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Academic or vocational education? A comparison of the long-term wage development of academic and vocational tertiary degree holders

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Abstract

Education is a key determinant of wage development. The relationship between education and wages is particularly strong in countries with vocationally oriented educational systems and a clear distinction between general and vocational education, such as Germany and Switzerland. However, whether general and vocational education offer the same returns to education is an ongoing debate. Previous findings from international research are still inconclusive. Against this background and based on theoretical arguments from human capital and signalling theory and the task-specific learning-by-doing approach, our paper examines the long-term wage development of Swiss university and professional education degree holders from the time they obtain their tertiary degree until their late career. It asks how differences between the two groups in wage development may be explained. Our results, produced with regression decomposition methods, show that within the first 20 years after graduation, university degree holders experience steeper wage growth. An important reason for this difference is that university graduates move more often than vocational tertiary degree holders into well-paid labour market positions endowed with formal authority, management responsibility, and a large proportion of cognitive nonroutine tasks.

Keywords University education, Higher vocational education, Long-term wage development, Work tasks, Decomposition methods

JEL Classification I26

1 Introduction

Education is a key determinant of wage levels, wage development, and other labour market outcomes, such as status mobility (e.g., Bills 2003; Gunderson and Oreopolous 2010; Sicherman 1990). The relationship between education and labour market outcomes is particularly strong in countries with vocationally oriented educational systems and labour markets, such as Germany and Switzerland (Bol and van de Werfhorst 2011). The educational systems of these countries have traditionally drawn a clear distinction between vocational and general education (Busemeyer and Trampusch 2019). At the upper-secondary level, only a minority of youth attend general education. Until the 1980s, academically oriented universities provided higher education for this small elite. However, higher education has expanded and diversified rapidly within recent decades (Altbach et al. 2009; Usher 2009). This process has led to an increasing

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vocationalization of higher education, by creating higher vocational programmes, by including vocational elements into existing university programmes, and by creating hybrid forms of higher education (e.g. Gellert and Rau 1992; Billett 2009). Switzerland has emphasized the first option. It created a vocational track of higher education alongside universities, called professional education, by elevating postsecondary vocational programmes to the tertiary level of the education system (Wettstein et al. 2017). Professional education is predominantly chosen by young people with upper-secondary vocational education and training diplomas.

Within the last decade, many countries have promoted vocational education and training as a remedy for youth unemployment and education–job mismatch at labour market entry. This is because upper-secondary VET has been shown to facilitate labour market integration in a matching job and leads, on average, to comparatively high wages at the beginning of the career (e.g., Lavrijsen and Nicaise 2017; de Lange et al. 2014; Wolbers 2007). However, whether general and vocational education offer the same returns to education in the long run is an ongoing debate. The findings from international research, mostly pertaining to upper-secondary education, are inconclusive and highlight the context dependency of effects of education (e.g. Hartog et al. 2002; Connolly and Gottschalk 2006; Bol and van de Werfhorst 2011; Brunello and Rocco 2017; Golsteyn and Stenberg 2017; Korber and Oesch 2019, Birkel and van de Werfhorst 2022; Hartog et al. 2022; for an overview see also Kriesi and Schweri 2019). Few studies have investigated various types of tertiary-level education. Brunello and Rocco (2017) find similar wage trajectories for British workers with vocational and general tertiary degrees, whereas a German and a Swiss study both find steeper wage trajectories for graduates from traditional universities than for graduates from other university types, such as universities of applied sciences (Backes-Gellner and Geel 2014; Dietrich and Patzina 2023). Descriptive results for Switzerland imply a long-term wage disadvantage for graduates with a professional education degree. They earn, on average and across all age groups, up to CHF 20,000 less per year than university degree holders (BFS 2019a, b; Aepli et al. 2021). A possible reason for this difference is that professional education teaches more occupation-specific skills than universities. Some scholars argue that occupation-specific skills devaluate more quickly than general knowledge and make workers less mobile and adaptable to changes in skill demand (Goldsteyn and Stenberg 2017; Hanushek et al. 2017; Fedorets 2018; Korber and Oesch 2019). However, this alleged mechanism is under-researched. Furthermore, comparisons of the long-term wage development of workers with different types of tertiary-level degrees are rare and, to our knowledge, non-existent for Switzerland. Most of the existing research either compares workers with upper-secondary VET with those holding general education degrees or is descriptive in nature. This article therefore attempts to answer the following questions: How do the wages of Swiss university and professional education graduates develop from the time they obtain their tertiary degrees until their late careers? How can differences in wage development between the two groups be explained?

These questions are relevant for several reasons. Firstly, wage trajectories of workers with different types of tertiary-level degrees and their determinants have been little investigated. Research has provided evidence that earnings depend on a complex interplay of individual, structural, and institutional factors. However, the relative significance of these factors in explaining differences between groups of workers with educational credentials on similar levels—the tertiary level in particular—is largely unknown. Secondly, the findings of our study are of interest beyond Switzerland because tertiary education has expanded and differentiated greatly within recent decades in all postindustrial economies. This development has accompanied an increase in inequality within countries (Altbach et al. 2009). Investigating the determinants of unequal labour market outcomes of workers with different types of credentials at the same education level can thus improve our understanding of inequality mechanisms and help to refine theories of social inequality.

Our article begins with an introduction to the Swiss tertiary education system, followed by theoretical considerations from human capital (Becker 1962), signalling theory (Spence 1973; Mincer 1974), and the task-specific learning-by-doing approach (Author et al. 2003; Gibbons and Waldman 2004). After describing our data sources and methodological approach, we describe the development of wages for both types of degree and their potential determinants. Afterwards, a first insight into the temporal development of the explanatory factors of wages is given by means of the Kitagawa-Oaxaca-Blinder (KOB) decomposition of each cross-section (Kitagawa 1955; Blinder 1973; Oaxaca 1973). Subsequently, we investigate the extent to which temporal differences in wage levels can be explained by changes in potential explanatory factors using of Kroeger and Hartmann's (2021) interventionist decomposition method. Finally, we discuss our empirical results.

2 Theoretical considerations

2.1 The structure of tertiary education

Within recent decades, tertiary education has diversified greatly in all postindustrial countries. Traditional academic universities have been complemented with higher education institutions that have a closer focus on vocational skills and knowledge (Altbach 2009; Billett 2009; Usher 2009). However, the landscape of higher education differs between countries and can include traditional universities, polytechnics, university of applied sciences, community colleges, higher vocational education, and other forms of tertiary education (Ulicna et al. 2016). Whereas the clear distinction between academic and vocational tracks of higher education has weakened in some countries, Swiss tertiary education has retained its dual structure and distinguishes between universities and vocationally oriented professional education. Access to the former is contingent on a baccalaureate; access to the latter usually requires an upper-secondary vocational education and training diploma (Kriesi and Trede 2018; Sander and Kriesi 2021).

Professional education imparts occupation-specific theoretical and practical knowledge. It often develops the content of training at upper-secondary level. It enables the practical consolidation of technical knowledge, provides professional specialization, and imparts management training (BBT 2011; Kriesi and Trede 2018; Weber and Kuhl 2009). In Switzerland, approximately 850 educational qualifications can be earned through three educational paths: federal diplomas of professional education and training, advanced federal diplomas of professional education and training, and colleges of professional education and training.

The federal diplomas of professional education and training represent a technical specialization of previous training and enable apprentices to be further trained. Courses leading to advanced federal diplomas of professional education and training impart expert knowledge, enable holders to occupy management positions, and extend the expertise represented by federal diplomas of professional education and training, if available in the occupational field (Wettstein et al. 2017; Kriesi and Trede 2018). Training for an (advanced) federal diploma of professional education usually last one to two years. Colleges of professional education and training provide full- or part-time training of two or three years' duration and qualify students for specialist or management positions (Baumeler et al. 2014; Kriesi and Trede 2018).

Universities include academic universities, Swiss federal institutes of technology, universities of applied sciences, and universities of teacher education. University degrees are offered at bachelor and master levels and take between three and five years to complete. Access to universities of applied sciences and of teacher education require a vocational or specialist baccalaureate, whereas access to academic universities and the Swiss federal institutes of technology, whose main function is research, requires an academic baccalaureate.

Compared to professional education, academic universities and universities of applied sciences and teacher education impart larger proportions of general knowledge. This includes advanced communication, presentations, complex problem-solving, and analytical skills. Students are also taught to acquire knowledge independently. In comparison to professional education, this knowledge is only partially subject specific and therefore tends to be broader (Ministry of Science, Technology, and Innovation 2005; BFS 2008; Heijke and Meng 2011; Tuor and Backes-Gellner 2010). Such differences are likely to lead to wage differentials between university graduates and workers with professional education.

The Swiss system of higher education shares commonalities with other postindustrial countries. Traditional universities and universities of applied sciences awarding bachelor and master degrees are widespread in most countries. In addition, the majority of countries offer some higher vocational training programs. In about half of the EU member states, higher vocational education has high or growing importance. However, the higher vocational education sector is more heterogeneous than the university sector in designations, institutional embedding, and skills taught (Ulicna et al. 2016). Germany, Austria, and Switzerland have traditionally included similar tracks of professional education, even though developments in their education systems have led to some divergence within the last two decades (Dionisius et al. 2023; Ebner et al. 2013; Vogtenhuber et al. 2021).

2.2 Determinants of wages

Wage levels depend on individual characteristics such as education and work experience, on workers' allocation to jobs, and on the time-dependent demand for specific skills, which influences the price that employers are willing to pay for certain types of skills (e.g., Becker 1962; Mincer 1974; Baron and Bielby 1980; Autor et al. 2003). Changes in skill demand and the concomitant price change due to technological development are seen as important drivers of income inequality between groups of workers (Autor et al. 2003; Card and DiNardo 2002). In the following sections, we discuss the roles of individual

characteristics, labour market allocation and changes in skill demand in explaining potential wage differences between workers with academic and vocational education at the time of labour market. Furthermore, we theorize the different wage development of these two groups across the career.

2.2.1 Wage levels in the early career

Human capital theory discusses income level as determined by individual productivity. It argues that productivity-relevant individual characteristics, such as skills acquired by education and work experience, lead to higher individual productivity and thus to higher wages (Becker 1962; Spence 1973; le Grand and Tåhlin 2002; Kalleberg and Mouw 2018). It also assumes that skills are firm specific, occupation specific, or generally applicable. Firm-specific skills are only useful in the company in which they are acquired. Occupation-specific skills and knowledge are transferable between employers. They lead to high productivity within specific occupations. This holds for practical occupation-specific skills in particular, which reduce the need for on-the-job training but also hamper the acquisition of general skills. General skills are useful irrespective of the firm or occupation and thus highly transferable between jobs (Shaw 1987; Neal 1995; Hanushek et al. 2017; Grønning et al. 2020; Schulz et al. 2023).

Individual skills and productivity are not directly observable before the start of employment. However, educational credentials serve as signals of workers' unobservable knowledge and skills and help to solve the problem of unequally distributed information between employers and employees (Spence 1973). Because the acquisition of educational qualifications is costly, and costs are negatively related to individual performance, rationally acting individuals will only invest in a certificate if they have the necessary skills. Educational certificates are thus interpreted as a largely reliable indicator of potential performance, ability, and trainability.

