⁹ Since all observations in the pooled sample are either conditional on a hypothetical bachelor's or master's degree, the gender gap for wage expectations associated with a bachelor's degree would be 0.023 log points higher than the average (see Appendix Table D.2 for details).

Table 2
Detailed decomposition for average expected earnings (Pooled).

	(1) Explained		(2) Unexplained	
Baseline characteristics:	0.005	(0.008)	0.084	(0.082)
Information intervention school	−0.000	(0.001)	0.039	(0.032)
Financial intervention school	0.003	(0.003)	0.021	(0.033)
Migration background	0.001	(0.002)	−0.025	(0.034)
First generation at college	−0.000	(0.001)	0.069*	(0.039)
Academic high school	−0.001	(0.002)	−0.002	(0.015)
Integrated high school	−0.001	(0.002)	−0.008	(0.019)
Vocational high school	0.000	(0.000)	0.011	(0.016)
Fast track to vocational degree	0.005	(0.006)	0.001	(0.006)
Master	−0.001	(0.002)	−0.023	(0.014)
Cognitive abilities:	0.004	(0.010)	−0.003	(0.007)
Final high school GPA	0.000	(0.003)	−0.000	(0.003)
Verbal cognitive skills	0.002	(0.009)	−0.003	(0.005)
Figural cognitive skills	0.002	(0.003)	0.000	(0.001)
Intended college major:	0.017	(0.011)	−0.008	(0.029)
Arts & Humanities	−0.000	(0.001)	−0.016*	(0.008)
Social Sciences & Economics	0.001	(0.004)	−0.000	(0.004)
Business & Management	−0.001	(0.002)	0.031***	(0.012)
STEM	0.019**	(0.008)	−0.013	(0.018)
Teaching	−0.005	(0.004)	−0.001	(0.008)
Law	0.001	(0.002)	−0.012*	(0.007)
Health & Medicine	−0.001	(0.004)	0.008	(0.013)
Other	−0.000	(0.003)	0.003	(0.008)
No college aspiration	0.000	(0.002)	−0.011	(0.018)
Missing information	0.003	(0.002)	0.002	(0.002)
Career motives:	0.004	(0.015)	−0.060	(0.068)
High income	0.002	(0.003)	−0.036	(0.029)
Promotion possibilities	−0.001	(0.003)	−0.005	(0.032)
Recognition	−0.004	(0.004)	0.010	(0.021)
Interesting job	0.004	(0.004)	0.055	(0.046)
Job security	−0.005	(0.004)	−0.012	(0.037)
Independent working	−0.000	(0.004)	0.006	(0.022)
Social interaction	−0.004	(0.007)	−0.034	(0.022)
Important for society	−0.000	(0.001)	−0.013	(0.020)
Help Others	0.004	(0.008)	−0.018	(0.026)
Spare time	0.001	(0.002)	−0.001	(0.015)
Health/safety conditions	0.002	(0.006)	−0.081**	(0.039)
Time for family	0.006	(0.005)	0.068**	(0.030)
Noncognitive abilities:	0.015	(0.009)	0.004	(0.008)
Openness	0.000	(0.002)	0.000	(0.001)
Extraversion	0.000	(0.002)	0.000	(0.002)
Conscientiousness	−0.000	(0.003)	−0.000	(0.001)
Neuroticism	−0.000	(0.000)	0.001	(0.006)
Agreeableness	−0.000	(0.000)	0.000	(0.001)
Locus of control (int.)	0.003	(0.004)	0.003	(0.005)
Academic self-efficacy	0.012*	(0.007)	0.001	(0.003)
Self-confidence	0.000	(0.005)	−0.000	(0.003)
Subtotal	0.045*	(0.024)	0.016	(0.106)
Constant			0.111	(0.111)
Total gap	0.173***	(0.035)		
N	940			

Notes: This table presents estimates of a detailed Oaxaca–Blinder decomposition using pooled coefficients as weighting scheme. The outcome variable is average expected wages of high school graduates pooled for education scenarios with a bachelor's and master's degree. Joint contribution of factors in each category given by coefficients behind the categories name (in bold). Standard errors allow for clustering at the individual level and presented in parentheses. Source: *Berliner-Studienberechtigten-Panel* waves 1–3. $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

As discussed earlier, the unexplained part may reflect expected discrimination. The constant (0.111 log points) could reflect a fixed level of discrimination due to unobservables while the other unexplained part could capture discrimination associated with observable characteristics. Women who place an importance on family time or who are potential first generation at college may plausibly expect to face greater discrimination on the labor market, and therefore hold lower wage expectations than comparable male counterparts. Women may also anticipate facing a more discriminating environment in Business & Management field, where wages are potentially less regulated and