The price paid for workers' skills in the form of wages depends on the demand for such skills. In recent decades, automation and computerization has increased the demand for highly qualified workers in most postindustrial economies (Autor et al. 2003; Sacchi et al. 2005; Spitz-Oener 2006; Liu and Grusky 2013). At the same time, technological change has substituted human routine tasks with machines. As a result, the demand and the price for the complementary tasks that serve to maintain, operate, and further develop machines, which are mainly analytical and interactive cognitive nonroutine tasks, have increased, whereas the price for routine tasks has decreased. Analytical tasks require general skills, such as problem solving, assessment, and planning skills, and skills for developing and applying rules. Interactive tasks also require many general skills, including negotiating, teaching, entertaining an audience, and presenting results (Spitz-Oener 2006). Wages are positively related to these cognitive nonroutine tasks, and their proportion in the workplace increases with rising levels of education and training (Autor et al. 2003; Goos and Manning 2007; Acemoglu and Autor 2011; Rohrbach-Schmidt and Tiemann 2013; Author and Handel 2013; Liu and Grusky 2013; Oesch 2013; Williams and Bol 2018; Sander and Kriesi 2019).

Individual skills and their demand explain only part of individual wage differences. Wages also depend on a worker's position in the labour market, as structuralist labour market scholars have shown (e.g., Baron and Bielby 1980; Preisendörfer 1987; Kalleberg and Mouw 2018). Labour market positions are characterized by wage-relevant occupation-specific job tasks and skills, formal authority, management responsibilities, and firm size. Wages vary between occupations. They are generally also higher in large firms, in positions with formal authority and positions with management responsibilities, and in jobs with large proportions of nonroutine tasks (Baron and Bielby 1980; Haupt and Ebner 2020; Sander and Kriesi 2019; Weeden 2002).

As described above, workers with professional education are equipped with many ready-to-use practical skills and work experience, whereas workers with university degrees are equipped with a larger proportion of general knowledge and skills needed for executing well-paid nonroutine tasks. These differences in skill endowment are likely to result in allocation to different jobs immediately after graduation. We thus assume that *workers with professional education are more likely to work in jobs with lower proportions of cognitive nonroutine tasks and in smaller firms. Due to their more extensive work experience, they are also more likely to work in jobs with formal authority or management responsibilities after graduation (H1).* Because jobs in smaller firms and with lower proportions of cognitive nonroutine offer lower pay and jobs with management responsibilities and formal authority offer higher pay, we argue that these differences in job allocation counterbalance each other at the beginning of the career. Therefore, we hypothesize that *average wages at labour market entry after completion of tertiary education do not differ significantly between individuals with professional and university degrees (H2).*

2.2.2 Wage development over careers

Wage development between groups of workers may diverge for several partly interrelated reasons: Firstly, workers with different educational credentials may

accumulate different skills and experience, as proposed by the task-specific learning-by-doing approach (Gibbons and Waldman 2004). Secondly, they may differ in opportunities for mobility, thus experiencing different changes in structural positions within the labour market (Baron and Bielby 1980; Preisendörfer 1987; Rosenfeld 1992). These two factors are interrelated because labour market allocation is likely to affect human capital accumulation and vice versa (Schulz et al. 2023). Thirdly, groups of workers with different educational credentials may be affected differently by structural changes to a national economy (Autor et al. 2003). Whereas the first two explanations assume that diverging wage trajectories are caused by differences in the development of worker characteristics, such as human capital and/or labour market positions, the third explanation argues that the value or price of these characteristics may develop differently over careers.

The task-specific learning-by-doing approach argues that learning at the workplace leads to the accumulation of task-specific human capital, which in turn determines individuals' productivity and wage development across the career (Becker 1962; Heckman and Sedlacek 1985; Gibbons and Waldman 2004; Kalleberg and Mouw 2018). Research has shown that learning gains at the workplace and human capital accumulation are more pronounced among workers performing complex and demanding cognitive nonroutine job tasks that require general skills, such as problem-solving competencies and analytical thinking (Gathmann and Schönberg 2010; Stinebrickner et al. 2019). *We assume that because university graduates have acquired more general skills than professional education graduates, university graduates experience steeper wage increases than professional education graduates (H3).*

Secondly, diverging wage trajectories between university and professional education graduates may be driven by differing opportunities for upward mobility (Schulz et al. 2023). When competing for well-paid positions in large firms with high status, formal authority, management responsibilities, and high proportions of nonroutine tasks, groups of workers with extensive general skills are likely to have an advantage (Markey and Parks 1989; Struck 2005; Frederiksen and Kato 2011). General skills may not only lead to higher learning gains but are also more easily transferred between positions than are occupation-specific skills. Consequently, university degrees may signal higher productivity and trainability than professional education degrees and thus provide an advantage in gaining access to jobs in large firms offering higher wages, more employment stability, and greater career opportunities (Baron and Bielby 1980; Zimmermann and Schmidt 1991; DiPrete 1993; Oi and Ison 1999; Leung et al. 2008) and to jobs with formal authority, management responsibilities, and high proportions of cognitive nonroutine tasks (see also Markey and Parks 1989; Struck 2005; Frederiksen and Kato 2011). In turn, access to these positions leads to more learning opportunities and thus fosters the acquisition of further general skills (Schulz et al. 2023), thus facilitating further upward mobility to even better paid positions.

Because positions in larger firms with formal authority, management responsibilities, and high proportions of cognitive nonroutine tasks are better paid than those in small firms or positions without authority or management responsibilities (Brüderl 1991; Gibbons and Waldman 1999; Frederiksen and Kato 2011; Kalleberg and Mouw 2018), wages for these jobs should increase faster. We thus propose the following hypothesis: *University graduates have steeper income trajectories than graduates of professional education because they more often gain access to positions in larger firms, to positions with formal authority, to positions with management responsibility, and to positions with high proportions of cognitive nonroutine tasks (H4).*

The third plausible source of variation in wage development is differences in the price of worker characteristics between the two groups, which may lead to wage differences despite comparable positions in the labour market. Possible reasons include differences in productivity, for example due to unequal ability and motivation, differences in risk attitudes and aspirations, and differences in job tasks. Rohrbach-Schmidt (2019) shows for Germany that even within the same occupations and positions, the proportion of better-paid cognitive nonroutine tasks can differ considerably. Assuming that university graduates are likely to gain access to jobs with higher proportions of cognitive nonroutine tasks, which have gained in value in recent decades, *the price for university graduates' labour may have increased, which leads to steeper wage trends (H5).*

3 Data and methods

3.1 Data and sample

We use data from the Swiss Labor Force Survey (SLFS) for the years 1996 to 2020 to test our hypotheses. The SLFS is conducted by telephone interviews with individuals of the permanent resident population of Switzerland aged 15 and older. Until 2010, the SLFS was designed as a rotating panel with a maximum duration of five years. From 2010 onwards, the observation span was reduced to two years (BFS 2017). We select all employed individuals working at least 10 h per week, aged between 25 and 60 years, born 1940 or later, with a tertiary-level degree who completed their studies between the age of

25 and 49.[1] Furthermore, we only include respondents who do not work in the agricultural sector and who have a full-time equivalent annual gross income between CHF 36,000 and CHF 458,000.[2][3]

3.2 Measures

The dependent variable is the annual gross wage for full-time work in CHF, based on a 42-h week, at inflation-adjusted prices as of December 2015.[4] For our model estimations, we use the logarithm of these values as proposed by Mincer (1974).[5]

We distinguish between respondents with a university degree (0) and those with a professional education degree (1). Individuals with a university degree have earned a degree from a [1] university of applied sciences, [2] a university of teacher education, or a [3] traditional university. Individuals with a professional education degree hold a [1] federal diploma of professional education and training, [2] an advanced federal diploma of professional education and training, or [3] a degree from a college of professional education and training. Because we are interested in wage development, time is measured by years of work experience. Our observation span ranges from the first year after completion of tertiary education to 35 years of work experience.[6]

Two dichotomous independent variables capture whether respondents' have a position with formal authority (1) or not (0) and whether they hold a management position (1). Formal authority refers to positions authorized to issue instructions to at least one employee, and a management position indicates membership of a company's management board. Company size distinguishes between individuals working in medium or large companies with at least 50 employees (1) and those in smaller companies with fewer than 50 employees (0).

The SLFS provides no information on work tasks. Our measure for the proportion of cognitive nonroutine work tasks per occupation[7] is thus derived from the German BIBB/BAuA employee surveys of 1999, 2006, and 2012 (Hall and Tiemann 2009; Jansen and Dostal 2015; Hall et al. 2018).[8] Given the similarity of the German and Swiss occupational systems, we deem it acceptable to apply the data to the Swiss labour market.

The literature on income mobility also highlights the relevance of gender for wage levels. Women receive lower wages compared to men (Blau and Kahn 2017; Combet and Oesch 2019). Therefore, we include a variable in our models that captures the proportion of women within the two educational groups. The variable is derived from the gender of each individual in our SLFS sample. Table 2 (see appendix) provides a descriptive overview of all variables per tertiary education type for the analysed sample, distinguishing between year 1 after receiving the degree, 10 years of work experience and 20 years of work experience.

3.3 Analytical strategy

To compare the wage development of workers with university and professional education degrees, we estimate wage regression models using Mincer's (1974) equation. Work experience is the basic time unit. The wage equation is estimated separately for both types of degree holders per year of work experience. The model is defined as follows for each individual i with tertiary degree type j at time t:

$$\begin{aligned} &ln\, Y_{ijt} = X'_{jt}\beta_{jt} + \varepsilon_{ijt};\, \mathrm{E}(\varepsilon_{ijt}) = 0; \\ &j \in \{academics, professionaleduc.graduates\}, \end{aligned} \tag{1}$$

[1] Tertiary degrees are only rarely completed before the age of 25 or after the age of 49. Consequently, our chosen age range includes more than 90% of all respondents in our sample with a tertiary-level degree.

[2] The poverty line was CHF 2,239 per month for a single person. Because these are net amounts, one can expect a minimum wage per month of about CHF 3000 gross, which corresponds to a gross annual income of CHF 36,000. Values higher than CHF 458,000 might be coding errors and amount to less than 0.1% of values for income in the dataset.

[3] OneSwiss franc (CHF) correspondsto approximately one dollar or one euro (January 2024).

[4] Source: complete index tables of the Swiss Federal Statistical Office.Information on the calculation method and online calculators are available under the following links.
Table download: https://www.bfs.admin.ch/bfs/de/home/statistiken/preise/landesindex-konsumentenpreise.html (accessed on 06.07.23).
Method of calculation: https://www.bfs.admin.ch/bfs/de/home/statistiken/preise/erhebungen/lik/berechnung.html
(retrieved 06.07.23).
Online calculator: http://www.portal-stat.admin.ch/lik_rechner/d/lik_rechner.html (retrieved on 06.07.23).

[5] Effects on wages are mostly assumed to be relative, such that the difference of 2 log values is similar to the ratio of their absolute.
value and is interpreted as the percentage difference in average wages.

[6] Work experience as a timeline could also include otherpotential temporal trends across the survey years, such as economic upswings or downswings. However, we consider this unlikely due to the structure of our sample, which combines numerous annual years per year of work experience.

[7] The exact classification tables and a short description can be found on the homepage of the Federal Statistical Office (BFS) at: https://www.bfs.admin.ch/bfs/de/home/statistiken/arbeit-erwerb/nomenclaturen/sbn2000.html (access on 06.07.2023).