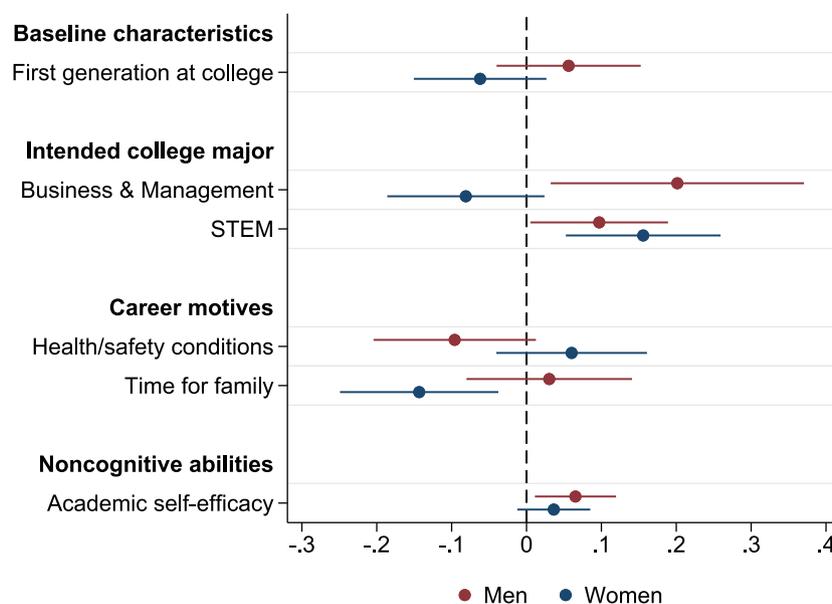


Fig. 2. Effect of preferences on average expected earnings (Pooled). Notes: This figure shows coefficient plots (95% confidence interval) for the effect of selected variables on average expected earnings pooled over degrees for men (red) and women (blue).

Source: Berliner-Studienberechtigten-Panel waves 1–3.

subject to negotiation.²⁰ A further possibility, however, is that the unexplained part reflects sorting into lower paying occupations or industries conditional on intended major and other characteristics, rather than discrimination. Such sorting can reflect the cultural norm in Germany that women tend to be the primary caregivers. As such they may expect to earn less even working full-time e.g. due to the requirement of more flexible working hours. The large contribution of *time for family* as a career motive via the unexplained part is consistent with this.

4.2. Other statistical moments

So far, we have presented decomposition results for the mean of average expected wages, pooling across education scenarios (master's and bachelor's degree). We now turn to a decomposition of statistical moments of both the individual distribution of wage expectations (i.e. minimum and maximum expectations for different degrees), as well as a decomposition of the aggregate distribution of average wage expectations at different quantiles, in order to gain further insight into the formation of wage expectations.

4.2.1. Individual distribution

Fig. 3 plots contributions via the explained and unexplained part for selected variables using decompositions for minimum and maximum expected wages as well as for master and bachelor scenarios, separately. The Figure also reports the sum of each factors contribution via the explained and unexplained part as a percentage of the overall gender gap to give an idea of overall importance of each factor for each expectation scenario. Underlying detailed decomposition results and coefficients are presented in Appendix Section D. Overall, the share explained by differences in coefficients (*unexplained part*) is considerably larger for the selected coefficients than the share of the gap explained by differences in endowments (*explained part*). This is especially true for potential first generations at college and career motives such as a very high preference for *good*

health and safety conditions or *time for family*. For some components, these factors explain over half of the gender gap in wage expectations alone.²¹ For other factors that might indicate occupational sorting, such as intended STEM enrollment, contributions via the explained part are slightly more comparable in size to contributions via the unexplained part.

Splitting out the expectations in this way demonstrates that certain factors have larger impacts on maximum expected wages rather than the minimum expected wages. This difference is especially clear for preferences for time with family, and for academic self-efficacy. Conversely, other factors, such as first-generation at college, appear to have a larger impact through minimum expected wages. There are also differences in the coefficients depending on the education scenario, i.e. wage expectations associated with a bachelor's and a master's degree. Certain factors such as first-generation and *time for family* are associated with larger penalties in expected wages and hence with a larger contribution under the master track, and other such as health and safety, having a larger contribution under the bachelor track.