[8] Due to the low case numbers, we aggregated the task values of the survey years of 1999, 2006, and 2012 and matched the indicator for the proportion of cognitive nonroutine tasks to the SLFS based on respondents' occupation (2-digit level of the Swiss occupational nomenclature), position, and work experience. For work experience, we distinguished between 1 and 6 years, 7–13 years, and 14–20 years of experience. For our final model estimation, we tested various combinations of time classifications and Swiss occupational nomenclature classification levels. The results of the tested combinations were very similar. We chose the option with the largest sample size and number of nomenclature classification levels.

where X is a vector containing the variables per respondent, tertiary degree type and timepoint, β is the vector containing the slope parameters of the tertiary degree type per timepoint and axis intercept, and ε is the respondent-specific error term per tertiary degree type and timepoint.

Our analysis involves three steps. First, we describe the wage trends of the two groups and their variability across time with density estimates. Second, we provide an overview of the relationships between wages and the predictor variables at each point in time. Third, we decompose changes in the wage gap over time and compare the temporal development of potential explanatory factors.

For steps two and three, we use Kroeger and Hartmann's (2021) interventionist decomposition method. Whereas the model estimates in step two compare the difference in logarithmic annual wages between workers with university and professional education degrees at any given time *t*, those in step three compare the difference between *t1* and any given time *t* between the two groups.

The analysis of the wage differences between the two groups at any given time t uses the Kitagawa-Oaxaca-Blinder decomposition (KOB; see Kitagawa 1955; Oaxaca 1973; Blinder 1973). This requires the influence of observable wage-relevant characteristics to be separated from unobserved influences. They are usually separated by isolating a stimulus in an experimental setting. However, observing the groups with and without stimulus simultaneously is not possible. Therefore, either a 'counterfactual state' is simulated or nearly identical respondents are sought for comparison. If unobserved factors are equally wage relevant to both groups and both groups have the same values of wage-relevant characteristics, there should be no more wage differences. KOB decomposition aims to solve this problem by comparing estimates of the wages of group A from its actual characteristics with the estimates that would result if group A had the characteristics of group B.[9]

In this study, taking university graduates as the reference group, KOB breaks down the total wage difference between the groups based on wage Eq. (1) into the part explained by the similarity of characteristics, the endowment effect, and a remainder, the unexplained part. Next to the constant, the unexplained part includes the slope parameter of Eq. (1), which is called the price of these characteristics or the wage structure effect.

[9] The average treatment effect on the treated is estimated more precisely in the present case.

If we extend the KOB decomposition as suggested by Jann (2008) and Fortin et al. (2011), the following wage difference of both groups (D) results:

$$\begin{aligned} D &= E(Y_A) - E(Y_B) = E(Y_A) - E(Y_B) \\ &\quad + E\left(Y^{B|GroupA}\right) - E\left(Y^{B|GroupA}\right) \\ &= \left(E(Y_B) - E\left(Y^{B|GroupA}\right)\right) + \left(E\left(Y^{B|GroupA}\right) - E(Y_A)\right), \end{aligned} \tag{2}$$

in which $E(Y_A) = E(X_A)'\beta_A; E(Y_B) = E(X_B)'\beta_B;$ $E\left(Y^{B|GroupA}\right) = E(X_B)'\beta_A,$

where D is the estimated wage gap, Y_B is the wage of professional education graduates, Y_A is the wage of university graduates and $Y^{B|GroupA}$ is the counterfactual wage that professional education graduates would have, given the endowments and coefficients of the university graduates.

For the university graduates reference group, the following equation results for the Kitagawa-Oaxaca-Blinder decomposition per time point *t*:

$$\begin{aligned} D_t &= [E(X_{At}) - E(X_{Bt})]'\beta_{Bt} + E(X_{Bt})'(\beta_{At} - \beta_{Bt}) \\ &\quad + [E(X_{At}) - E(X_{Bt})]'(\beta_{At} - \beta_{Bt}) \\ &= [\Delta X_t]'\beta_{Bt} + E(X_{Bt})'(\Delta\beta_t) + [\Delta X_t]'(\Delta\beta_t) \end{aligned} \tag{3}$$

Equation (3) corresponds to a triple decomposition. The first term measures $[E(X_{At}) - E(X_{Bt})]'\beta_{Bt}$, the effect due to differences in the endowment set. This component measures the expected change in the outcome of professional education graduates if they had the predictor levels of the university graduates.

$E(\mathrm{X}_{Bt})'(\beta_{At} - \beta_{Bt})$ measures the effect due to differences in the value of the endowments, sometimes also called the price effect. The intercept is included. The price effect measures the expected change in the wages of professional education graduates if they had the coefficients of the university graduates.

Finally,$[E(X_{At}) - E(X_{Bt})]'(\beta_{At} - \beta_{Bt})$ shows the effect due to the interaction of endowments and their value. This term is usually not considered because of its difficult interpretation.

For the decomposition of changes in the wage gap over time, i.e., the difference between *t1* and any given time *t*, we use Kroeger and Hartmann's (2021) threefold interventionist decomposition method, represented by Eq. (4). This method decomposes the change in the wage gap over time and between the two groups into an endowment effect (ΔE), a coefficient effect (ΔC), which includes the constant, and an interaction effect (ΔI):

$$\Delta Y^A - \Delta Y^B = \Delta Y = \Delta E + \Delta C + \Delta I. \tag{4}$$

Thus, each point in time t is compared with the same fixed reference point in time, which in our case is t_1, the year after earning the degree, when the vast majority of tertiary education graduates are employed.

The endowment component is calculated by subtracting the group-specific compositional changes, weighted by their initial coefficients, over time:

$$\Delta E = \left[E(X_{At}) - E\left(X_{At_0}\right)\right]' \beta_{At_0} - \left[E(X_{Bt}) - E\left(X_{Bt_0}\right)\right]' \beta_{Bt_0}. \quad (5)$$

Equation (5) shows how much the gap between the groups changes due to the changes in the endowments between both time points. To isolate the endowment effect, the coefficients are fixed at their initial value at the first time point and do not change over time.

The coefficient component is calculated by subtracting the group-specific changes in coefficients, including the constant, weighted by their initial endowments, over time:

$$\Delta C = E\left(X_{At_0}\right)' \left(\beta_{At} - \beta_{At_0}\right) - E\left(X_{Bt_0}\right)' \left(\beta_{Bt} - \beta_{Bt_0}\right) \quad (6)$$

Equation (6) shows how much the gap between the groups changes due to the changes in the coefficients between both time points. To isolate the coefficient effect, the endowments are fixed to their initial value at the first time point and do not change over time.[10]

Finally, the interaction component is calculated by subtracting the group-specific interactions of temporal endowment changes and temporal coefficient changes:

$$\Delta I = \left[E(X_{At}) - E\left(X_{At_0}\right)\right]' \left(\beta_{At} - \beta_{At_0}\right) - \left[E(X_{Bt}) - E\left(X_{Bt_0}\right)\right]' \left(\beta_{Bt} - \beta_{Bt_0}\right). \quad (7)$$

As with the KOB decomposition, the interpretation of this component is difficult.

Finally, although our data include yearly cross-sectional and longitudinal weights from which inferences may be drawn about the Swiss population in a specific year, we do not use these weights for our descriptive or inference statistical analyses. First, unweighted regression estimates are generally consistent, unbiased, and more efficient than weighted estimates (Winship and Radbill 1994). Second, the recommended weights were mainly created for cross-sectional analyses of each year. For the construction of our time scale, work experience since graduation of a tertiary-level qualification, we always use several survey years of the SLFS. Consequently, the use of the weights is not theoretically justifiable. Furthermore, descriptive and inferential statistical analyses (not shown here) with weighted data show results comparable to unweighted analyses.

[10] However, the proportion of the wage difference explained by the coefficient change also contains the constant. The constant contains unexplained parts that cannot be attributed to the substantive change in the explanatory variables.

4 Results

We begin this section by describing the wage trajectories of the two groups of workers within the first 35 years after earning their degree. The second section presents the findings for the determinants of the wage levels at various career stages. Section three investigates the reasons for the two groups' unequal wage development over time.

4.1 A glance at the development of wages over time

Figure 1 and Table 1 show wage development for the complete sample over careers from obtaining the tertiary qualification.

Overall, the trend shows that wage differentials between the two groups are rather small directly after completion of tertiary-level training. They amount to about CHF 11,260 (see Table 1) but increase later in the career. After 20 years of work experience, the wage gap reaches about CHF 35,000 and remains stable thereafter. The ratio of the average mean annual wages in Table 1 shows that professional education graduates earn CHF 90,203 and thus about 89% of the gross annual salary of Swiss university graduates (CHF 101,463) shortly after obtaining their tertiary degree. The ratio falls to the disadvantage of professional education graduates to approximately 83% in the 10th year after graduation, to 76% in the 20th year, and shows no noteworthy change thereafter: it is 77% in the 35th year. This relative difference is not negligible when looking at the relative change in wages within each educational group. Whereas the average salary of Swiss university graduates rises from CHF 101,463 to CHF 147,050 within the first 20 years, which amounts to a relative increase of almost 45%, professional education graduates experience a relative increase of only about 24%. Professional education graduates thus only achieve about 48% of the relative wage growth of the academic workforce. The erratic trajectories of both groups towards the end of the observation span are most likely due to decreasing case numbers. These findings are in line with the hypothesis that university graduates have a steeper wage increase than professional education graduates (H3). Possible reasons are university graduates' more extensive general skills, which help them to increase their learning gains and productivity faster.

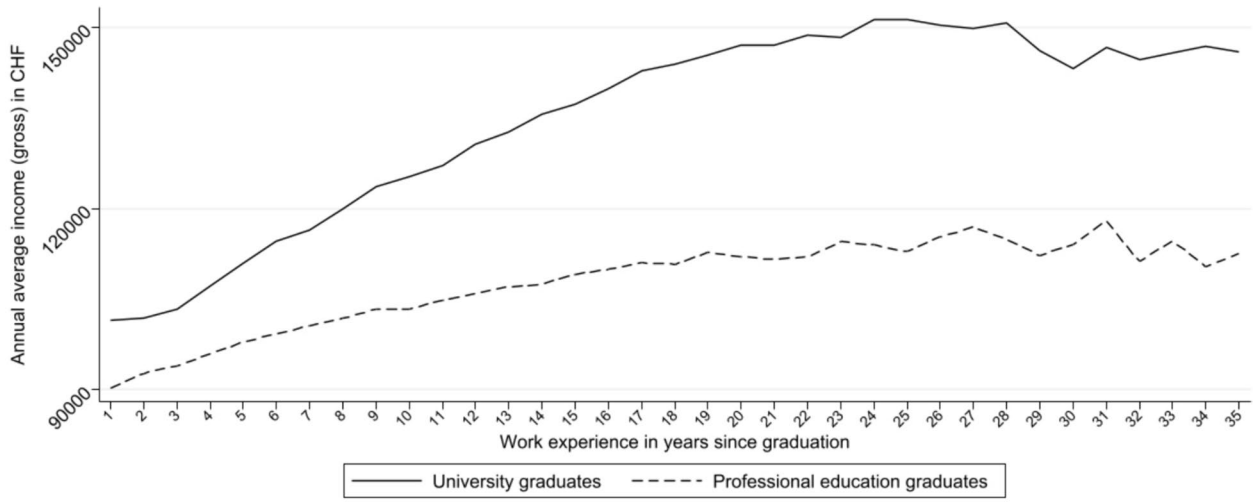

Fig. 1 Development of annual average wages of university and professional education graduates by work experience

Figure 2 shows the probability core densities of wages estimated over time. As can be seen in the left-hand panel of Fig. 2, the estimated wage distributions for university graduates are somewhat broader than for those with professional education. This means that wage variability is larger and increases over time, especially at the high-income side of the distribution. The right-hand panel of Fig. 2 shows that this shift to the right is less pronounced among workers with professional education and indicates a stronger concentration of wages in the middle wage segment. The position and shape of the density functions for 20 and 30 years of experience are comparable. As no right shift is observable for either of the groups, we can conclude that no significant changes occur in wage development from 20 years onwards. This is supported by Fig. 1, which shows stable and parallel development of average wages after 20 years of work experience for both educational groups. From these findings, we conclude that wage developments take place mainly within the first two decades of working life after completion of tertiary education (see Fig. 5 in the appendix). This period is therefore relevant to explaining the underlying mechanisms and is the focus of the following sections.