If certain factors contribute mainly to expected gender gaps in maximum earnings and scenarios with higher educational attainment, we interpret them as affecting mainly higher career paths. If e.g. women expect certain career motives to have a detrimental effect on the upper end of their expected earnings distribution (i.e. they expect a lower maximum wage), this might imply that they expect (having to) forgo higher career paths. A good example is the preference for *time for family*. Appendix Section E is dedicated to the role of this preference and shows that the expected *family penalty* is comparable in size to actual child penalties in Germany, which are one potential (and potentially large) subset of expected *family penalties*.

The only other job preference that seems to have a large and significant (negative) impact on the gender gap in wage expectations is the one for good health and safety condition. Contributions via the unexplained part are large for both expected minimum and maximum wages and both college degrees. Appendix Figure D.2 shows that men who hold this preference expect about 10% lower wages than their male counterparts. For female high school graduates, the association is

²⁰ Gender differences in negotiation styles can especially help in explaining differences in advancement rates (see e.g. Bertrand, 2018). Kiessling et al. (2019) argue that gender differences in negotiation styles are important determinants for both expected wages and starting wages.

²¹ Note that even though these two factors would jointly overexplain the gap, other factors explain negative shares and therefore counteract.

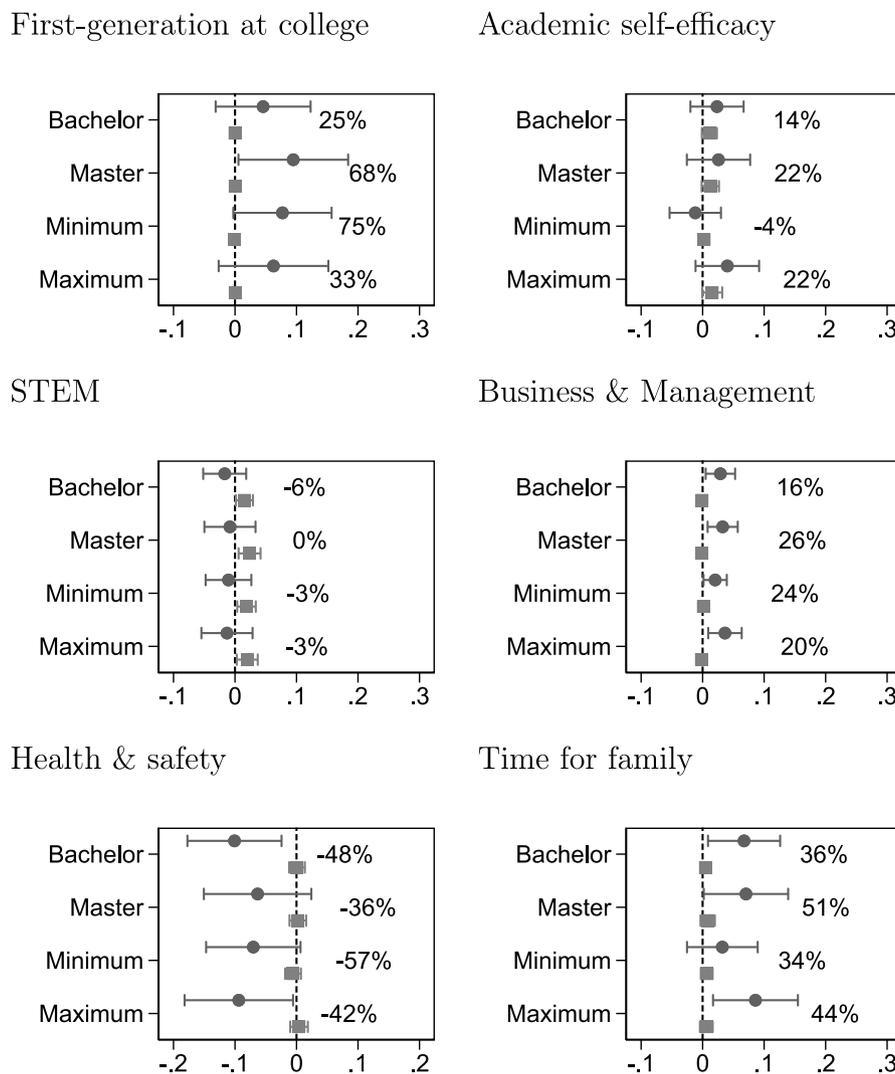


Fig. 3. Contributions via explained and unexplained part for selected variables. Notes: This figure shows absolute contributions of different factors to the gender gap in wage expectations via the unexplained part (dark gray circles) and the explained (light gray squares) in log points and for different components: Bachelor's and master's degree, expected minimum and maximum wages. Joint relative contributions via explained and unexplained part are reported in percent. Source: Berliner-Studienberechtigten-Panel waves 1–3.

rather positive. One possible interpretation of the differences in male and female coefficients is that *good health and safety conditions* are, on average, associated with very different types of jobs by men and women. Another notion is that men expect wage premiums for *risky* jobs as a form of compensating differential (see e.g. Biddle & Zarkin, 1988). Sorting of men into occupations with high risk premia could be one way of how this factor translates into realized earnings gaps.²²

The factor with the largest single contributions (via the unexplained part for master's degrees and minimum expected wages) is being potential first generation at college. Especially female high school graduates without college educated father or mother often hold lower wage expectations than their female counterparts, while for men the association is rather positive (Appendix Figures D.1 and D.2). However, coming from a family with lower educational attainment might not only increase the gap in wage expectations, but could also be associated with a lower probability of college enrollment. In turn, also wage expectations

for a college degree and thus potential returns to college could affect college enrollment. Another factor that is also likely to affect college enrollment, namely the individuals academic self-efficacy, seems to contribute mostly to the gender gap in expectations for a master's degree and maximum earnings.

4.2.2. Overall distribution

An extension of the OB decomposition based on recentered influence functions (RIF) allows to assess the gender gap at other statistical moments than the mean, using quantile regressions (see Firpo et al., 2018, for details). Here, we use this RIF decomposition to decompose the gender gap at different quantiles. As in the main analysis, we again use pooled average wage expectations of all individuals pooled as outcome. Before, we showed that e.g. *time for family* as a career motive has a higher relative importance for individual maximum vs. minimum wage expectations. If this career motive also explains a larger share of the gender gap at higher quantiles of the overall distribution of average expectations, this would confirm our interpretation, that already after high school graduation, many women expect having to give up higher career paths in order to take on family responsibilities.

²² See Table D.3 for a decomposition of the implicitly expected range ($y_{max} - y_{min}$) as a measure of earnings risk. Overall, the same factors that affect average wage expectations also affect the range with similar relative importance.

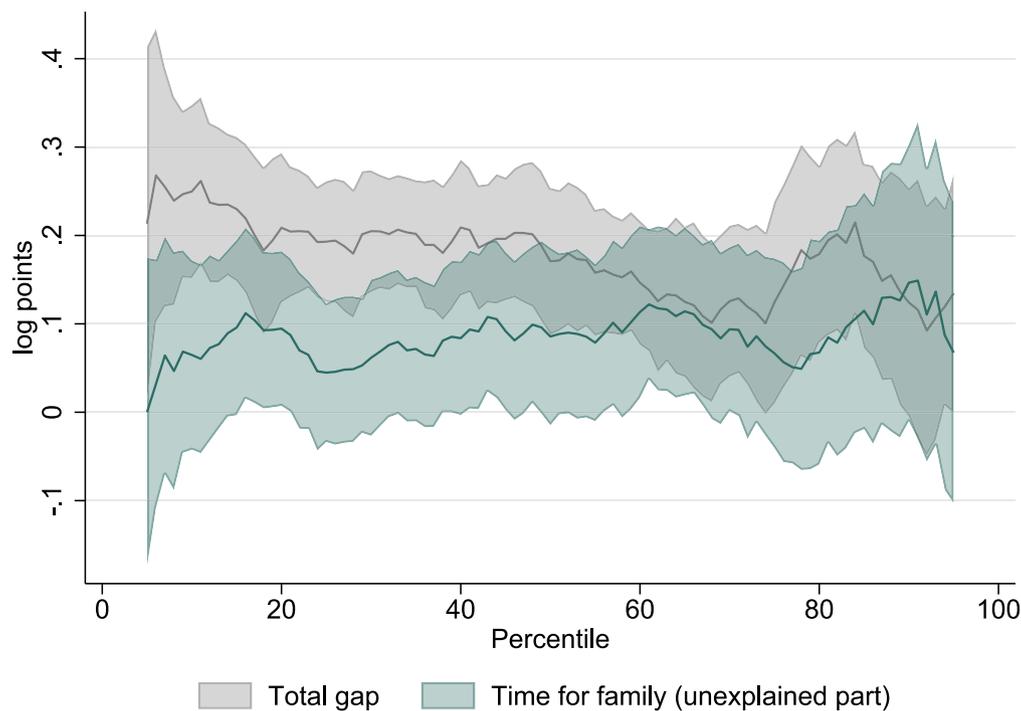


Fig. 4. RIF decomposition for different percentiles (pooled). *Notes:* This figure shows results of a Oaxaca–Blinder type RIF decomposition (Firpo et al., 2018) at each percentile (5 to 95). Men serve as reference group. The outcome variable is average expected wages of high school graduates pooled over education scenarios (bachelor's and master's degree). Total gap in gray and contribution of *time for family* via unexplained part in green. The decomposition controls for all baseline characteristics, cognitive and noncognitive ability measures, intended college major and career motives. Bootstrapped 95% confidence intervals (400 replications). $N = 948$.
Source: Berliner-Studienberechtigten-Panel waves 1–3.