4.2 Wage differences between university and professional education graduates at different career stages

This section analyses the cross-sectional log wage level differences of the two groups and its determinants from the first to the 20th year after graduation. Table 4 (see appendix) shows the threefold cross sectional decomposition results of the interventionist method into the endowment, coefficient, and interaction effects for each cross section and a detailed decomposition of the determinants. The coefficients show that the difference of the logarithmic wage[11] increases over time from about 8.8% to 27% to the advantage of university graduates (see the log wage values of 0.084 and 0.241 in the outcome observed row). These results are in line with the increasing wage gap within the first 20 years of the career illustrated in Fig. 5 (see appendix).

Starting with the first year after graduation (see years of work experience = 1 column in Table 4), the log. wage difference between university graduates and professional education graduates of 0.084 (approximately 8.8%) is highly significant to the advantage of university graduates (see outcome observed row). Our hypothesis that workers with academic and professional education earn similar wages directly after graduation must thus be rejected (H2). This significant gap is explained by the development of the wage determinants shown in Fig. 3. Over the whole observation period, university graduates work in jobs with higher proportions of cognitive nonroutine tasks than do professional education degree holders. University graduates also work more frequently in medium and large companies, and the proportion of women is higher than among professional education graduates. Directly after graduation, fewer university graduates work in jobs with formal authority and management responsibilities. However, they catch up after approximately 15 years.

The results in Table 4 (see appendix) indicate whether these differences explain part of the wage gap between

[11] The logarithmized values can be interpreted approximately as percentages. More precisely, the difference of the mean log wages of 0.084 corresponds to the relative difference of the geometric means of the non-log wages of $(e^{0.084} - 1) * 100 = 8.76$ percent.

Table 1 Overview of wage development over time (total sample)

Variable	University degree					Professional education degree					Difference university/professional education degree
	n	Mean wage	Std.	Min	Max	*n*	Mean wage	Std.	Min	Max	Δ wage
Average of mean annual wage (gross) in CHF at $t=1$	4887	101,463	44,334	36,038	453,037	3956	90,203	30,181	36,390	353,241	11,260
Average of mean annual wage (gross) in CHF at $t=10$	3499	125,283	55,594	36,275	455,448	2169	103,397	36,881	36,631	433,471	21,886
Average of mean annual wage (gross) in CHF at $t=20$	2096	147,050	67,073	36,317	452,645	1276	112,044	45,076	36,004	397,825	35,006
Average of mean annual wage (gross) in CHF at $t=35$	380	145,996	66,316	37,972	445,200	224	112,570	47,238	41,013	402,567	33,426

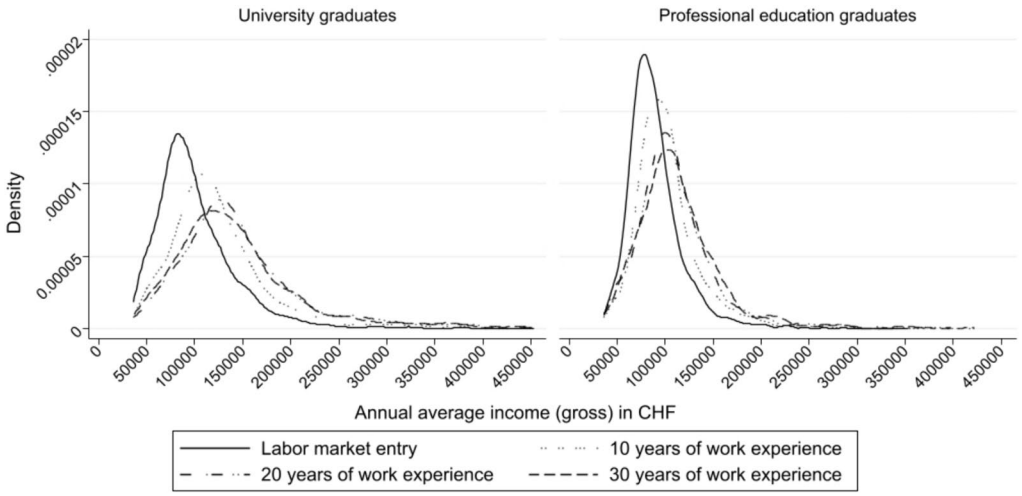

Fig. 2 Epanechnikov core density estimate of annual average wage of university and professional education graduates

the two groups. The KOB endowment effects capture a potential change in the wages of professional education graduates if they had the same endowments as university graduates. Directly after graduation, about 8% of this gap can be explained by significant differences in endowments: Compared to university graduates and in line with hypothesis 1, professional education graduates work significantly more often in jobs with lower proportions of cognitive nonroutine tasks and significantly less often in medium and large companies. This explains part of their wage disadvantage after graduation. Vocational education graduates also work significantly more often in jobs with formal authority or management responsibilities in their first jobs after completion of tertiary education. However, these endowments are not able to compensate their wage disadvantage at the beginning of the career.

In the following years, the endowment effects of cognitive nonroutine tasks and company size increase slightly, but the effect of formal authority positions or management responsibilities disappears, and the two groups converge. Across the whole observation span, university graduates thus work more often in jobs with large proportions of cognitive nonroutine tasks and in large firms. It takes approximately 15 years until university graduates make good their initial disadvantage in positions with formal authority and management responsibility.

The lower proportion of women among professional education graduates has a consistently significant negative effect on the wage gap across the career. If the proportion of women among this group was similar to that of university graduates, their average wages would be significantly lower over the whole observation period. Taken together, these findings are in line with the hypothesis that university and professional education graduates are allocated to different positions in the labour market (H1). University graduates start their career more often in positions with higher proportions of cognitive nonroutine tasks and in large companies, whereas professional education graduates move earlier into positions with formal authority and management responsibilities. The next section discusses whether the changes observed in endowments over careers are indeed responsible for the differences between the two groups in wage trajectories.

To assess potential wage structure effects, we examine the value differences in the KOB coefficient effects (see second half of Table 4, column 1).[12] The coefficient effects indicate whether we could expect a change in the wages of professional education graduates if they received the same wages for certain characteristics as university graduates at different stages in their career. Gender and company size show no significant effect in the first year after graduation. However, part of the remaining log wage difference of the first year can be explained by the proportion of cognitive nonroutine tasks, by the proportion of workers with formal authority and in management positions. Immediately after earning their degrees, professional education graduates receive lower wages than university graduates for cognitive nonroutine tasks but higher wages for positions of formal authority and management positions than university graduates. A possible reason for this difference is the allocation to jobs and occupations that differ in their wage structures.

[12] We refrain from interpreting the total effect because it includes a change in the intercept. This is a kind of residual, unexplained by the (change in) X variables in the model (see Kröger and Hartmann 2021).

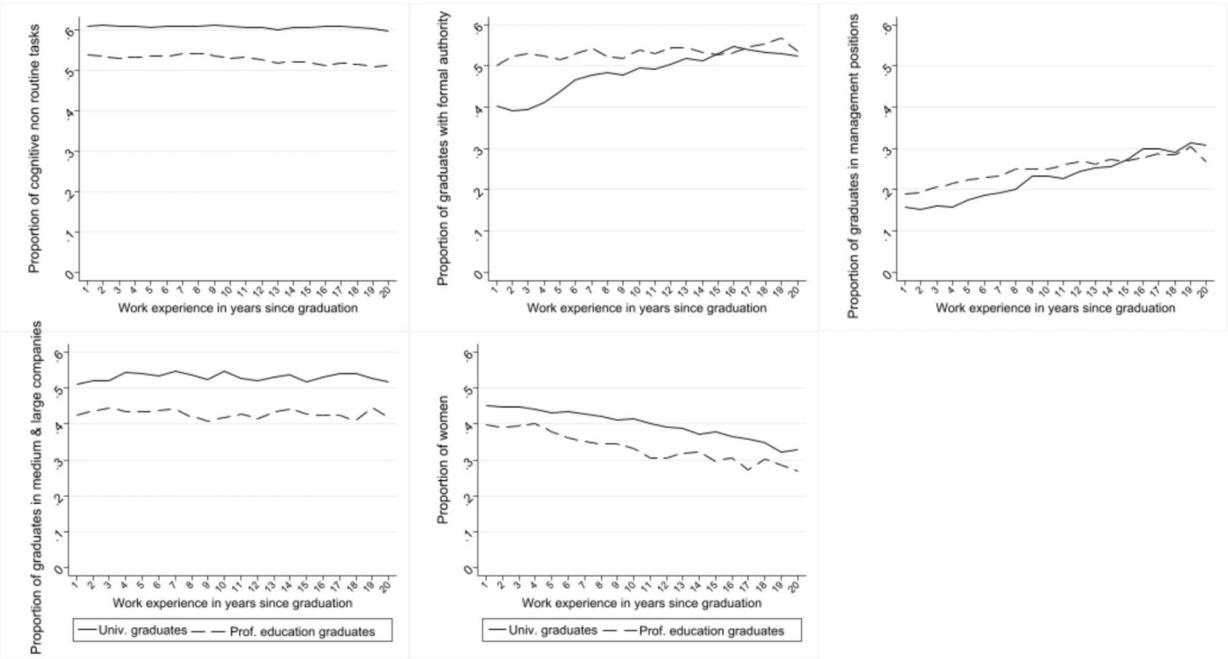

Fig. 3 Development of determinants by work experience for university and professional education graduates

The cross-sectional wage structure effect for medium and large companies becomes significant after 7 years, showing that professional education graduates receive a wage premium later in their careers when working in medium- and large-sized companies rather than small ones. The price for management positions is higher for professional education graduates only at the beginning of their careers and becomes insignificant thereafter, possibly because university graduates are able to make good their initially lower experience. The rest of the variables show erratic patterns. Overall, we find some wage structure effects, which seem to be fairly stable across different career stages. The observable changes in significance regarding company size and management positions are only moderate.

4.3 Determinants of wage development over careers

This section explains which variables determine wage development over time. We compare all points in careers with the first year of employment after completion of tertiary education. As described in the methods section, the interventionist decomposition method distinguishes between two interpretable components, the endowment and the coefficient effect, and one further not clearly interpretable interaction term for the first two components. The endowment effect shows how much the wage gap between the two groups changes due to changes in labour market characteristics such as formal authority and firm size over time, if the coefficients, fixed at their initial value, do not change. The coefficient effect captures how much the wage gap between the two groups changes because the wage value of their labour market characteristics change if the endowments do not change.