Fig. 4 shows decomposition results along the distribution (5th–95th percentile). In line with e.g. Briel et al. (2022) and Kiessling et al. (2019), the gender gap is largest at lower quantiles and smaller at higher quantiles. In contrast, the share attributable differences in coefficients (unexplained part) of preferences for *time for family* is relatively stable and tends to increase along the distribution. Hence, the relative importance of *time for family* is highest for individuals that expect to be top earners. Around the 90th quantile, differences in subjective beliefs about the returns to *time for family* commitments even overexplain the gap. Effectively, other factors in the decomposition counteract this.²³ The increasing relative importance of *time for family* at higher quantiles of the distribution of wage expectations supports our interpretation, that, at early age and in contrast to men, women expect having to trade off career opportunities against family commitments.

5. College enrollment

Initially, we motivated the relevance of wage expectations as determinant of educational investment and thus future realized gender wage gaps. Lower wage expectations of female high school graduates may affect the actual gender wage gap through lower expected returns to education and thus lower incentives to invest in education. Additionally, these lower expectations may also impact through the formation of reservation wages which are likely to influence the decision to accept wage offers. While we cannot address the latter (see e.g. Kiessling et al., 2019, on this topic), we can complement a strand of literature that empirically investigates whether wage expectations are related to college enrollment (Schweri & Hartog, 2017) and resulting socioeconomic

²³ Appendix Table D.4 shows more detailed RIF decomposition results at the 10th, 25th, 50th, 75th and 90th quantile for the factors of interest from Fig. 3. Overall, the results are similar to the decomposition of average wage expectations.

gaps (Boneva & Rauh, 2020) and gender gaps (Belfield et al., 2020) in enrollment.²⁴

In addition, we can corroborate findings regarding the relevance of gender-specific wages for additional educational investment. Studies have shown that gender-specific differences in work values (Berkes et al., 2022) and the anticipated time commitment to the work or family domain (Wiswall & Zafar, 2021) influence gender differences in educational choices. Given this evidence, a closer look at how expected returns to education could influence gender differences in a key educational choice: enrolling in college or not, goes beyond existing evidence, examining choice models (Boneva et al., 2022, 2021), by investigating how expectations influence actual behavior.²⁵ Studies have shown that young people's decision processes are context dependent, whereby they often rely on observed educational choices or occupations, which encompass gender-specific stereotypes (Mead, 2022; Wiswall & Zafar, 2015, 2021). Therefore, considering this evidence on the prevailing gender differences in choices, we examine how wage expectations could influence enrollment in college education by also looking at differences between female and male students, as such choices explain a significant portion of the gender wage gap (Reuben et al., 2017; Wiswall & Zafar, 2018). Information on college enrollment and expected returns to college is available for 445 individuals. Our results give supporting evidence that expected returns to college education and enrollment are indeed linked.

Table 3 shows descriptive statistics for college enrollment and expected returns to college for the complete subsample as well as by

²⁴ The 2015 cohort of high school graduates in Germany shows a gender gap of eight percentage points in the enrollment rates of high school graduates after two years (male: 71%, female: 63%, see Destatis (2020)).

²⁵ See e.g. Favara et al. (2021) on how wage expectations are associated with actual college enrollment in developing countries.

Table 3
Expected returns and college enrollment by subgroup.

	Main	Gender		SES	
	(1)	Male (2)	Female (3)	High (4)	Low (5)
Enrollment (<i>C</i>)	67.2	71.2	64.4	68.5	66.3
Expected returns (<i>R</i>)	0.340 (0.270)	0.345 (0.268)	0.336 (0.272)	0.311 (0.260)	0.359* (0.276)
N	445	184	261	181	264

Notes: This table presents descriptive statistics on college enrollment rates (in percent) and expected returns to college (in log points) for the complete college enrollment analysis sample and by gender and SES. Standard deviations in parentheses are reported for expected returns to college. Significance stars indicate differences based on a two-sided t-test within the respective subgroups. Source: *Berliner-Studienberechtigten-Panel* waves 1–5. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

gender and socioeconomic status (SES).²⁶ College enrollment (*C*) measures the percentage of high school graduates in our sample that enrolls for college within two years of graduation, i.e. between winter term 2014 and summer term 2016. Overall enrollment rates and enrollment rates by gender are representative of actual population shares. Surprisingly however, graduates with and without at least one parent with a tertiary degree (i.e. high and low SES graduates) show similar enrollment rates. Enrollment rates after two years are only 2.2 percentage points (pp) lower for graduates that are the potential first generation at college (68.5% vs. 66.3%). This difference is not statistically significant. Expected returns to college (*R*) are defined as the difference between expected earnings with a bachelor's and a vocational degree (in log points). Expected returns to college are large²⁷ for the subsample at hand and vary extensively,²⁸ but there is virtually no difference between genders. Expected returns to college held by low SES students (0.359 log points, about 48.7%) are significantly higher than those held by high SES graduates (0.311 log points, about 41.2%). Table C.2 shows that the actual returns to college in 2014 range from 17.6% for females to 20.2% for males, meaning that high SES students are better informed about the returns to college.

To estimate the association between college enrollment and the expected returns to college we rely on a simple linear probability model:

$$C_i = \beta_0 + \beta_1 R_i + \beta_2 F_i + \beta_3 (R_i \times F_i) + X_i' \gamma + \mu_s + \varepsilon_i, \tag{5}$$

where $C_i \in \{0,1\}$ signals college enrollment within two years of graduation, $F_i \in \{0,1\}$ is a dummy that signals if a student is female, X_i is the vector of covariates from the decomposition and μ_s are school (*s*) fixed effects. Expected returns to college R_i simply measure the difference between expected earnings with a bachelor's and a vocational degree ($\ln(y_{i,d=BA}) - \ln(y_{i,d=voc})$). Table 4 shows the corresponding estimation results. Results in Panel A are based on a bivariate model that includes only expected returns as explanatory variables. We also check for robustness of these results to the inclusion of school fixed effects (Panel B) and school fixed effects plus the set of control variables used in the decomposition (Panel C). In addition to the baseline coefficient in the respective first column, each Panel shows results from a fully interacted model with interactions by gender and by socioeconomic status. In all specifications we account for clustering at the school level, reflecting e.g. possible peer effects. As the number of clusters is small (27 schools), we also report p-values from a wild cluster bootstrap (WCB, Roodman et al., 2019). Additionally, Fig. 5 shows the underlying subgroup coefficients for both genders as well as low and high SES graduates.

²⁶ We define high SES as having at least one parent with college education and low SES as being potential first generation at college.

²⁷ Mean: $45.7\% \approx 100\% \times (e^{2 \times (0.340 + 0.270^2)/2} - 1)$.

²⁸ SD: $40 \text{ pp} \approx 100 \text{ pp} \times \sqrt{(e^{0.270^2} - 1) \times e^{2 \times 0.340 + 0.270^2}}$.

Panel A of Table 4 shows that in the baseline specification without control variables and fixed effects, there is a positive and significant association between the expected returns to college and college enrollment. Column 1 indicates that a 1% increase in the expected returns to college is associated with an on average 0.147 pp higher probability of subsequent college enrollment.²⁹ Column 2 additionally shows the interaction for potential first generation students at college. Higher expected returns are associated with a significantly higher enrollment rates for students who have at least one parent with a college degree. For potential first generation college students, the resulting subgroup coefficient is insignificant and close to zero (see Fig. 5).³⁰ Lastly, Column 3 shows that while the association between expected returns and enrollment intentions for men is close to zero, the average association between the two variables is significantly higher for female high school graduates. The resulting subgroup coefficient for women is about twice as large (0.289) as the average effect and statistically different from zero at the 5% level, confirmed by a WCB. This result suggests, that monetary concerns play a larger role for women than for men when deciding whether to enroll at college or not.

Lastly, Panels B and C show results from specifications that include school fixed effects and the set of control variables from the decomposition in addition to school fixed effects, respectively. Overall, the results follow a similar pattern as in Panel A. Again, large and significant interactions for different socioeconomic backgrounds exist, while the average association between expected returns to college and college enrollment is smaller and not significant. The subgroup coefficient for men is again small and negative, while the difference to the association for women is large. Even though this interaction is not statistically significant, Fig. 5 shows that the underlying subgroup coefficients for women are large and positive (0.211 in Panel B and 0.208 in Panel C) and statistically significant at the 10% and 5%-level, again confirmed by a wild cluster bootstrap. Overall, wage expectations seem to matter for the college enrollment of women, while men seem to be less affected in their enrollment decisions by such considerations. This association is robust to an inclusion of school fixed effects and a large range of control variables.