The evolution of the decomposition components for the first 20 years in the labour market after tertiary graduation is illustrated in Fig. 4. The endowment effect increases steadily over time, is consistently significant from year five onwards, and explains between 30 and 40% of the temporal change between labour market entries and the later years of careers. The detailed decomposition results in Table 5's total column (see appendix) confirm the developments that we observed in Fig. 3: about 10% of the increasing wage gap is driven by an increasing proportion of cognitive nonroutine tasks for university graduates. If the proportion of cognitive nonroutine tasks were to increase at the same rate for professional education graduates as for university graduates, the wage difference would become smaller with increasing work experience, provided that the price for these tasks remained constant at the level of the first year of work experience.

Between 80 and 90% of the endowment effects are driven by the stronger increase of university graduates who move into jobs with formal authority and management positions. This increases the wage gap over time in favour of university graduates. Consequently, the

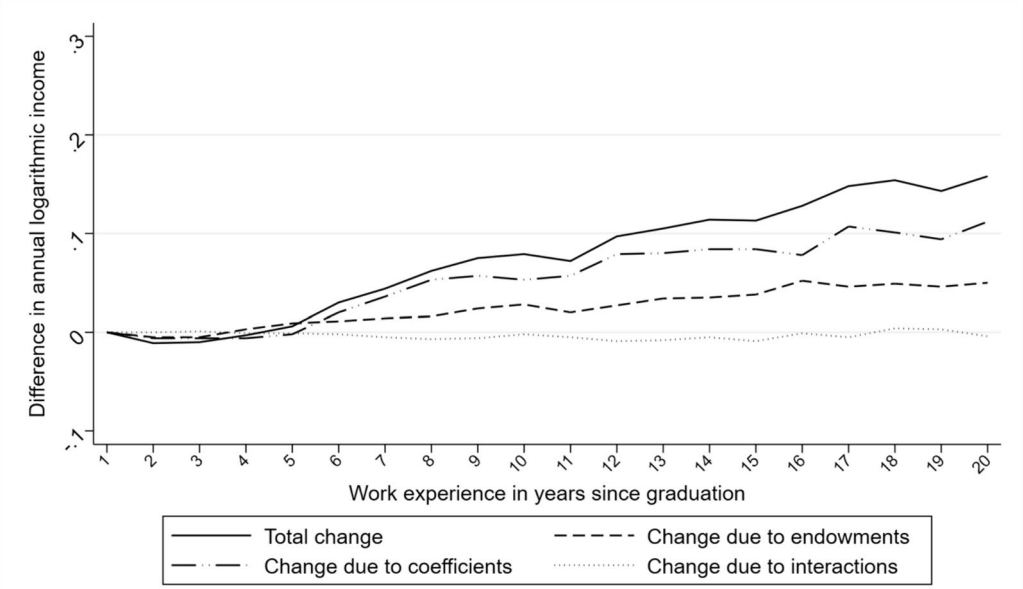

Fig. 4 Change of the annual wage gap and decomposition components of university and professional education graduates

wage difference between the two groups would become smaller with increasing work experience if professional education graduates experienced the same increase in the proportion of individuals working in jobs with formal authority and management positions as university graduates provided that the initial price of these characteristics did not change. We find no significant effects of the proportion of women or of individuals working in medium and large companies on the increase in the wage gap over time.

Taken together, the findings support hypothesis (4), that university graduates have steeper income trajectories because they gain access more often than professional education graduates to positions with a high proportion of cognitive nonroutine tasks, formal authority, and management responsibility (H4). Two mechanisms may explain these findings. Firstly, university graduates may accumulate more human capital after labour market entry because their training has imparted more general skills, which results in a higher learning capacity. Secondly, income mobility may be higher because their degrees and first labour market positions have a higher signalling value, which facilitates mobility into better-paid positions.

The total wage structure effect, shown in Table 5, is statistically significant and increases steadily over time (see the total coefficients line in the second part of Table 5). The detailed decomposition results reveal no consistent and systematic trends over time, despite some scattered significant coefficients for cognitive nonroutine tasks, management position, and company size for certain years. At first glance, this lack of systematic time trends contradicts the significant and increasing total effect. However, the total effect also contains a constant including the unexplained part, which is likely to drive the significant total effect. Consequently, not all the coefficient changes observed can be attributed to our explanatory variables (see footnote 10). Consequently, we reject our final hypothesis, that professional education graduates have flatter wage trends because the price for their labour has decreased in recent decades (H5).

In summary, we observe systematic endowment effects of the labour market position within the first 20 years of work experience after graduation. They explain between 30 and 40% of the increasing wage gap between workers with professional education and university graduates. About a tenth of the widening wage gap is due to the higher proportion of cognitive nonroutine working tasks assigned to university graduates. The rest is largely due to the stronger increase in jobs with formal authority and management positions among workers with university degrees. There is little evidence that the differences between the two groups' wage trajectories are driven by a systematic devaluation of professional education graduates' endowment prices. The cross-sectional differences observed imply that some price differences exist from directly after graduation. However, they do not change systematically over time. Overall, the results are in line with the assumption that changes in labour market

position impact wage trends in favour of Swiss university graduates. Likely reasons include higher productivity levels and a higher signalling value of their degrees and positions due to their general knowledge and skills and higher proportions of cognitive nonroutine tasks, leading to higher learning gains. There is little evidence that the price of cognitive nonroutine tasks has changed in the Swiss labour market over time.

4.4 Robustness checks

First, we tested whether the development of the wage gap shown in Fig. 1 is similar for different birth cohorts. We find this pattern for the majority of the birth cohorts: around 85% of the total sample. The pattern is most stable for cohort years with large sample sizes. Additionally, we tested all models with and without cohort effect dummies. The results did not change. Therefore, we do not control for birth cohort in our final models.

Second, the task data are unavailable for some occupations, leading to a loss of cases. To test whether this may affect the results, we compared the wage development of the complete sample and the reduced sample after task data matching. Although the sample size decreased due to data availability, the development of the wage gap did not change significantly.

Third, we tested whether the effects found for our wage determinants within the first 20 years after graduation also hold for the observation span between 21 and 35 years of work experience. Due to the low numbers of individuals with more than 20 years of experience, we estimated a KOB model with aggregated data for 21–35 years of work experience. The results (not shown) are comparable to the KOB results for up to 20 years of work experience presented in Sect. 4.2.

5 Discussion and conclusions

This article provides a detailed overview and analysis of the long-term wage development of academic and vocational degree holders. It examines the extent to which graduates of the two types of tertiary education in Switzerland differ in their wage development after earning their degree and which factors explain differences between the two groups. Our theoretical approach combines arguments from human capital theory, structural labour market approaches, and the task-specific learning-by-doing approach.

The results are largely in line with our assumptions. Firstly, they show that even in the first year after graduation from tertiary education, average wages differ significantly in favour of university graduates. Secondly, average wages grow for both groups over the first 20 years of employment after graduation. However, the observed wage trajectories diverge in favour of Swiss university graduates. The main drivers for this unequal development and the steeper wage trend of university graduates compared to professional education graduates are changes in endowments. University graduates more often move into well-paid labour market positions with formal authority, with management responsibility and a large proportion of cognitive nonroutine tasks. Despite some differences in the value of their labour market allocation from the beginning of careers, the diverging wage trajectories cannot be explained by systematic value changes to the two groups' average characteristics.

The findings have three theoretical implications. Firstly, they confirm the allocation property of educational credentials, which is particularly pronounced in countries with strong links between the educational system and the labour market (Bol et al. 2019). Educational credentials determine to which firms and jobs young workers can gain access. In the Swiss case, workers with university and professional education degrees gain access to different jobs. Because wage levels differ between firms and jobs, average wages differ early in careers.

Secondly, the findings imply that differences in income development for tertiary-level degree holders are not driven by systematic changes in the value or price of the skills imparted by university or professional education. This is likely due to the pattern of structural change observed in the labour markets of Switzerland and of a number of other European countries, which can be characterized by a pronounced upskilling of the work force and the demand for labour. The demand for unskilled labour has decreased rapidly, whereas the demand for highly skilled nonroutine cognitive and nonroutine occupation-specific skills has risen (Aepli et al. 2021; Oesch and Piccitto 2019; Oesch 2013). Workers with all types of tertiary-level skills may thus have been protected from a depreciation of their skills. This implies that in postindustrial economies, price changes are a negligible factor in explaining income trajectories at the tertiary level. Whether this finding also holds for labour markets with looser links between education and employment, where higher education credentials are less important in allocating workers to jobs (Brown and Souto-Otero 2020), is an open question that has to be answered by future research.

Thirdly, the findings suggest that occupational mobility is the main driver of differences in income trajectories between university and professional education graduates.

Educational credentials are tied to specific opportunities for job and firm changes, which in turn lead to differences in income development. University graduates' labour market allocation early in their careers to larger firms and jobs with higher proportions of cognitive nonroutine tasks is likely to act as a more favourable stepping-stone to well-paid positions with formal authority and management responsibilities. The continuous increase in the proportion of university graduates with formal authority and in management positions and the consistently higher proportion of cognitive nonroutine jobs and employment in larger firms are in line with both the learning-by-doing approach and signalling theory. The former argues that university graduates are more upwardly mobile due to their larger general human capital, which improves their learning ability and flexibility in the labour market. The latter claims that university degrees have a higher signalling value, which increases the incumbents' chances of working in well-paid jobs that include large proportions of cognitive nonroutine tasks and offer many learning opportunities. Higher learning gains leading to faster accumulation of human capital and higher signalling values of skills and credentials improve workers' competitive positions in the labour market and thus their chances of further upward mobility and income gains. Both arguments are theoretically plausible and consistent with our findings.

Although the findings of this study pertain solely to Switzerland, they have implications beyond the Swiss context. Firstly, it is highly plausible that the mechanisms described above also hold for countries with similarly structured labour markets and educational systems, such as Germany, Austria, and the Netherlands. These countries are characterized by occupationally segmented labour markets and tight links between the educational systems and the labour market allocation of school leavers. Vocational education has traditionally played an important role in their educational systems. Secondly, our findings are in line with the conclusion of previous studies, that the expansion and diversification of higher education in postindustrial economies have not reduced social inequality substantially (e.g., Shavit 2007; Triventi 2013). Given that neither the wage levels directly after graduation nor ensuing opportunities for the upward mobility of professional education graduates match those of their counterparts with university degrees, our findings do not support the education policy claim in Switzerland and Germany that vocational and general tracks of higher education are equivalent (Gonon and Hägi 2019; Münk 2020).

Lastly, our study also has limitations and indicates directions for further research. The data do not allow us to draw fully reliable causal conclusions. For example, a considerable part of wage growth could be the result of performance-based or motivational self-selection into the two types of education. It would therefore be important to control for such factors and to investigate the assumed learning effect, for instance with individual-level panel data. Furthermore, we cannot test the mechanisms that explain the relationship between wage trajectories and type of education. Thus, we are unable to corroborate the extent to which the differences we have observed are due to differences in productivity, signalling value, or learning gains. Finally, the results may also be partly driven by the fact that we cannot control for the occupational field. Professional education graduates might, to some extent, work in different and less well paid occupational fields than university graduates. Further research should therefore extend the results in this paper by additionally considering factors such as cognitive ability, motivation, individual performance, and occupational field in a longitudinal design. Another aspect warranting further investigation is the role of price changes in worker characteristics. Although it is highly plausible that price changes do not affect income trajectories at the top end of occupationally segmented labour markets with strong upskilling trends, such as the Swiss and German ones, future research should investigate whether this finding also holds for labour markets with a different structure.

Appendix

See Fig. 5 and Tables 2, 3, 4, 5.

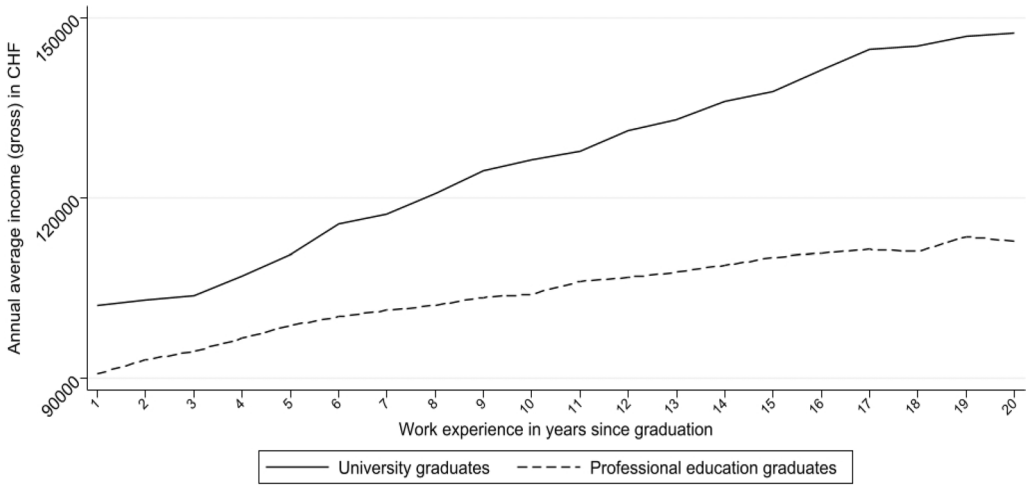

Fig. 5 Development of annual average wage of university and professional education graduates in analysis subsample

Table 2 Descriptives for the analysed subsample (≤ 20 years of work experience)

Variables at t = 1; N = 7407 (University degree = 3901; Professional Education degree = 3506)	**University degree**	**Std.**	**Min**	**Max**	**Professional education degree**	**Std.**	**Min**	**Max**
Average of mean annual wage (gross) in CHF	102,116	45,116	36,038	453,037	90,765	30,395	36,390	353,241
Average log. of mean annual wage (gross) in CHF	11.45	0.40	10.50	13.02	11.37	0.29	10.50	12.77
Proportion of cognitive nonroutine tasks (in %)	0.61	0.14	0.08	0.88	0.54	0.14	0.20	0.85
Proportion of individuals with formal authority	0.40	0.49	0	1	0.50	0.50	0	1
Proportion of individuals in management positions	0.16	0.37	0	1	0.19	0.40	0	1
Proportion of individuals in medium and large companies	0.51	0.50	0	1	0.43	0.49	0	1
Proportion of women	0.45	0.50	0	1	0.40	0.49	0	1
Variables at t = 10; N = 4818 (University degree = 2941; Professional education degree = 1877)	**University degree**	**Std.**	**Min**	**Max**	**Professional education degree**	**Std.**	**Min**	**Max**
Average of mean annual wage (gross) in CHF	126,343	56,158	36,275	455,448	104,024	37,121	36,631	433,471
Average log. of mean annual wage (gross) in CHF	11.66	0.41	10.50	13.03	11.50	0.32	10.51	12.98
Proportion of cognitive nonroutine tasks (in %)	0.61	0.13	0.20	0.84	0.53	0.14	0.21	0.78
Proportion of individuals with formal authority	0.50	0.50	0	1	0.54	0.50	0	1
Proportion of individuals in management position	0.23	0.42	0	1	0.25	0.43	0	1
Proportion of individuals in medium and large companies	0.54	0.50	0	1	0.42	0.49	0	1
Proportion of women	0.41	0.49	0	1	0.33	0.47	0	1
Variables at t = 20; N = 2797 (University degree = 1714; Professional education degree = 1083)	**University degree**	**Std.**	**Min**	**Max**	**Professional education degree**	**Std.**	**Min**	**Max**
Average of mean annual wage (gross) in CHF	147,498	68,129	36,317	452,645	112,788	45,481	36,729	397,825
Average log. of mean annual wage (gross) in CHF	11.81	0.44	10.50	13.02	11.57	0.37	10.51	12.89
Proportion of cognitive nonroutine tasks (in %)	0.60	0.15	0.04	0.86	0.51	0.14	0.21	0.81
Proportion of individuals with formal authority	0.53	0.50	0	1	0.53	0.50	0	1
Proportion of individuals in management positions	0.31	0.46	0	1	0.27	0.44	0	1
Proportion of individuals in medium and large companies	0.52	0.50	0	1	0.42	0.49	0	1
Proportion of women	0.33	0.47	0	1	0.27	0.44	0	1

Table 3 Development of log. wage and explanatory variables (endowments & coefficients) per year of work experience (averages)

Mean predicted outcome differences between the groups (empirical values)										
Years of work experience	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Mean log wage of university graduates	11.453	11.467	11.481	11.510	11.540	11.580	11.604	11.625	11.648	11.663
Mean log wage of professional education graduates	11.369	11.395	11.407	11.429	11.451	11.467	11.477	11.479	11.489	11.500
Mean log. wage difference between both groups per time point	0.084	0.073	0.074	0.081	0.089	0.113	0.127	0.146	0.159	0.163
Endowments university graduates										
Proportion of men	0.548	0.553	0.552	0.560	0.570	0.566	0.573	0.579	0.587	0.587
Proportion of women	0.452	0.447	0.448	0.440	0.430	0.434	0.427	0.421	0.413	0.413
Proportion of persons without formal authority	0.597	0.608	0.606	0.588	0.563	0.533	0.521	0.517	0.523	0.505
Proportion of persons with formal authority	0.403	0.392	0.394	0.412	0.437	0.467	0.479	0.483	0.477	0.495
Proportion of persons without management position	0.841	0.848	0.840	0.841	0.824	0.814	0.806	0.800	0.767	0.765
Proportion of persons with management position	0.159	0.152	0.160	0.159	0.176	0.186	0.194	0.200	0.233	0.235
Proportion of persons working in micro and small companies	0.490	0.480	0.479	0.455	0.460	0.466	0.454	0.464	0.476	0.452
Proportion of persons working in middle and large companies	0.510	0.520	0.521	0.545	0.540	0.534	0.546	0.536	0.524	0.548
Proportion of cognitive non routine tasks	0.607	0.612	0.607	0.607	0.606	0.608	0.608	0.609	0.611	0.608
Endowments professional education graduates										
Proportion of men	0.601	0.610	0.604	0.598	0.621	0.640	0.650	0.657	0.656	0.669
Proportion of women	0.399	0.390	0.396	0.402	0.379	0.360	0.350	0.343	0.344	0.331
Proportion of persons without formal authority	0.499	0.476	0.470	0.475	0.484	0.471	0.457	0.476	0.482	0.461
Proportion of persons with formal authority	0.501	0.524	0.530	0.525	0.516	0.529	0.543	0.524	0.518	0.539
Proportion of persons without management position	0.809	0.807	0.792	0.785	0.776	0.770	0.767	0.748	0.748	0.751
Proportion of persons with management position	0.191	0.193	0.208	0.215	0.224	0.230	0.233	0.252	0.252	0.249
Proportion of persons working in micro and small companies	0.575	0.564	0.555	0.567	0.567	0.563	0.560	0.580	0.592	0.582
Proportion of persons working in middle and large companies	0.425	0.436	0.445	0.433	0.433	0.437	0.440	0.420	0.408	0.418
Proportion of cognitive non routine tasks	0.537	0.533	0.530	0.533	0.534	0.535	0.540	0.542	0.536	0.530
Coefficients university graduates										
Proportion of men	0.548	0.553	0.552	0.560	0.570	0.566	0.573	0.579	0.587	0.587
Proportion of women	0.452	0.447	0.448	0.440	0.430	0.434	0.427	0.421	0.413	0.413
Proportion of persons without formal authority	0.597	0.608	0.606	0.588	0.563	0.533	0.521	0.517	0.523	0.505
Proportion of persons with formal authority	0.403	0.392	0.394	0.412	0.437	0.467	0.479	0.483	0.477	0.495
Proportion of persons without management position	0.841	0.848	0.840	0.841	0.824	0.814	0.806	0.800	0.767	0.765
Proportion of persons with management position	0.159	0.152	0.160	0.159	0.176	0.186	0.194	0.200	0.233	0.235
Proportion of persons working in micro and small companies	0.490	0.480	0.479	0.455	0.460	0.466	0.454	0.464	0.476	0.452
Proportion of persons working in middle and large companies	0.510	0.520	0.521	0.545	0.540	0.534	0.546	0.536	0.524	0.548
Proportion of cognitive non routine tasks	0.607	0.612	0.607	0.607	0.606	0.608	0.608	0.609	0.611	0.608

Table 3 (continued)

Mean predicted outcome differences between the groups (empirical values)										
Years of work experience	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Coefficients professional education graduates										
Proportion of men	0.601	0.610	0.604	0.598	0.621	0.640	0.650	0.657	0.656	0.669
Proportion of women	0.399	0.390	0.396	0.402	0.379	0.360	0.350	0.343	0.344	0.331
Proportion of persons without formal authority	0.499	0.476	0.470	0.475	0.484	0.471	0.457	0.476	0.482	0.461
Proportion of persons with formal authority	0.501	0.524	0.530	0.525	0.516	0.529	0.543	0.524	0.518	0.539
Proportion of persons without management position	0.809	0.807	0.792	0.785	0.776	0.770	0.767	0.748	0.748	0.751
Proportion of persons with management position	0.191	0.193	0.208	0.215	0.224	0.230	0.233	0.252	0.252	0.249
Proportion of persons working in micro and small companies	0.575	0.564	0.555	0.567	0.567	0.563	0.560	0.580	0.592	0.582
Proportion of persons working in middle and large companies	0.425	0.436	0.445	0.433	0.433	0.437	0.440	0.420	0.408	0.418
Proportion of cognitive non routine tasks	0.537	0.533	0.530	0.533	0.534	0.535	0.540	0.542	0.536	0.530
Mean predicted outcome differences between the groups (empirical values)										
Years of work experience	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Mean log wage of university graduates	11.678	11.704	11.718	11.734	11.746	11.766	11.788	11.791	11.801	11.806
Mean log wage of professional education graduates	11.523	11.523	11.528	11.537	11.549	11.555	11.556	11.554	11.575	11.565
Mean log. wage difference between both groups per time point	0.155	0.181	0.189	0.197	0.197	0.212	0.232	0.237	0.227	0.241
Endowments university graduates										
Proportion of men	0.598	0.608	0.612	0.627	0.623	0.635	0.643	0.654	0.678	0.672
Proportion of women	0.402	0.392	0.388	0.373	0.377	0.365	0.357	0.346	0.322	0.328
Proportion of persons without formal authority	0.507	0.497	0.480	0.487	0.471	0.453	0.462	0.466	0.469	0.474
Proportion of persons with formal authority	0.493	0.503	0.520	0.513	0.529	0.547	0.538	0.534	0.531	0.526
Proportion of persons without management position	0.773	0.756	0.747	0.742	0.727	0.700	0.700	0.708	0.685	0.691
Proportion of persons with management position	0.227	0.244	0.253	0.258	0.273	0.300	0.300	0.292	0.315	0.309
Proportion of persons working in micro and small companies	0.473	0.479	0.470	0.462	0.483	0.471	0.459	0.459	0.472	0.481
Proportion of persons working in middle and large companies	0.527	0.521	0.530	0.538	0.517	0.529	0.541	0.541	0.528	0.519
Proportion of cognitive non routine tasks	0.607	0.606	0.599	0.604	0.605	0.609	0.609	0.605	0.604	0.598
Endowments professional education graduates										
Proportion of men	0.694	0.696	0.681	0.678	0.703	0.694	0.728	0.697	0.715	0.732
Proportion of women	0.306	0.304	0.319	0.322	0.297	0.306	0.272	0.303	0.285	0.268
Proportion of persons without formal authority	0.470	0.457	0.456	0.467	0.472	0.468	0.452	0.447	0.434	0.465
Proportion of persons with formal authority	0.530	0.543	0.544	0.533	0.528	0.532	0.548	0.553	0.566	0.535
Proportion of persons without management position	0.739	0.731	0.737	0.727	0.730	0.722	0.713	0.716	0.695	0.731
Proportion of persons with management position	0.261	0.269	0.263	0.273	0.270	0.278	0.287	0.284	0.305	0.269