The results above suggest that expected returns to college play a larger role for college enrollment of high school graduates from more educated families and for women. Both associations cannot be explained by women or high SES graduates simultaneously having higher expected returns to college and enrollment rates. We therefore provide supporting evidence for the hypothesis that wage expectations matter for human capital investment and thus predictive of actual wage differences between genders. Previous work with Best Up found positive effects of information on the returns to college on both enrollment intentions (Peter & Zambre, 2017) and actual college enrollment (Peter et al., 2021), supporting the notion that a gender gap in wage expectations might affect educational choices and thus entrench subsequent earnings inequalities.

6. Conclusion

Based on a unique survey in which we elicit the range of high school graduates' wage expectations for different degree types, this study investigates respective gender differences and how different factors, such as preferences for certain job attributes and college majors, as well

²⁹ This associations might seem small, but Table 3 reveals that expected returns are large (about 45.7% for the subsample at hand) and vary extensively (standard deviation about 40 pp). I.e. a one standard deviation change in expected returns is associated with an about 5.9 pp higher enrollment probability.

³⁰ One might expect that this association is explained by high SES graduates simultaneously showing higher wage expectations and college enrollment rates. However, Table 3 shows that this is not the case.

Table 4
Expected returns to further education and college enrollment.

	Panel A			Panel B			Panel C		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Expected returns to college	0.147** (0.061) [0.037]	0.342*** (0.085) [0.002]	-0.067 (0.116) [0.588]	0.096 (0.063) [0.155]	0.322*** (0.087) [0.003]	-0.063 (0.132) [0.638]	0.094 (0.055) [0.091]	0.320*** (0.097) [0.002]	-0.061 (0.126) [0.626]
× First generation		-0.305** (0.148) [0.044]			-0.354** (0.152) [0.022]			-0.368** (0.156) [0.020]	
× Female			0.357* (0.174) [0.064]			0.274 (0.200) [0.183]			0.269 (0.195) [0.180]
School FE				✓	✓	✓	✓	✓	✓
Controls									
N	445	445	445	445	445	445	445	445	445

Notes: This table presents estimates from a linear probability model with college enrollment as dependent variable. Expected returns to college are calculated as the difference between (log) expected wages with a bachelor's degree and a vocational degree. Control variables comprise the variables included in the decomposition. Standard errors in parentheses allow for clustering at the school level. P-values in brackets are based on a wild cluster bootstrap with 1999 replications. Source: *Berliner-Studienberechtigten-Panel* waves 1–5. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

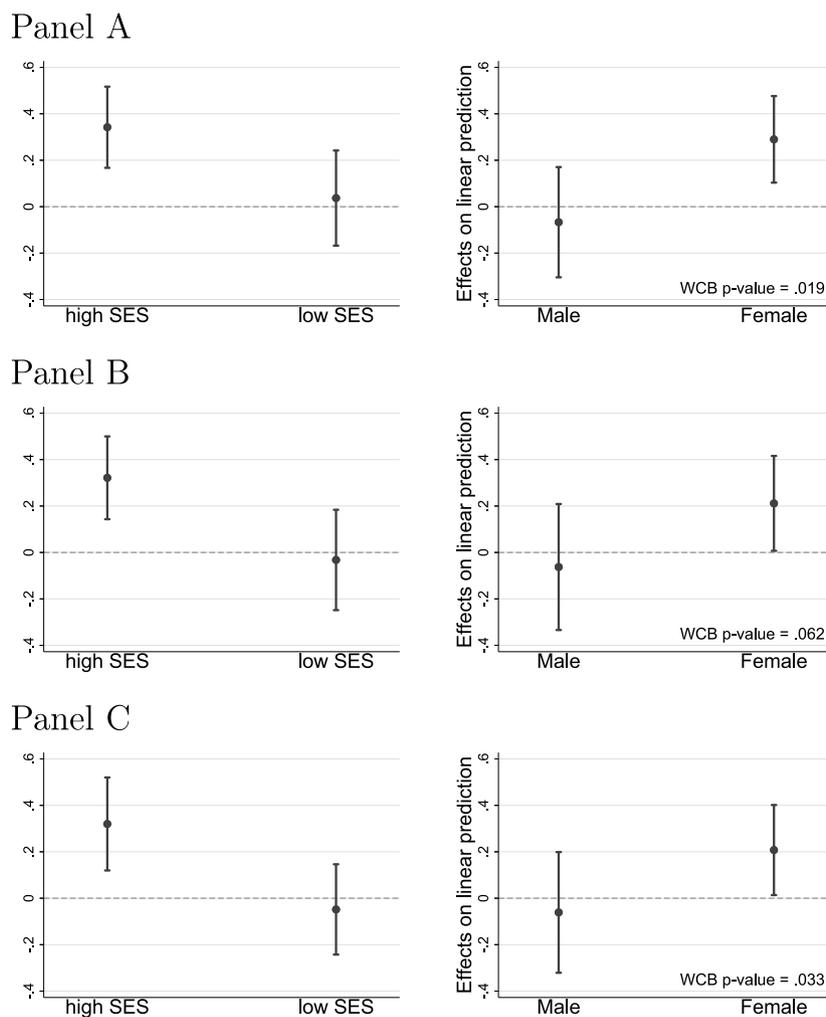


Fig. 5. Average marginal associations by gender and SES. Notes: This figure shows subgroup coefficient plots (95% confidence intervals) by gender and socioeconomic background for each Panel in Table 4. Standard errors allow for clustering at the school level. P-values from a wild cluster bootstrap with 1999 replications are reported for females. Source: *Berliner-Studienberechtigten-Panel* waves 1–5.

as cognitive and noncognitive abilities, shape them. The results of our analysis can be summarized in four key findings.

First, already at high school graduation female students expect to earn over 15% less than their male counterparts. This observation cannot be explained by women being better informed about wages that are currently paid on the labor market. Second, female high school

graduates expect large family penalties, even conditional on full-time employment. These family penalties are especially large for individual maximum expectations, higher degree types and higher quantiles of the overall distribution of wage expectations. This indicates that, early on, women expect having to trade off advancements opportunities and thus leadership positions in order to take on family responsibilities.

However, female high school graduates still underestimate the size of family penalties when compared to contemporaneous child penalties, one potential subset of family penalties, observed in Germany.

Third, including expected family penalties, most factors affect the gender gap in wage expectations mainly through differences in coefficients rather than differences in endowments. Related studies often neglect the contribution of expected family penalties and other factors via the unexplained part therefore underestimate its relative importance. Finally, differences in the expected returns to higher education are likely to impact female human capital investment. Thereby, gender gaps in wage expectations can also affect the formation of gender gaps in realized earnings.

The findings of this study provide some evidence for a selection of women into lower paying occupations or industries in exchange for certain job characteristics. However, certain job characteristics and majors are associated with fundamentally different expected returns by men and women, which signals expected gender-based discrimination. As such expected discrimination might itself be simultaneously associated with the formation of preferences, expected discrimination and sorting can go hand in hand.

Future policies that affect early wage expectations and encourage women to pursue higher career paths can be roughly divided into two groups. The first set of policies primarily includes measures that aim at improving the compatibility of family and career for women. For instance, such measures might aim to increase incentives for men to undertake a larger share of care work: An adjustment of income splitting, the expansion of parental allowances, especially for fathers, a reduction of statutory working hours, or family leave regulations also for those who take care of older parents or disabled relatives might be measures which help to combine work and family time. Other measures might aim at the expansion of publicly funded daycare for children and disabled elderly or encourage *top sharing*, i.e. shared leadership positions between men and women, associated with a reduction in working hours. If young women observe such policies and update their beliefs about the compatibility of family and career accordingly, also expected family penalties and hence the gender gap in wage expectations might be reduced.

The second set of policies includes measures that directly aim to adjust wage expectations and career plans. However, such measures face a dilemma: On the one hand, information campaigns about the costs of family commitments can be beneficial as they could enable more informed career and family care decisions of women and thus might give them more bargaining power when it comes to the intra-household division of labor. On the other hand, we present evidence that young women underestimate family penalties when compared to contemporaneous labor market data. If this can be interpreted as optimism or motivation to arrange family and career, it might be counterproductive to lower their wage expectations by informing them about family penalties. Thus, possible information campaigns should also include information on family allowances and career counseling for women, to avoid discouragement.

While the results of this study are descriptive in nature, they provide evidence on why women (expect having to) give up on higher paying career paths and postulate a fruitful perspective for future research on the causal mechanisms that shape wage expectations and their importance for students' future career and human capital investment.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request

Appendix A. Supplementary data

Supplementary material related to this article can be found online at <https://doi.org/10.1016/j.econedurev.2023.102398>.

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