Table 3 (continued)

Mean predicted outcome differences between the groups (empirical values)										
Years of work experience	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Proportion of persons working in micro and small companies	0.572	0.586	0.565	0.560	0.571	0.576	0.576	0.590	0.556	0.584
Proportion of persons working in middle and large companies	0.428	0.414	0.435	0.440	0.429	0.424	0.424	0.410	0.444	0.416
Proportion of cognitive non routine tasks	0.531	0.525	0.518	0.521	0.519	0.512	0.516	0.515	0.509	0.510
Coefficients university graduates										
Proportion of men	0.598	0.608	0.612	0.627	0.623	0.635	0.643	0.654	0.678	0.672
Proportion of women	0.402	0.392	0.388	0.373	0.377	0.365	0.357	0.346	0.322	0.328
Proportion of persons without formal authority	0.507	0.497	0.480	0.487	0.471	0.453	0.462	0.466	0.469	0.474
Proportion of persons with formal authority	0.493	0.503	0.520	0.513	0.529	0.547	0.538	0.534	0.531	0.526
Proportion of persons without management position	0.773	0.756	0.747	0.742	0.727	0.700	0.700	0.708	0.685	0.691
Proportion of persons with management position	0.227	0.244	0.253	0.258	0.273	0.300	0.300	0.292	0.315	0.309
Proportion of persons working in micro and small companies	0.473	0.479	0.470	0.462	0.483	0.471	0.459	0.459	0.472	0.481
Proportion of persons working in middle and large companies	0.527	0.521	0.530	0.538	0.517	0.529	0.541	0.541	0.528	0.519
Proportion of cognitive non routine tasks	0.607	0.606	0.599	0.604	0.605	0.609	0.609	0.605	0.604	0.598
Coefficients professional education graduates										
Proportion of men	0.694	0.696	0.681	0.678	0.703	0.694	0.728	0.697	0.715	0.732
Proportion of women	0.306	0.304	0.319	0.322	0.297	0.306	0.272	0.303	0.285	0.268
Proportion of persons without formal authority	0.470	0.457	0.456	0.467	0.472	0.468	0.452	0.447	0.434	0.465
Proportion of persons with formal authority	0.530	0.543	0.544	0.533	0.528	0.532	0.548	0.553	0.566	0.535
Proportion of persons without management position	0.739	0.731	0.737	0.727	0.730	0.722	0.713	0.716	0.695	0.731
Proportion of persons with management position	0.261	0.269	0.263	0.273	0.270	0.278	0.287	0.284	0.305	0.269
Proportion of persons working in micro and small companies	0.572	0.586	0.565	0.560	0.571	0.576	0.576	0.590	0.556	0.584
Proportion of persons working in middle and large companies	0.428	0.414	0.435	0.440	0.429	0.424	0.424	0.410	0.444	0.416
Proportion of cognitive non routine tasks	0.531	0.525	0.518	0.521	0.519	0.512	0.516	0.515	0.509	0.510

Table 4 Detailed KOB decomposition results per year of work experience

Decomposition of levels										
Years of work experience	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Outcome										
Observed	**0.084*** **	**0.073*** **	**0.074*** **	**0.081*** **	**0.089*** **	**0.113*** **	**0.127*** **	**0.146*** **	**0.159*** **	**0.163*** **
SE	0.008	0.008	0.008	0.009	0.007	0.008	0.010	0.009	0.010	0.011
Detailed decomposition results										
Endowments										
Proportion of women	− 0.005***	− 0.006***	− 0.007***	− 0.005**	− 0.006***	− 0.010***	− 0.011***	− 0.013***	− 0.013***	− 0.012***
SE	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.002
Proportion of persons with formal authority	− 0.008***	− 0.013***	− 0.011***	− 0.011***	− 0.006***	− 0.006***	− 0.004***	− 0.003**	− 0.002	− 0.003*
SE	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Proportion of persons with management position	− 0.003**	− 0.003**	− 0.005***	− 0.006***	− 0.005***	− 0.004**	− 0.004**	− 0.005***	− 0.002	− 0.001
SE	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Proportion of persons working in middle and large companies	0.009***	0.008***	0.009***	0.014***	0.014***	0.012***	0.012***	0.015***	0.015***	0.014***
SE	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.003
Proportion of cognitive non routine tasks	0.014***	0.022***	0.023***	0.027***	0.028***	0.026***	0.027***	0.022***	0.030***	0.030***
SE	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.004
Total endowments	**0.007***	**0.008***	**0.009***	**0.018*** **	**0.023*** **	**0.019*** **	**0.020*** **	**0.016*** **	**0.029*** **	**0.028*** **
SE	0.003	0.003	0.004	0.005	0.004	0.004	0.004	0.005	0.005	0.006
Decomp endowments %	**8.086***	**11.272***	**12.318***	**22.531*** **	**26.095*** **	**16.898*** **	**15.913*** **	**11.168*** **	**18.189*** **	**17.026*** **
Coefficients										
Proportion of women	0.002	0.004	0.013*	0.006	0.000	− 0.001	0.000	0.003	0.014*	0.002
SE	0.006	0.006	0.006	0.007	0.005	0.006	0.006	0.005	0.007	0.006
Proportion of persons with formal authority	0.050***	0.022**	0.045***	0.021**	0.046***	0.037***	0.038***	0.021*	0.058***	0.054***
SE	0.009	0.008	0.008	0.008	0.009	0.009	0.009	0.010	0.010	0.010
Proportion of persons with management position	0.021***	0.030***	0.016**	0.023***	0.009	0.023***	0.012*	0.023***	0.014*	0.014*
SE	0.004	0.005	0.005	0.005	0.005	0.005	0.006	0.006	0.007	0.007
Proportion of persons working in middle and large companies	0.010	0.004	0.004	− 0.005	0.001	0.013	0.019*	0.022**	0.035***	0.044***
SE	0.007	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.007	0.009
Proportion of cognitive non routine tasks	− 0.087***	− 0.143***	− 0.198***	− 0.189***	− 0.189***	− 0.153***	− 0.200***	− 0.129***	− 0.151***	− 0.105**
SE	0.026	0.026	0.028	0.029	0.031	0.030	0.030	0.033	0.036	0.039
Intercept	0.103**	0.179***	0.227***	0.245***	0.234***	0.202***	0.263***	0.205***	0.174***	0.132**
SE	0.032	0.030	0.034	0.036	0.039	0.033	0.037	0.038	0.045	0.048
Total coefficients	**0.099*** **	**0.096*** **	**0.107*** **	**0.100*** **	**0.100*** **	**0.121*** **	**0.134*** **	**0.145*** **	**0.144*** **	**0.141*** **

Table 4 (continued)

Decomposition of levels										
Years of work experience	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SE	0.008	0.009	0.008	0.008	0.008	0.008	0.011	0.009	0.010	0.012
Decomp coefficients %	**118.526*** **	**132.519*** **	**144.549*** **	**123.978*** **	**112.192*** **	**106.864*** **	**105.261*** **	**99.642*** **	**90.727*** **	**86.881*** **
Interactions	− 0.022***	− 0.032***	− 0.042***	− 0.037***	− 0.034***	− 0.027***	− 0.027***	− 0.016**	− 0.014*	− 0.006
Decomp interactions %	− 26.613***	− 43.791***	− 56.867***	− 46.509***	− 38.287***	− 23.762***	− 21.174***	− 10.810**	− 8.916*	3.907
Total	**0.084*** **	**0.073*** **	**0.074*** **	**0.081*** **	**0.089*** **	**0.113*** **	**0.127*** **	**0.146*** **	**0.159*** **	**0.163*** **
Decomposition of levels										
Years of work experience	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Outcome										
Observed	**0.155*** **	**0.181*** **	**0.189*** **	**0.197*** **	**0.197*** **	**0.212*** **	**0.232*** **	**0.237*** **	**0.227*** **	**0.241*** **
SE	0.011	0.010	0.011	0.012	0.013	0.012	0.015	0.013	0.015	0.015
Detailed decomposition results										
Endowments										
Proportion of women	− 0.013***	− 0.013***	− 0.012***	− 0.007**	− 0.011***	− 0.010***	− 0.017***	− 0.006*	− 0.007*	− 0.010**
SE	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.003
Proportion of persons with formal authority	− 0.003*	− 0.004*	− 0.002	− 0.002	0.000	0.001	− 0.001	− 0.002	− 0.003	− 0.001
SE	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002
Proportion of persons with management position	− 0.003*	− 0.003	− 0.001	− 0.002	0.000	0.003	0.001	0.001	0.001	0.004
SE	0.001	0.002	0.001	0.002	0.002	0.002	0.001	0.002	0.002	0.002
Proportion of persons working in middle and large companies	0.013***	0.016***	0.011***	0.016***	0.014***	0.017***	0.021***	0.020***	0.015***	0.020***
SE	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.003	0.004	0.005
Proportion of cognitive non routine tasks	0.025***	0.030***	0.033***	0.032***	0.028***	0.033***	0.035***	0.029***	0.045***	0.031***
SE	0.004	0.004	0.005	0.005	0.005	0.005	0.006	0.007	0.008	0.007
Total endowments	**0.018** **	**0.026*** **	**0.029*** **	**0.038*** **	**0.031*** **	**0.045*** **	**0.039*** **	**0.042*** **	**0.050*** **	**0.045*** **
SE	0.006	0.006	0.006	0.006	0.006	0.008	0.008	0.009	0.010	0.009
Decomp endowments %	**11.463*** **	**14.317*** **	**15.335*** **	**19.117*** **	**15.573*** **	**21.009*** **	**16.928*** **	**17.647*** **	**22.243*** **	**18.846*** **
Coefficients										
Proportion of women	0.000	− 0.004	− 0.001	− 0.008	− 0.007	− 0.006	0.003	− 0.018*	0.004	− 0.003
SE	0.006	0.006	0.008	0.007	0.007	0.007	0.007	0.009	0.008	0.009
Proportion of persons with formal authority	0.039***	0.035**	0.038***	0.045***	0.039**	0.042**	0.038**	0.043**	0.062***	0.040*
SE	0.010	0.011	0.011	0.011	0.014	0.014	0.012	0.015	0.018	0.017
Proportion of persons with management position	0.014*	0.003	0.009	0.002	0.007	0.015	0.022*	0.015	0.020	0.011

Table 4 (continued)

Decomposition of levels										
Years of work experience	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
SE	0.006	0.007	0.007	0.007	0.008	0.008	0.009	0.010	0.012	0.010
Proportion of persons working in middle and large companies	0.032***	0.030***	0.028**	0.013	0.023*	0.030**	0.033**	0.034**	0.018	0.028*
SE	0.007	0.008	0.009	0.010	0.010	0.010	0.011	0.010	0.012	0.011
Proportion of cognitive non routine tasks	− 0.107**	− 0.163***	− 0.160***	− 0.082	− 0.076	− 0.069	− 0.056	− 0.035	− 0.165**	− 0.111*
SE	0.036	0.038	0.040	0.042	0.042	0.036	0.046	0.051	0.053	0.052
Intercept	0.171***	0.276***	0.268***	0.203***	0.190***	0.159***	0.154**	0.156**	0.267***	0.243***
SE	0.042	0.043	0.045	0.049	0.049	0.047	0.051	0.059	0.067	0.062
Total coefficients	**0.150*** **	**0.177*** **	**0.181*** **	**0.173*** **	**0.176*** **	**0.172*** **	**0.192*** **	**0.194*** **	**0.206*** **	**0.208*** **
SE	0.011	0.010	0.012	0.012	0.013	0.013	0.013	0.014	0.017	0.015
Decomp coefficients %	**96.522*** **	**97.721*** **	**95.878*** **	**87.545*** **	**89.185*** **	**81.040*** **	**82.993*** **	**82.007*** **	**91.057*** **	**86.069*** **
Interactions	− 0.012	− 0.022**	− 0.021**	− 0.013	− 0.009	− 0.004	0.000	0.001	− 0.030**	− 0.012
Decomp interactions %	7.986	− 12.039**	− 11.213**	6.662	4.758	2.049	0.079	0.345	− 13.300**	4.915
Total	**0.155*** **	**0.181*** **	**0.189*** **	**0.197*** **	**0.197*** **	**0.212*** **	**0.232*** **	**0.237*** **	**0.227*** **	**0.241*** **

Notes: SE based on 100 bootstrap samples; * $p < .05$, ** $p < .01$, *** $p < .001$

Table 5 Interventionist decomposition results of changes per year of work experience

Decomposition of change										
Years of work experience	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Outcome										
Observed	0.000	− 0.011	− 0.010	− 0.003	0.006	0.030**	0.044***	0.062***	0.075***	0.079***
SE	(.)	0.010	0.011	0.012	0.011	0.010	0.011	0.012	0.013	0.013
Detailed decomposition results										
Change of endowments										
Proportion of women	0.000	0.000	0.000	0.001	0.000	− 0.002	− 0.002	− 0.002	− 0.002	− 0.003
SE	(.)	0.001	0.001	0.002	0.001	0.002	0.002	0.002	0.002	0.002
Proportion of persons with formal authority	0.000	− 0.004	− 0.004	0.000	0.005*	0.009***	0.010***	0.013***	0.012***	0.014***
SE	(.)	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003
Proportion of persons with management position	0.000	− 0.002	− 0.001	− 0.002	0.000	0.002	0.003	0.003	0.010**	0.010***
SE	(.)	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003
Proportion of persons working in middle and large companies	0.000	0.000	− 0.001	0.004	0.003	0.002	0.003	0.004	0.004	0.006**
SE	(.)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Proportion of cognitive non routine tasks	0.000	0.001	0.002*	0.001	0.001	0.000	− 0.001	− 0.001	0.000	0.001
SE	(.)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total endowments	**0.000**	**− 0.005**	**− 0.005**	**0.003**	**0.009***	**0.011***	**0.014****	**0.016*****	**0.024*****	**0.028*****
SE	(.)	0.005	0.005	0.005	0.004	0.005	0.005	0.005	0.005	0.005
Decomp endowments %	**0.000**	**44.281**	**48.436**	**108.450**	**153.012**	**38.862**	**31.108***	**25.711*****	**31.921*****	**35.723*****
Change of coefficients										
Proportion of women	0.000	0.002	0.011	0.003	− 0.004	− 0.006	− 0.004	− 0.003	0.011	− 0.002
SE	(.)	0.010	0.010	0.010	0.010	0.009	0.010	0.010	0.010	0.010
Proportion of persons with formal authority	0.000	− 0.025*	− 0.006	-0.026*	− 0.003	− 0.013	− 0.010	− 0.023*	0.009	0.002
SE	(.)	0.010	0.011	0.011	0.011	0.011	0.011	0.010	0.012	0.011
Proportion of persons with management position	0.000	0.009	− 0.004	0.000	− 0.011*	− 0.001	− 0.008	− 0.002	− 0.008	− 0.008
SE	(.)	0.006	0.006	0.005	0.006	0.006	0.005	0.006	0.006	0.006
Proportion of persons working in middle and large companies	0.000	− 0.008	− 0.007	-0.017	− 0.010	0.005	0.010	0.016	0.033**	0.041**
SE	(.)	0.009	0.010	0.012	0.010	0.011	0.011	0.010	0.011	0.013
Proportion of cognitive non routine tasks	0.000	− 0.060	− 0.123**	-0.107*	− 0.104*	− 0.065	− 0.112**	− 0.037	− 0.059	− 0.009
SE	(.)	0.041	0.041	0.045	0.043	0.045	0.043	0.046	0.049	0.055
Intercept	0.000	0.076	0.123**	0.141**	0.130**	0.099*	0.160**	0.102	0.070	0.028
SE	(.)	0.045	0.047	0.053	0.049	0.048	0.049	0.053	0.057	0.065
Total coefficients	**0.000**	**− 0.006**	**− 0.006**	**− 0.006**	**-0.002**	**0.020**	**0.036****	**0.053*****	**0.057*****	**0.053*****
SE	(.)	0.010	0.010	0.011	0.010	0.010	0.011	0.011	0.012	0.012
Decomp coefficients %	**0.000**	**56.444**	**58.607**	**190.968**	**33.657**	**66.726**	**81.457*****	**84.891*****	**75.573*****	**66.872*****

Table 5 (continued)

Decomposition of change										
Years of work experience	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Interactions	0.000	0.000	0.001	− 0.001	− 0.001	− 0.002	− 0.005*	− 0.007*	− 0.006	− 0.002
Decomp interactions %	0.000	0.725	7.043	17.482	19.355	5.587	12.564	10.602	7.494	2.595
Total	**0.000**	**− 0.011**	**− 0.010**	**− 0.003**	**0.006**	**0.030****	**0.044*****	**0.062*****	**0.075*****	**0.079*****
Decomposition of change										
Years of work experience	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Outcome										
Observed	0.072***	0.097***	0.105***	0.114***	0.113***	0.128***	0.148***	0.154***	0.143***	0.158***
SE	0.015	0.014	0.013	0.014	0.016	0.015	0.016	0.017	0.017	0.017
Detailed decomposition results										
Change of endowments										
Proportion of women	− 0.004*	− 0.003	− 0.002	0.000	− 0.003	− 0.001	− 0.003	0.000	0.001	− 0.001
SE	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002
Proportion of persons with formal authority	0.014***	0.015***	0.018***	0.017***	0.021***	0.024***	0.021***	0.019***	0.018***	0.020***
SE	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.003
Proportion of persons with management position	0.007*	0.010**	0.013***	0.013***	0.016***	0.021***	0.020***	0.019***	0.022***	0.024***
SE	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005
Proportion of persons working in middle and large companies	0.002	0.003	0.002	0.002	0.001	0.003	0.004	0.006*	0.000	0.002
SE	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003
Proportion of cognitive non routine tasks	0.001	0.002*	0.004**	0.003**	0.003**	0.005***	0.004***	0.004***	0.006***	0.005***
SE	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total endowments	**0.020*****	**0.027*****	**0.034*****	**0.035*****	**0.038*****	**0.052*****	**0.046*****	**0.049*****	**0.046*****	**0.050*****
SE	0.005	0.005	0.006	0.006	0.006	0.007	0.007	0.006	0.008	0.007
Decomp endowments %	**28.154*****	**27.303*****	**31.884*****	**30.669*****	**33.532*****	**40.254*****	**31.117*****	**31.679*****	**32.364*****	**31.464*****
Change of coefficients										
Proportion of women	− 0.004	− 0.012	− 0.008	− 0.016	− 0.015	− 0.014	− 0.003	− 0.032*	0.000	− 0.012
SE	0.010	0.012	0.012	0.011	0.012	0.010	0.013	0.014	0.013	0.014
Proportion of persons with formal authority	− 0.011	− 0.015	− 0.012	− 0.007	− 0.010	− 0.008	− 0.013	− 0.010	0.003	− 0.012
SE	0.012	0.011	0.012	0.011	0.015	0.013	0.013	0.014	0.016	0.016
Proportion of persons with management position	− 0.008	− 0.016*	− 0.011	− 0.017**	− 0.014*	− 0.009	− 0.004	− 0.009	− 0.006	− 0.010
SE	0.006	0.006	0.007	0.006	0.007	0.007	0.007	0.008	0.008	0.008
Proportion of persons working in middle and large companies	0.028*	0.028*	0.021	0.008	0.019	0.028*	0.033*	0.033*	0.014	0.029*

Table 5 (continued)

Decomposition of change										
Years of work experience	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
SE	0.011	0.012	0.012	0.014	0.013	0.013	0.014	0.014	0.015	0.014
Proportion of cognitive non routine tasks	− 0.015	− 0.079	− 0.075	0.016	0.018	0.026	0.044	0.065	− 0.080	− 0.023
SE	0.047	0.050	0.054	0.056	0.060	0.051	0.054	0.062	0.067	0.065
Intercept	0.068	0.173**	0.164**	0.100	0.086	0.055	0.050	0.053	0.163*	0.139
SE	0.054	0.053	0.062	0.064	0.067	0.060	0.059	0.061	0.074	0.071
Total coefficients	**0.057*** **	**0.079*** **	**0.080*** **	**0.084*** **	**0.084*** **	**0.078*** **	**0.107*** **	**0.101*** **	**0.094*** **	**0.112*** **
SE	0.012	0.013	0.013	0.015	0.015	0.014	0.014	0.017	0.016	0.016
Decomp coefficients %	**79.500*** **	**81.503*** **	**75.647*** **	**73.885*** **	**74.204*** **	**60.789*** **	**72.237*** **	**65.432*** **	**65.810*** **	**71.171*** **
Interactions	− 0.005	− 0.009*	− 0.008	− 0.005	− 0.009	− 0.001	-0.005	0.004	0.003	− 0.004
Decomp interactions %	7.654	8.805	7.531	4.554	7.736	1.044	3.355	2.889	1.825	2.635
Total	**0.072*** **	**0.097*** **	**0.105*** **	**0.114*** **	**0.113*** **	**0.128*** **	**0.148*** **	**0.154*** **	**0.143*** **	**0.158*** **

Notes: SE based on 100 bootstrap samples; * $p < .05$, ** $p < .01$, *** $p < .001$

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Author contributions
I.K. and F.S. wrote the introduction, theoretical and methods sections, the results and conclusion together. F.S. prepared and analysed the data. Both authors read and approved the final manuscript.

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Availability of data and materials
The data that support the findings of this study are available from the Swiss Federal Statistical Office, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. However, these data are available from the authors upon reasonable request and with the permission of the Swiss Federal Statistical Office.

Declarations

Competing interests
The authors declare that they have no competing interests.

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Publisher's Note

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